

TEXAS A&M  
**AGRILIFE**  
EXTENSION



# **FORAGE AND PASTURE INSECT PEST MANAGEMENT**

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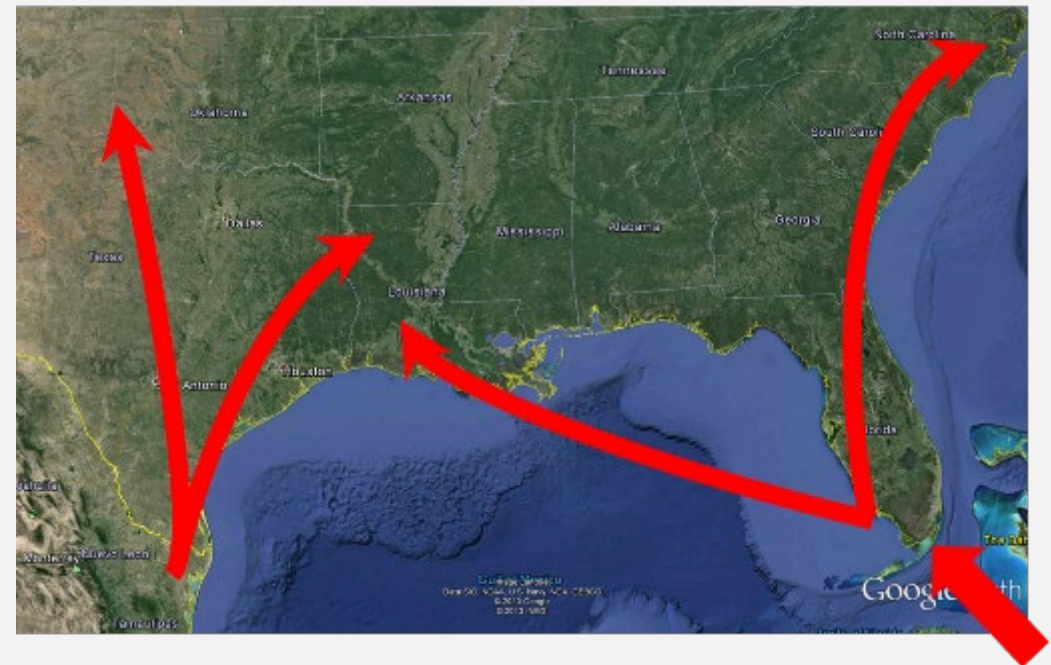
# FALL ARMYWORM STRAINS

- There are multiple strains of fall armyworm.
- The two predominant strains are:
  - The rice strain (R-strain) predominates on rice, alfalfa, pasture grasses, and millet. Will move from grass onto other crops. Historically easy to manage with insecticides.
  - The corn strain (C-strain) is typically found on corn, sorghum, and cotton. Historically tolerant to some insecticides such as pyrethroids, and some Bt proteins.
- These strains can inter-breed, but it is not common.
- It is the R-strain that we deal with in pastures.



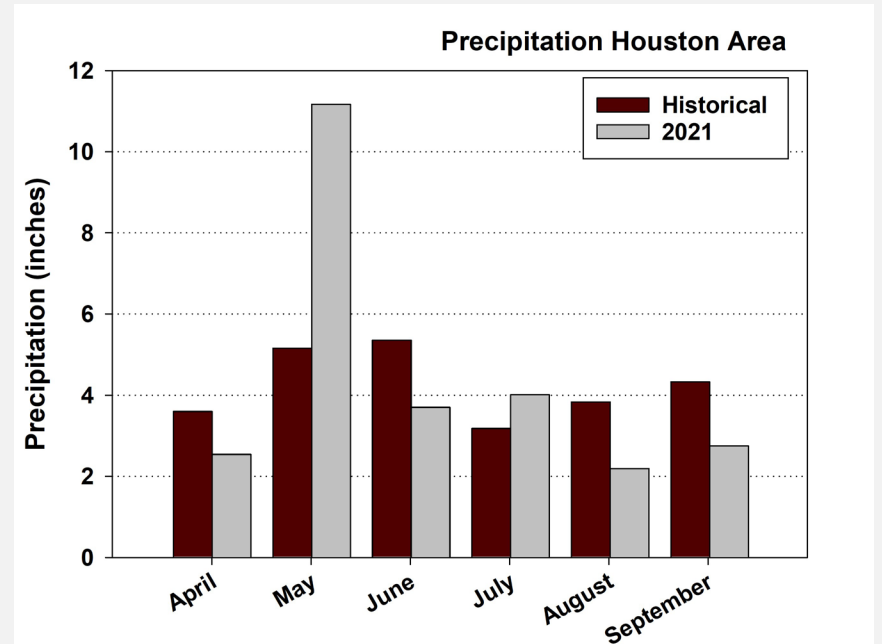
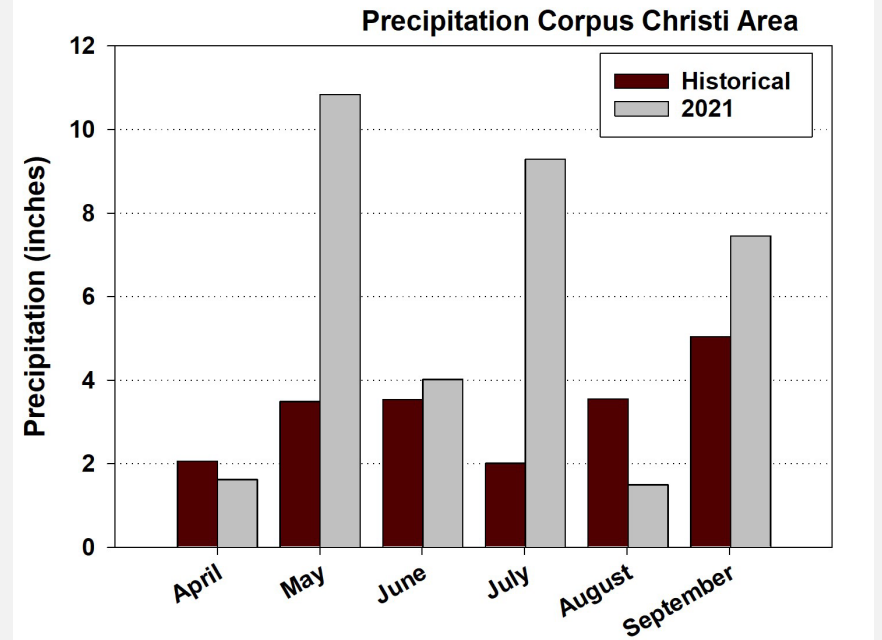
# FAW POPULATION DEVELOPMENT

- Generation from egg to adult completed in about 4 weeks during summer
  - Much longer during cool weather
- Cannot survive freezing weather
  - Overwinter in south Texas
- Moths migrate north in summer
- FAW outbreaks can occur in mid-summer and fall after rains



# FALL ARMYWORM OUTBREAKS

- Widespread fall armyworm outbreak beginning in early October 2017
- Biblical outbreaks in 2018 in September, and 2021 in June and July
- Most outbreaks occur following heavy rainfall events in Spring and Summer



# MONITORING FALL ARMYWORM

- Early detection of armyworm infestations is the best defense against crop loss
- Look for outbreaks after summer rains
- Prefer dense, lush grasses (well fertilized)
- Inspect grassy areas along fence lines, tree lines, and waterways
- Pheromone traps have been used to monitor moth activity but their effectiveness is uncertain
- Cattle egrets lingering in pasture
- Listen for reports of outbreaks
- Scout for worms and damage
  - Visually
  - Sweep net



# MAKING VISUAL INSPECTIONS

- Worms sticking to pants or boots
  - Scout these areas first, or area of dead grass
- Early signs of armyworm damage by small worms include leaves that are chewed on the underside only and fields with a slight “frosted” appearance
  - Slightly larger worms will create a windowpane effect
  - Large worms, grass is gone
- Pull back the thatch and look at the base of the base and soil for hiding worms and worm excrement (resemble dark grass seeds)
- Run your hands through the grass in a 1- to 2-square-foot area to knock the larvae to the soil and make them easier to see. Then part the grass to look for larvae on the soil.

# DAMAGE INDICATORS

- Look for leaf feeding
- Small worms graze on green portion of leaf, resulting in windowpane effect
- Larger worms consume entire leaf



# USING A SWEEP NET

- Sweep net is the favored method
- Picks up easily missed small worms
- Use a standard 15-inch canvas sweep net
- Best used early morning or late afternoon
  - May miss them when hot and worms are near the soil surface
- Drag the net back and forth forcefully through the grass canopy as deep as possible without interfering with fluid motion or digging dirt
- Take 25 sweeps before checking the net for worms





# MOST OF THE TIME

- Infestations are usually noticed because large worms are crawling everywhere.
- On pant legs and boots after walking through the pasture.
- On tires and running boards after driving through the pasture.
- Not an ideal way to find them since they have probably already caused economic damage, but it is better than totally missing them.



# WHEN TO TAKE ACTION

- Early detection and control is necessary to avoid crop loss
  - Small worms are easier to kill
- Threshold varies with size of grass and size of worms
  - Big worms eat more
  - Seedling grass and new growth following cutting cannot tolerate as many worms
  - Thresholds are not written in the Gospels, nor did Moses bring them down from Mt. Sinai
- Threshold
  - Visual: 3 or more ½ inch or larger worms per square foot
  - Sweep net (15-inch): 2 or more ½ inch worms per sweep

\* *count 2 smaller worms as 1 big worm*



# INSECTICIDES FOR ARMYWORMS

Class	Active ingredient	Trade names	Pre-grazing Interval (days)	Pre-harvest interval (days)
Pyrethroids	Cyfluthrin	Tombstone	0	0
	Beta-cyfluthrin	Baythroid XL, Sultrus	0	0
	Zeta-cypermethrin	Mustang, Mustang Maxx	When dry	0
	Lambda-cyhalothrin	Calvary, Firestone, Grizzly, Kendo, L – C Insecticide, Lambda T, Lambda-Cy, LambdaStar, Lamcap, Paradigm, Province, Ravage, Silencer, Warrior	0	7 for hay, 0 for forage
	Gamma-cyhalothrin	Declare	0	7
Benzoylureas	Diflubenzuron	Dimilin, Durant, Micromite, Unforgiven	0	1
	Methoxyfenozide	Intrepid, Invertid, Troubadour, TurnStyle, Zylo	0	7
Carbamates	Methomyl	Lannate, Nudrin	7	3
	Carbaryl	Sevin, Carbaryl	14	14
Diamide	Chlorantraniliprole	Vantacor (Prevathon)	0	0
Spinosyn	Spinosad	Blackhawk	When dry	3
Diamide + Pyrethroid	Chlorantraniliprole + Lambda-cyhalothrin	Besiege	0	7 for hay, 0 for forage

# INSECTICIDE PROPERTIES

Class	Active ingredient	Trade names	Properties
Pyrethroids	Cyfluthrin	Tombstone	<ul style="list-style-type: none"> <li>• Fast acting</li> <li>• Short residual (3-5 days)</li> <li>• All worm sizes</li> <li>• Not rainfast</li> <li>• Contact only</li> <li>• Non-systemic</li> <li>• Inexpensive</li> <li>• Low toxicity</li> <li>• Broad spectrum</li> </ul>
	Beta-cyfluthrin	Baythroid XL, Sultrus	
	Zeta-cypermethrin	Mustang, Mustang Maxx,	
	Lambda-cyhalothrin	Calvary, Firestone, Grizzly, Kendo, L – C Insecticide, Lambda T, Lambda-Cy, LambdaStar, Lamcap, Paradigm, Province, Ravage, Silencer, Warrior	
	Gamma-cyhalothrin	Declare	

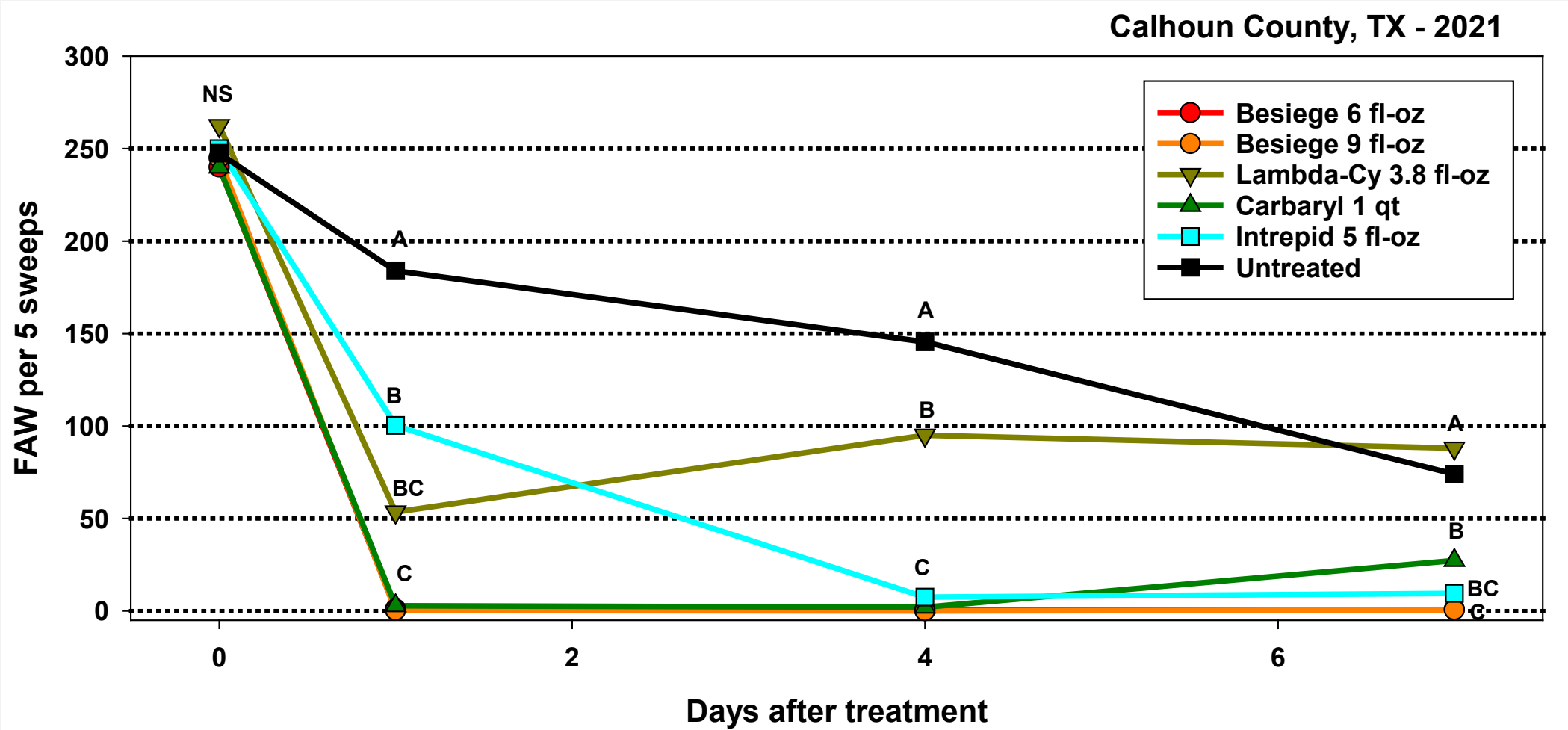
Class	Active ingredient	Trade names	Properties	
Benzoylureas	Diflubenzuron	Dimilin, Durant, Micromite, Unforgiven	<ul style="list-style-type: none"> <li>• Slow acting (3-4 days)</li> <li>• Dimilin provides good residual (10-14 days)</li> <li>• Others provide decent residual (5-7 days)</li> <li>• Not rainfast</li> <li>• Diflubenzuron only small worms</li> <li>• Others get all sizes</li> </ul>	<ul style="list-style-type: none"> <li>• Must be eaten</li> <li>• Non-systemic</li> <li>• Inexpensive</li> <li>• Very low toxicity</li> <li>• Target specific</li> </ul>
	Methoxyfenozide	Intrepid, Invertid, Troubadour, TurnStyle, Zylo		
Carbamate	Methomyl	Lannate, Nudrin	<ul style="list-style-type: none"> <li>• Fast acting</li> <li>• Short residual (3-5 days)</li> <li>• All worm sizes</li> <li>• Not rainfast</li> <li>• Contact only</li> <li>• Non-systemic</li> <li>• Methomyl is highly toxic, Carbaryl is not very toxic</li> <li>• Moderately expensive</li> <li>• Broad spectrum</li> </ul>	
	Carbaryl	Sevin, Carbaryl		

<b>Class</b>	<b>Active ingredient</b>	<b>Trade names</b>	<b>Properties</b>
Diamide	Chlorantraniliprole	Vantacor (Prevathon)	<ul style="list-style-type: none"> <li>• Fairly fast acting (several days)</li> <li>• Good residual (14-20+ days)</li> <li>• Rainfast</li> <li>• Must be eaten</li> <li>• All worm sizes</li> <li>• Translaminar systemic</li> <li>• Expensive</li> <li>• Very low toxicity</li> <li>• Target specific</li> </ul>
Spinosyn	Spinosad	Blackhawk	<ul style="list-style-type: none"> <li>• Fairly fast acting (several days)</li> <li>• Short residual (4-7 days)</li> <li>• Rainfast</li> <li>• Must be eaten</li> <li>• All worm sizes</li> <li>• Translaminar systemic</li> <li>• Expensive</li> <li>• Very low toxicity</li> <li>• Target specific</li> </ul>
Diamide + Pyrethroid	Chlorantraniliprole + Lambda-cy	Besiege	See Vantacor but faster

# **FAW INSECTICIDE EFFICACY**

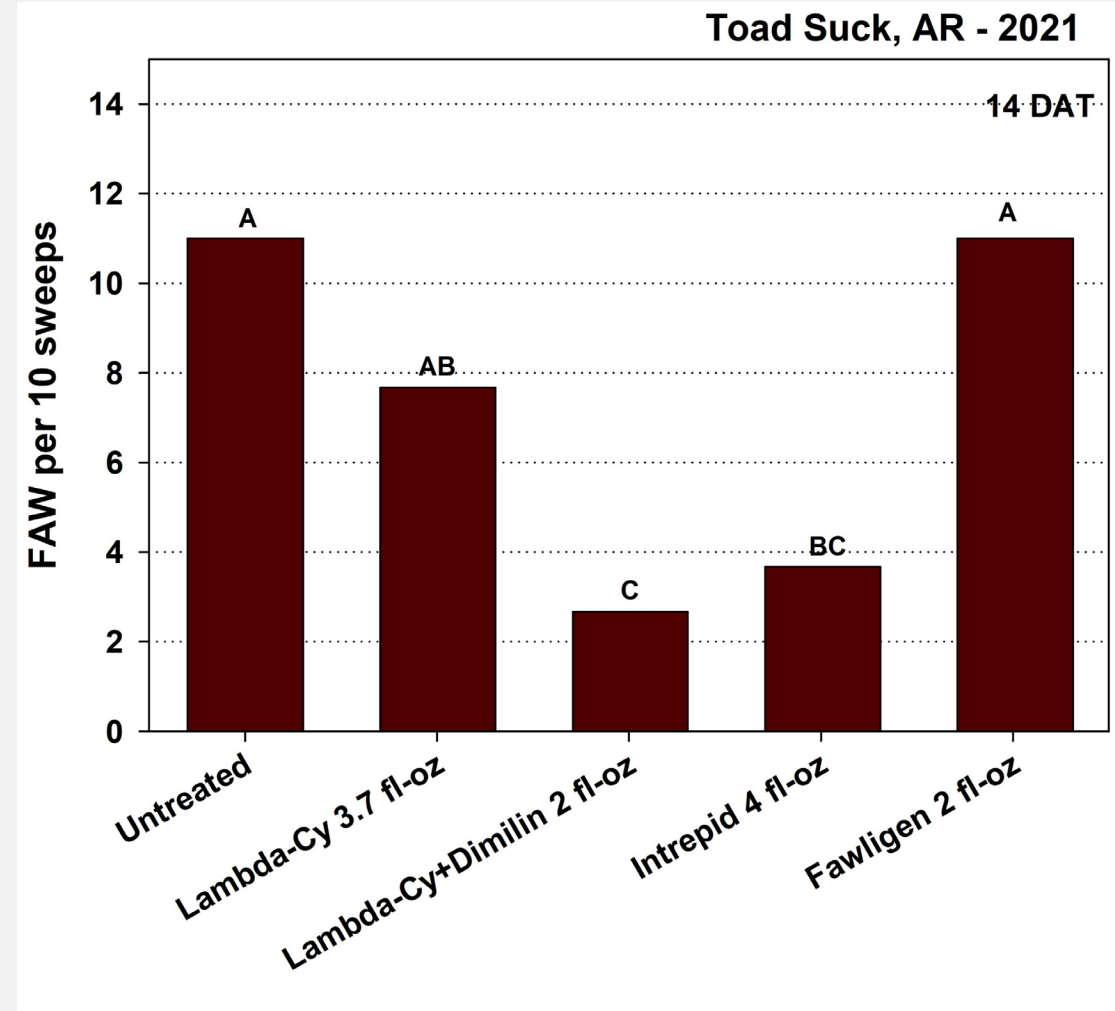
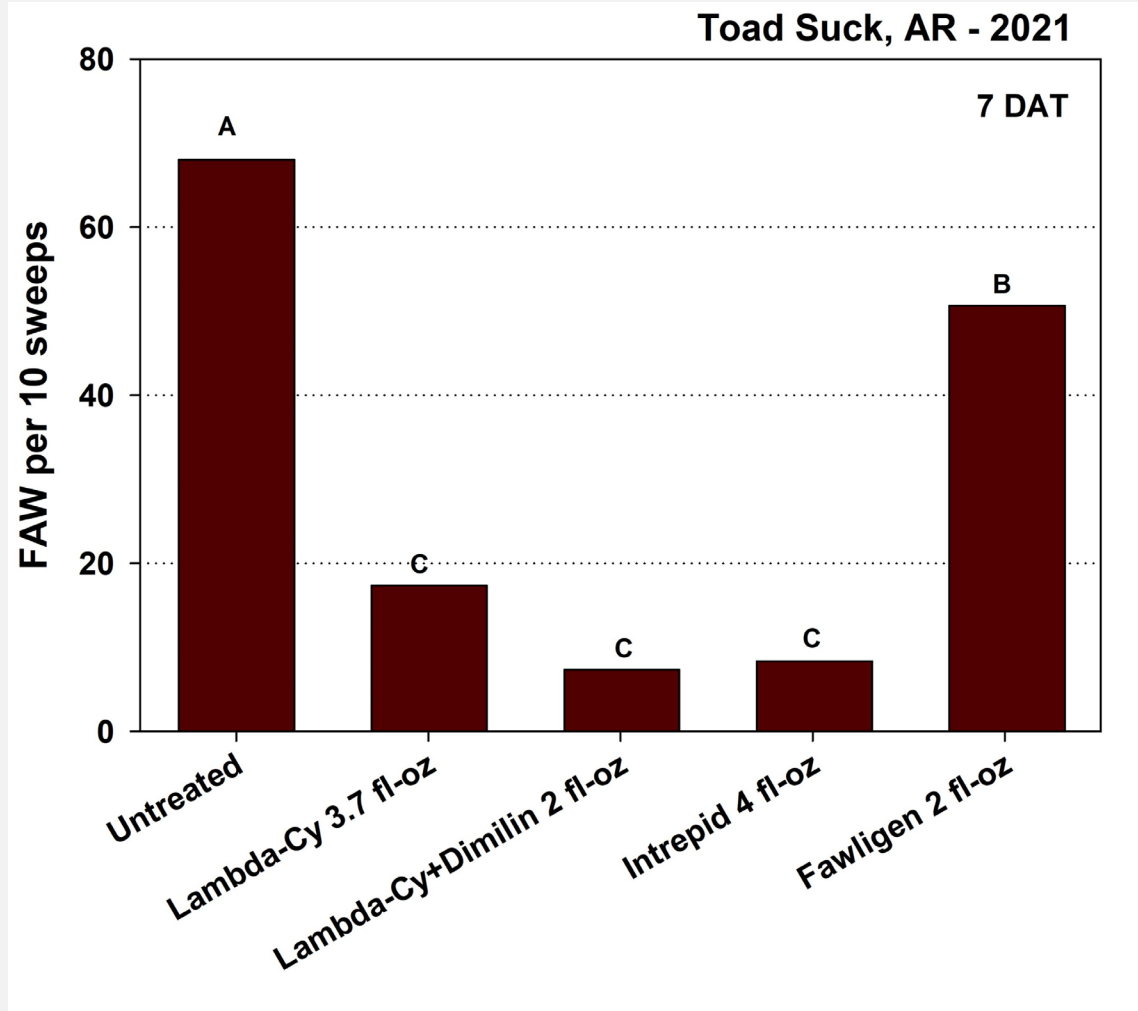


# FAW INSECTICIDE EFFICACY – LOWER GULF COAST

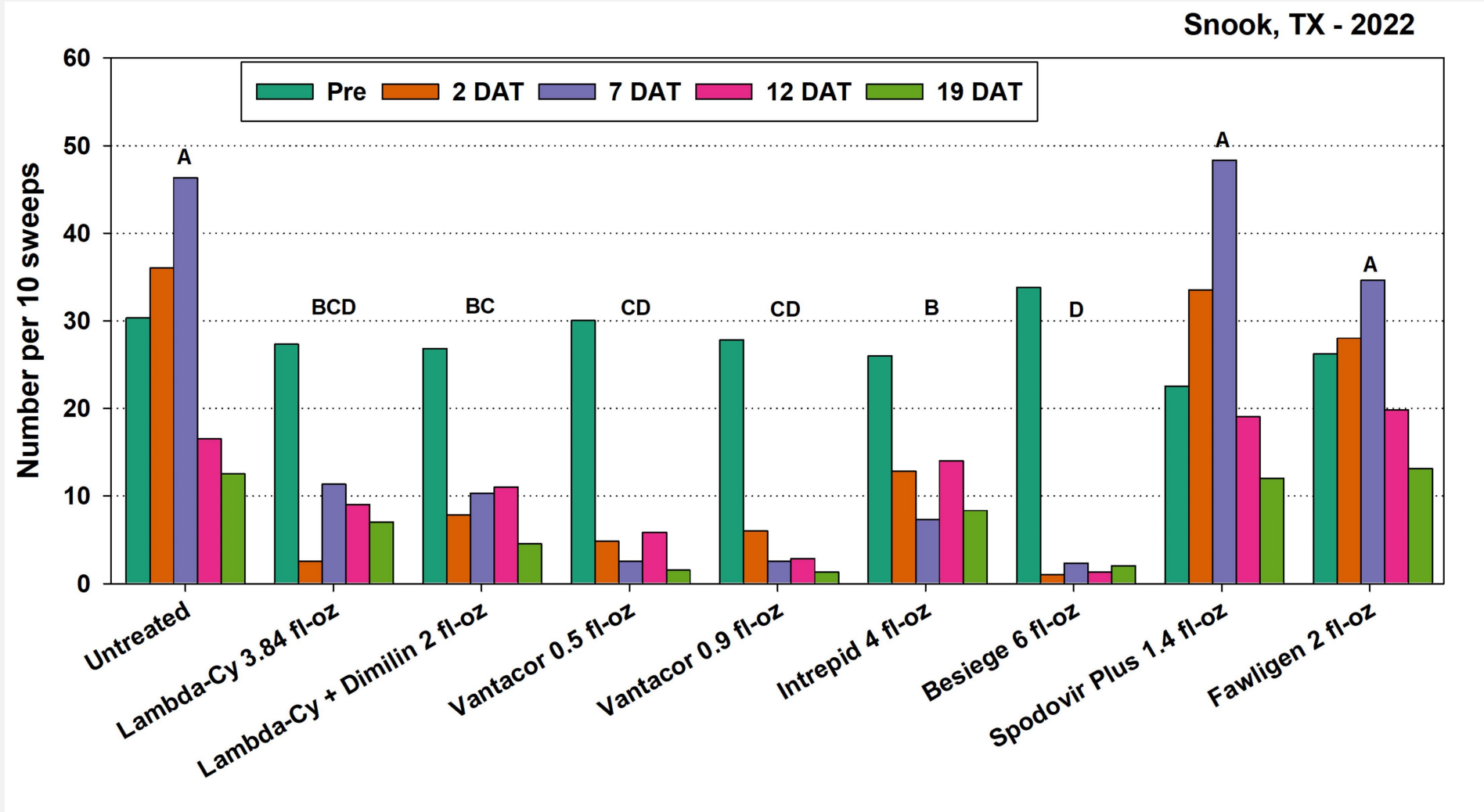




# FAW INSECTICIDE EFFICACY - ARKANSAS



# FAW INSECTICIDE EFFICACY – BURLESON COUNTY



## WHAT IS UP WITH PYRETHROID EFFICACY CONSISTENCY?

- Poor insecticide coverage or improper sprayer calibration.
- Overlapping eggs lays resulting in hatches after insecticide has worn off.
- Population is not moving from the lower canopy to the upper to become exposed to the in insecticide.
- Rainfall after an application.
  - Light rainfall may actually help move the insecticide into the canopy where the worms reside.
  - Heavy rainfall may wash the insecticide off.
- If FAW are corn strain, they are naturally more tolerant to pyrethroids.
  - Not likely.
- Pyrethroid resistance has developed.
  - Not likely

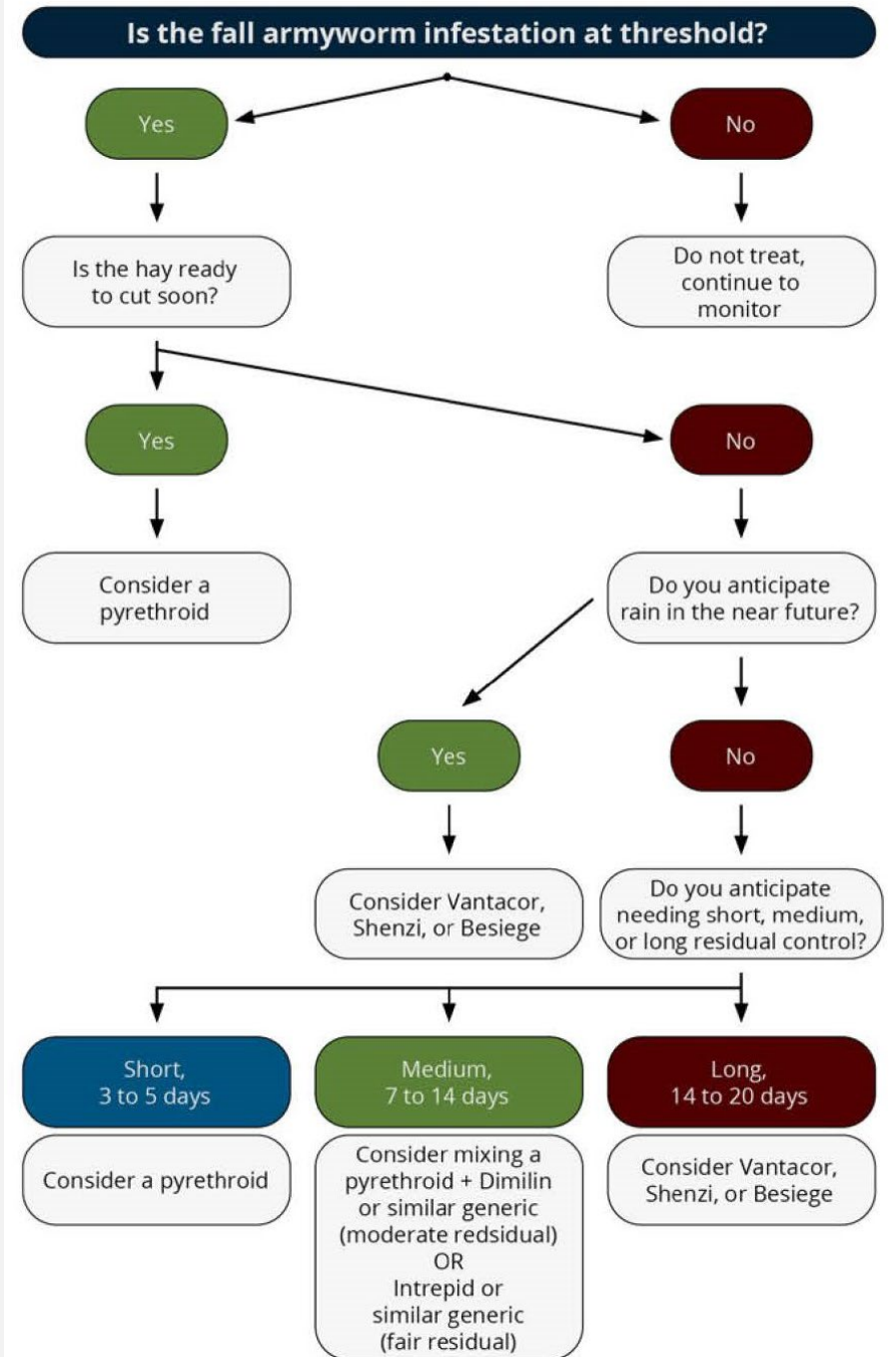
# APPROXIMATE COSTS OF SOME INSECTICIDES

Insecticide	Rate	Acres covered per gallon	\$/gallon	\$/acre
Besiege	4 fl-oz/ac	32.0	\$290.00	\$9.06
	6 fl-oz/ac	21.3		\$13.62
	9 fl-oz/ac	14.2		\$20.43
Lambda-Cy	3.8 fl-oz/ac	33.7	\$80.00	\$2.38
Carbaryl	32 fl-oz/ac	4.0	\$44.00	\$11.00
Intrepid	4 fl-oz/ac	32.0	\$240.00	\$7.50
	5 fl-oz/ac	25.6		\$9.38
Dimilin	2 fl-oz/ac	64.0	\$240.00	\$3.75
Vantacor (Prevathon)	0.7 fl-oz/ac (8 fl-oz/ac)*	45.7/qt (16/gal)	\$450/qt	\$9.84
	1.2 fl-oz/ac (14 fl-oz/ac)	26.7/qt (9.1/gal)		\$16.88
	1.7 fl-oz/ac (20 fl-oz/ac)	18.8/qt (6.4/gal)		\$23.90
Blackhawk	2 oz	8.0/lb	\$115/lb	\$14.38
Lannate	32 fl-oz	4.0	\$65.00	\$16.25

\*Grasshopper low rate

Lambda Cy + Dimilin = \$6.13/ac

# DECISION MAKING TREE

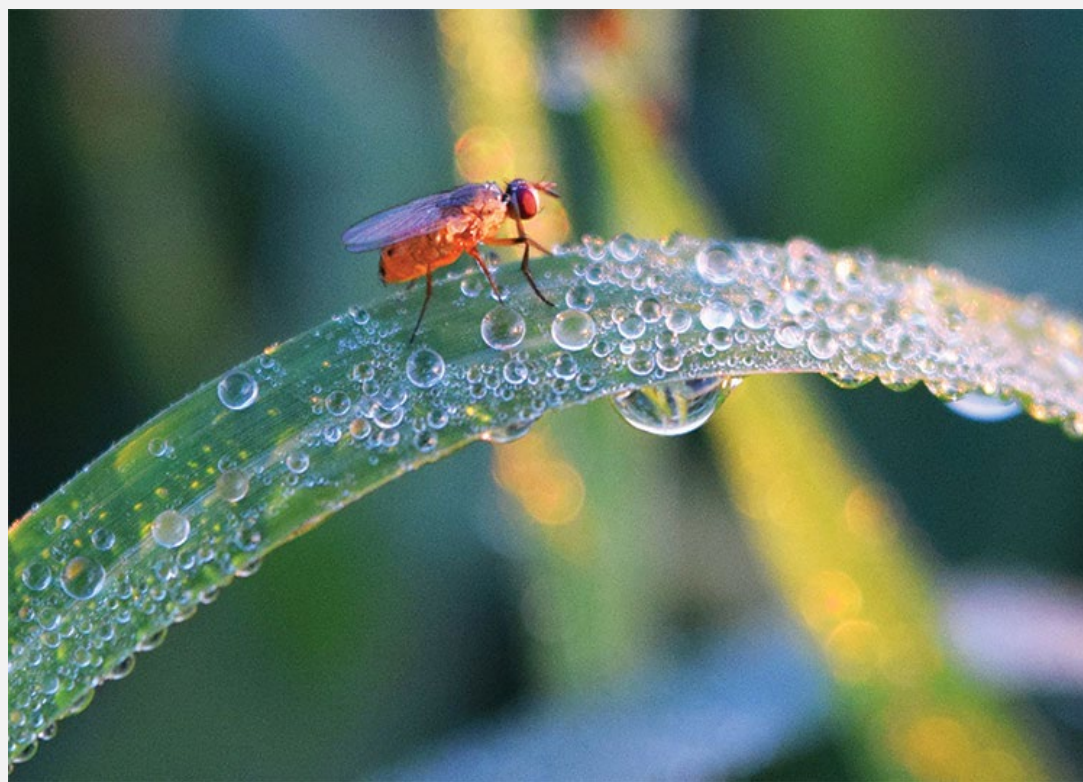


# TRUE ARMYWORMS

- Unlike fall armyworm the true armyworm is a spring pest.
- Like fall armyworm they can reach huge numbers.
- They prefer to feed on small grains, ryegrass and other cool-season grasses.
- Do not like Bermudagrass but will eat it after consuming a cool-season grass in the Bermuda pasture.
- Habits are like fall armyworm.
  - Hide during the day or when hot.
- Easy to control with insecticides; pyrethroids are highly effective.
- Sample for them same as fall armyworms and use the same thresholds.

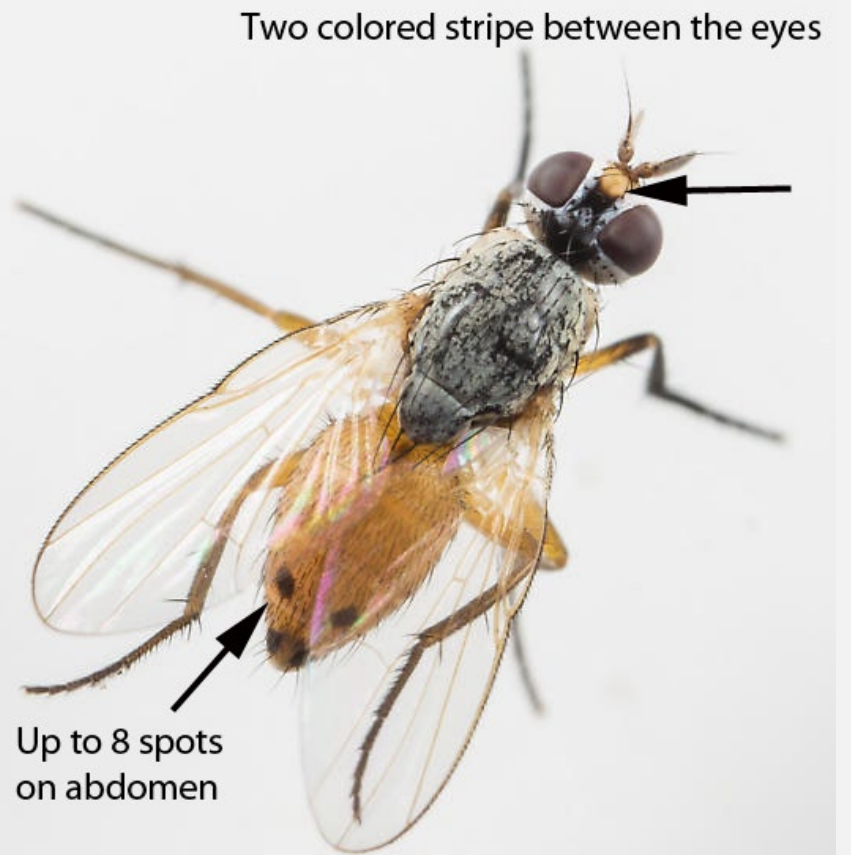


# **BERMUDAGRASS STEM MAGGOT**



# BGSM DESCRIPTION

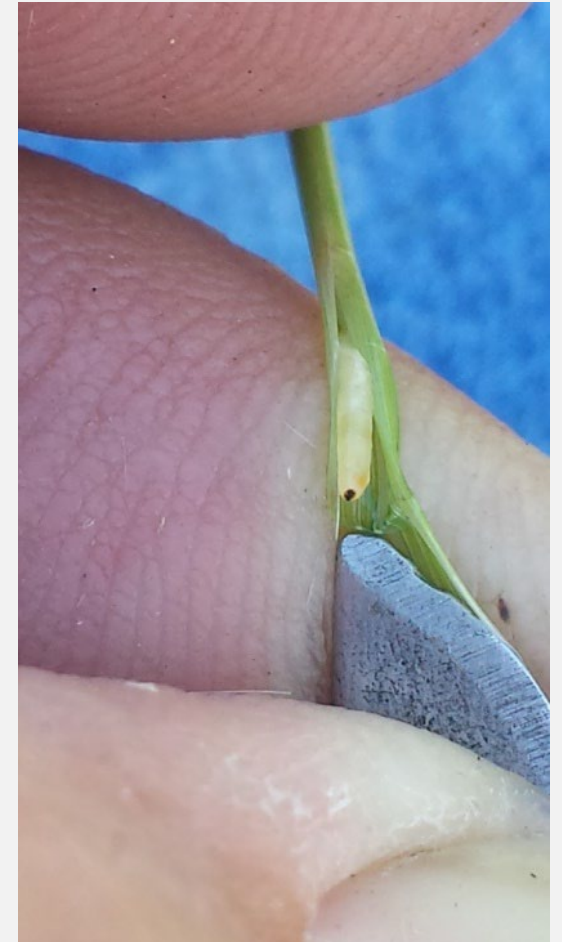
- *Atherigona reversura*, (Muscidae)
- Gray with yellow abdomen and dark red-brown eyes
- Adult is a small fly, 1/8 inch long





# BGSM DESCRIPTION

- The larvae are creamy-white to yellowish
- Grow to be about 1/8 inch long
- Typical maggot appearance
- Usually not seen because they leave the stem before damage is evident



# LIFE CYCLE

- Fly deposits eggs on leaf or stem
- Eggs hatch in 2-3 days
- Maggot bores into the stem at the top node and tunnels within the stem where they will develop for 6-12 days
  - Damage will not be evident for 1-3 days
- Maggots cutout of the stem and pupate in the soil
- Pupation requires about 7-10 days
- Adults live 14-20 days and can lay ~30 eggs
- Life cycle completed in 2-3 weeks. Multiple generations per year

# EVIDENCE OF DAMAGE

- Top two leaves appear white, wilted and dead
- Dead leaves are easily pulled from the sheath
- Split open stem just below dead leaves (at next node) to confirm tunneling or presence of maggot
- Infested fields have a frosted or bronzing appearance
- After feeding maggot bores exits the pseudostem leaving a hole



# DAMAGE POTENTIAL

- Damaged stem cease growing
  - A new shoot will form at the lower node, but this delays crop development
- If damage first appears within a week of harvest, less yield loss will occur
- If damage first appears when regrowth is 6-8 inches, yield impact will be more severe
- If soil moisture and growing conditions are good for rapid grass growth, loss of the upper few leaves will have minimum impact on yield
- Bermudagrass stands receiving high rates of N fertilizer tend to suffer more BGSM damage
- Grazed pastures are not as likely to suffer from BGSM damage because the livestock will eat the eggs and newly hatched maggots (*grazing pressure dependent*)
- Bermudagrass pastures isolated from other bermudagrass pastures are less likely to be as heavily infested

# YIELD LOSS

- **Yield**
  - **For every 1% of stem damage there is a reduction of 8.90 lbs/acres of hay**
- **Quality (highly variable)**
  - **Protein: 0.06% reduction protein for every 1% stem damage**
  - **Total digestible nutrients: 0.05% reduction in TDN for every 1% stem damage**
  - **Acid detergent fiber: 0.03% increase in ADF for every 1% stem damage**



**Fig. 5. Pyrethroid treated verses non-treated areas of a bermudagrass field infested with bermudagrass stem maggots. Photo by Ben Thrash.**

# SCOUTING

- BGSM population increase over the summer
- Most economically damaging infestations occur August-October
- Adult flies can be sampled with a sweep net or yellow sticky cards
  - But using adult fly capture as a mean to determine the need to spray has not been successful
- Determining need to spray is best made based on damage
- Examine stems from several locations through the pasture and count the number with and without damage to get a percentage damaged stems



# DECISION MAKING & TREATMENTS

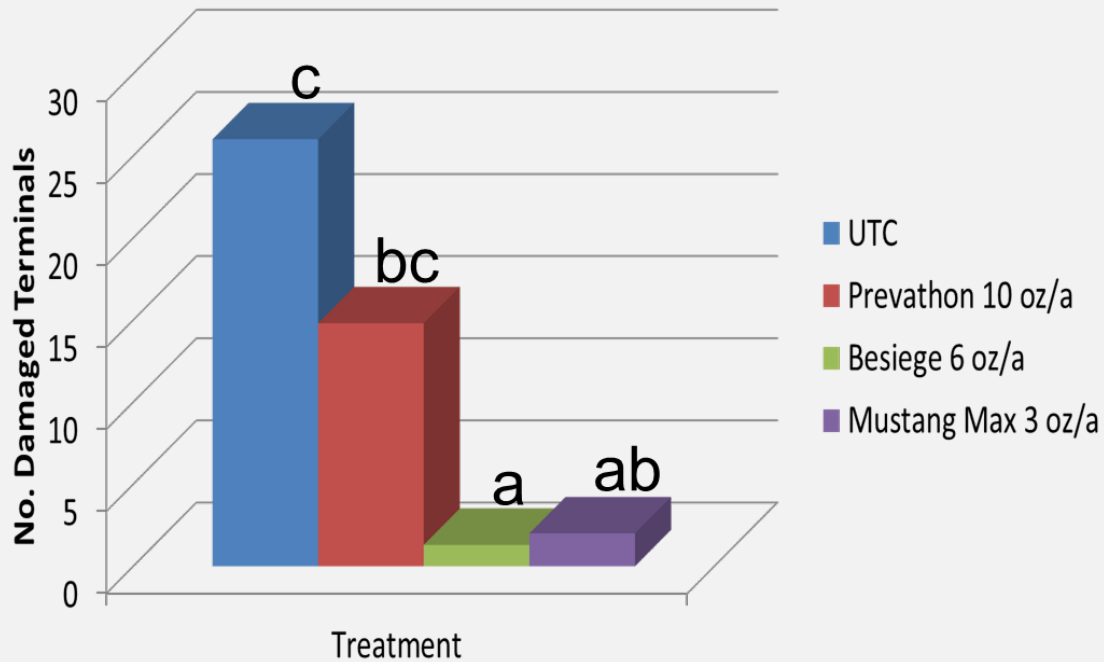
Value of Bermudagrass Hay	Value (\$/lb)	Economic Injury Level	Economic Threshold (0.7 EIL)
\$180/ton	0.09	16%	11%
\$140/ton	0.07	21%	15%
\$100/ton	0.05	28%	20%
\$80/ton	0.04	34%	24%
\$60/ton	0.03	46%	32%
\$40/ton	0.02	69%	48%

Common sense: if neighboring pasture is infested and cut, in about 7 days emerging flies may move to your pasture

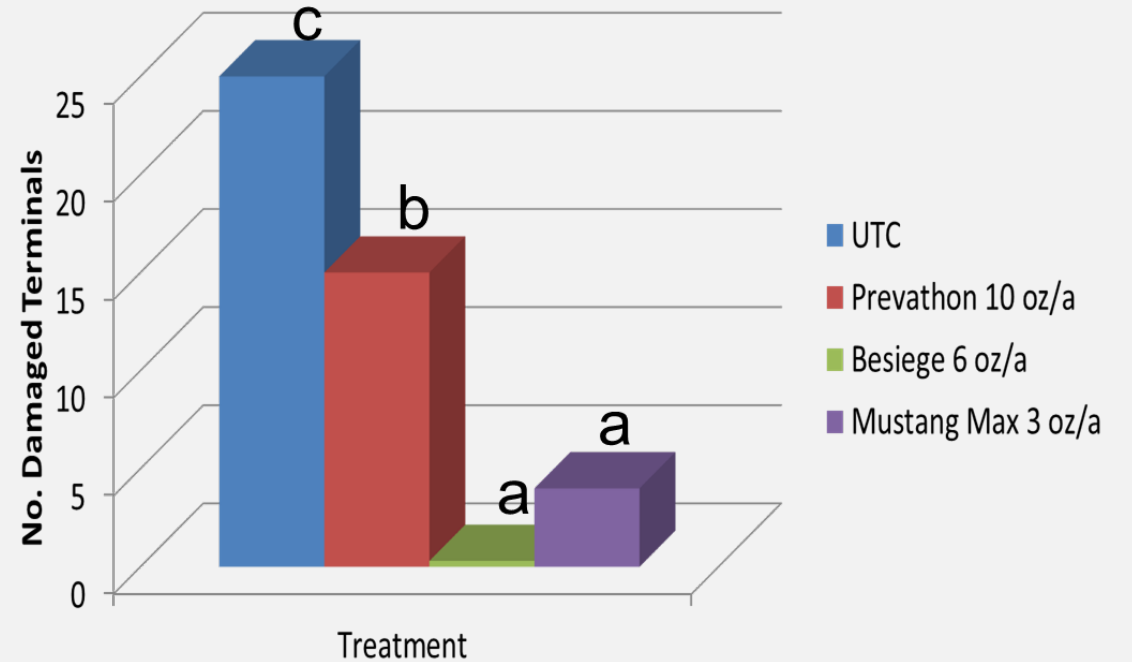
- Based application cost of \$10/acre
  - Chemical + surfactant + application
- Rule of thumb: treat when 20% of stems show evidence of BGSM injury
- Treatment (2 options):
  - Cut the hay
    - Cut within a week
    - Spray 7 days after cutting
  - Insecticide
    - Pyrethroids are the only choice at this time
      - Will not affect the maggots
      - Kills the adults
    - Retreat in 7 days after first application

# BERMUDAGRASS STEM MAGGOT INSECTICIDE EFFICACY

10 DAT



19 DAT





# MANAGING A DAMAGED FIELD – DAMAGE CONTROL

- Bermudagrass does not tolerate shading
- Dead stems shade the lower stems, delaying or preventing new shoot formation
- Thus, heavily infested fields will produce little forage but lots of flies
- Consider cutting heavily damaged pasture early to remove damage and setting up for a clean start
- Maggots surviving cutting will often exit post-cut and pupate
- In about a week get ready, because there will most likely to a very large emergence of BGSM flies



# DESERT TERMITES



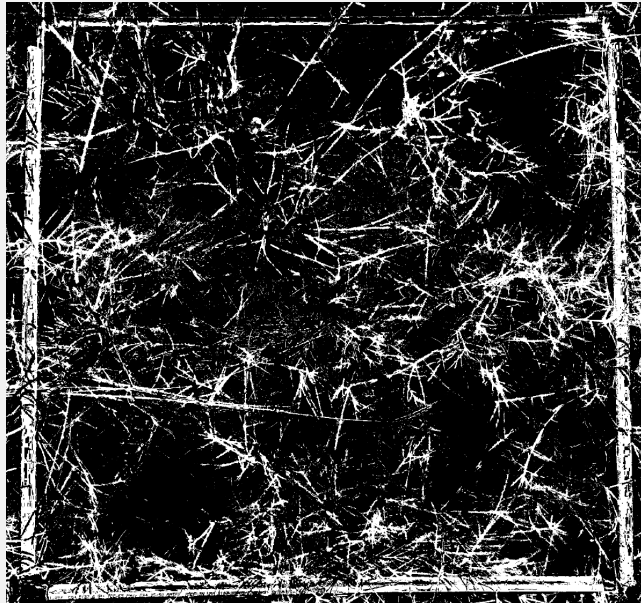
# OCCURRENCE AND DAMAGE

- Feed primarily on dry grass, cow patties, twig bark, etc.
  - Do not feed on wood
  - Feed little on green grass
- Build dirt tunnels, “cartons or castings” over green grass which kills the grass; then they feed on it
- Can have over 4,000 termites/m<sup>3</sup>
- Can consume 24 mg plant material/g-termites/day
- Build population during wet years, but they are usually not evident due to good grass production
- During dry years, especially those following wet years, large populations are notable, and damage is pronounced because the grass is not growing



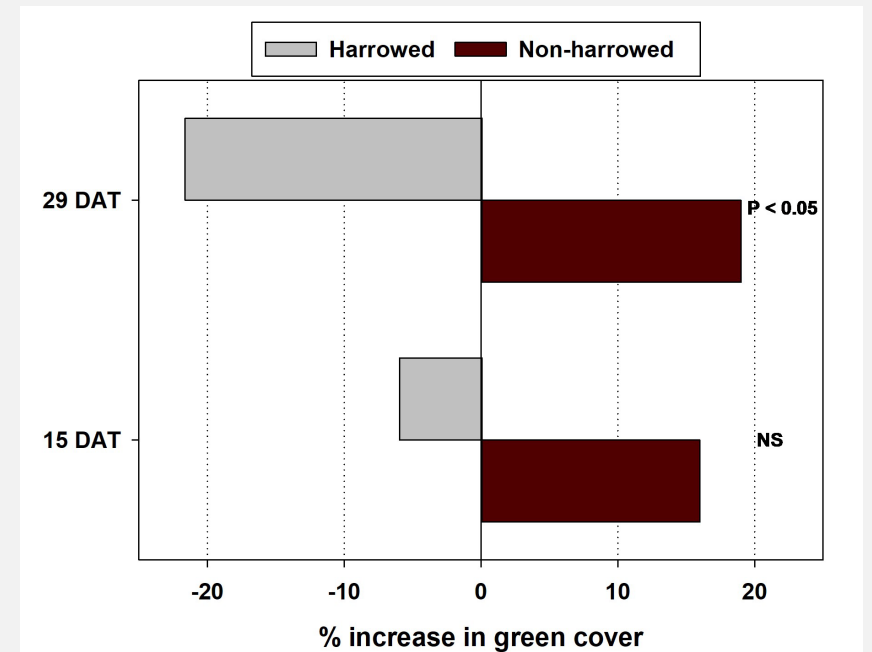
# DESERT TERMITE MANAGEMENT TEST

- Found information that Malathion may provide control, particularly if the mud tunnels were destroyed before application
- Conducted an insecticide efficacy test looking at 5 insecticides sprayed after harrowing or with not harrowing
- Rated percentage ground covered by mud tunnels, and measure the percentage to green grass coverage

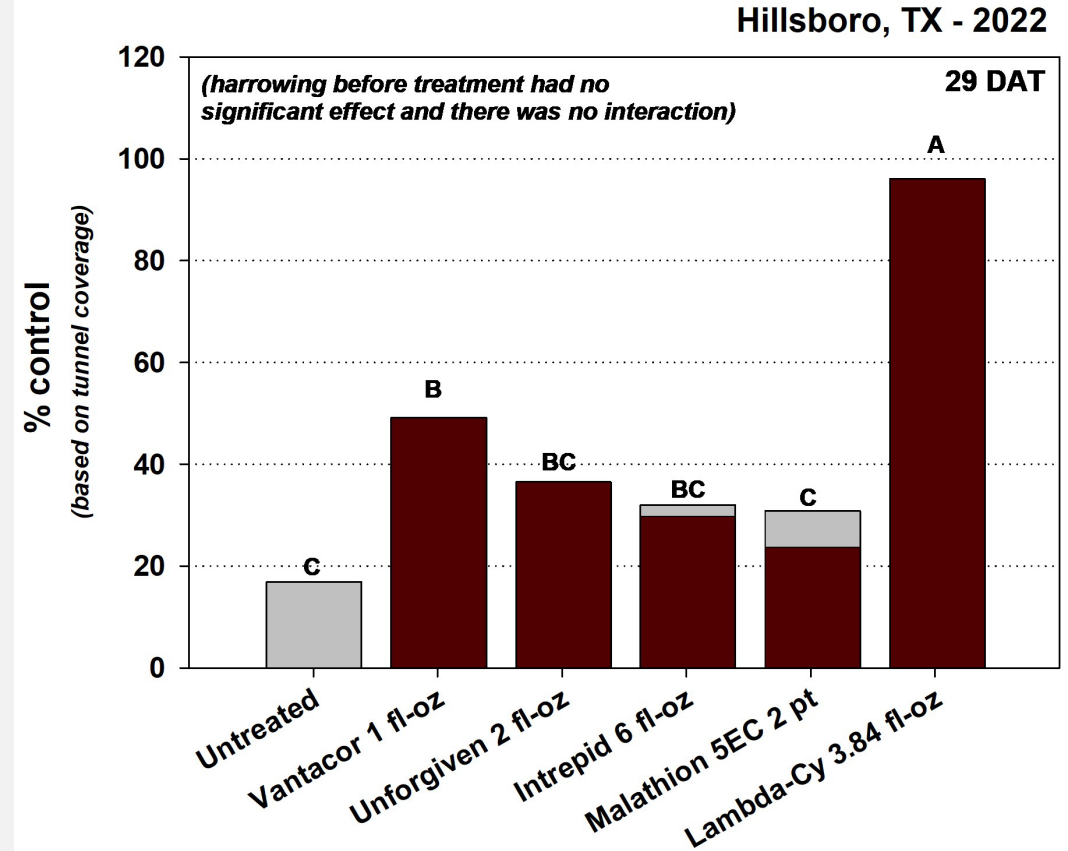
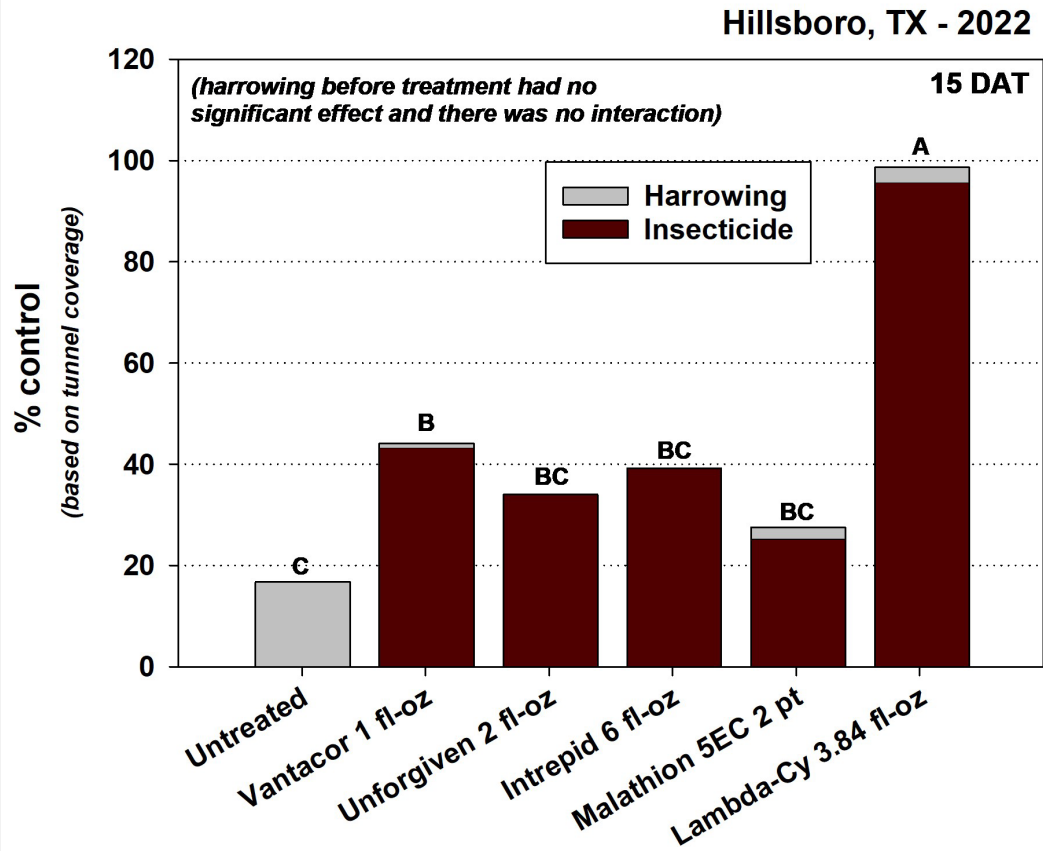


# IMPACT OF HARROWING

- No statistically significant impact
- Harrowing may provide ~18% control
  - *On next slide*
- May result in 40-50% slower forage re-growth



# INSECTICIDE EFFICACY



# GRASSHOPPER INSECTICIDE EFFICACY



# GRASSHOPPERS

- Lay eggs in summer and fall.
- Dry, warm, open falls favor larger grasshopper populations come spring.
- Cold winters do not impact egg survival much.
- Hatch in the spring and build numbers through the summer, most have 3 generations per year (40-60 days, egg to adult).
- Heavy spring rains reduce grasshopper populations by drowning the little ones.
- Cool, wet springs favor disease that can reduce grasshopper numbers.



Figure 21. Differential grasshopper



Figure 22. Red-legged grasshopper



Figure 24. Two-striped grasshopper



Figure 25. Packard grasshopper



# GRASSHOPPER DAMAGE

- It is estimated that 62 hoppers/sq-yard consume vegetation at the same rate as 2.5 animal units.
- 15-28 hoppers/sq-yd represents a severe infestation.
- 7 hoppers/sq-yard on 10 acres consumes grass at the same rate as 1 cow.
- 30-60 hoppers/sq-yard can consume all the grass if left unchecked.
- Eat grass closer to ground than cows.



# SCOUTING FOR GRASSHOPPERS

- Its an estimate at best.
- Try to estimate the number of 1/2 -inch or bigger grasshoppers per square-yard.
- Sample along the pasture margin as well as the interior.
  - They are often most numerous on the margins.
- If you can locate areas where the hoppers are hatching out, treating those may prevent movement into nearby pastures.
- Like most pasture pests, they usually go unnoticed until they are numerous.



# ADULT GRASSHOPPER INFESTATION RATINGS AS NUMBER/SQ-YARD

Infestation/sq-yd	Rating
0-2	Non-economic
Light	3 - 7
Threatening	8 - 14
Severe	15- 28
Biblical	>28

- If along the pasture margin, treat at  $\geq 21$  hoppers/sq-yd
- In the pasture, treat at  $\geq 8$  hoppers/sq-yd



# INSECTICIDES FOR GRASSHOPPERS

Class	Active ingredient	Trade names	Pre-grazing Interval (days)	Pre-harvest interval (days)	Properties
Pyrethroids	Cyfluthrin	Tombstone	0	0	Cheap, fast, not rainfast Short residual, will only kill what is in the field at the time
	Beta-cyfluthrin	Baythroid XL, Sultrus	0	0	
	Zeta-cypermethrin	Mustang, Mustang Maxx	When dry	0	
	Lambda-cyhalothrin	Calvary, Firestone, Grizzly, Kendo, L – C Insecticide, Lambda T, Lambda-Cy, LambdaStar, Lamcap, Paradigm, Province, Ravage, Silencer, Warrior	0	7 for hay, 0 for forage	
	Gamma-cyhalothrin	Declare	0	7	
Benzoylureas	Diflubenzuron	Dimilin, Durant, Micromite, Unforgiven	0	1	Cheap, decent residual, not rainfast, only kills small hoppers. Consider mixing with a pyrethroid
Carbamates	Carbaryl	Sevin, Carbaryl	14	14	Moderately expensive, not rainfast, short residual
Diamide	Chlorantraniliprole	Vantacor (Prevathon)	0	0	Expensive, little slow, long residual control, effective at low rates
Diamide + Pyrethroid	Chlorantraniliprole + Lambda-cyhalothrin	Besiege	0	7 for hay, 0 for forage	Expensive, fast acting, long residual control, effective at low rates

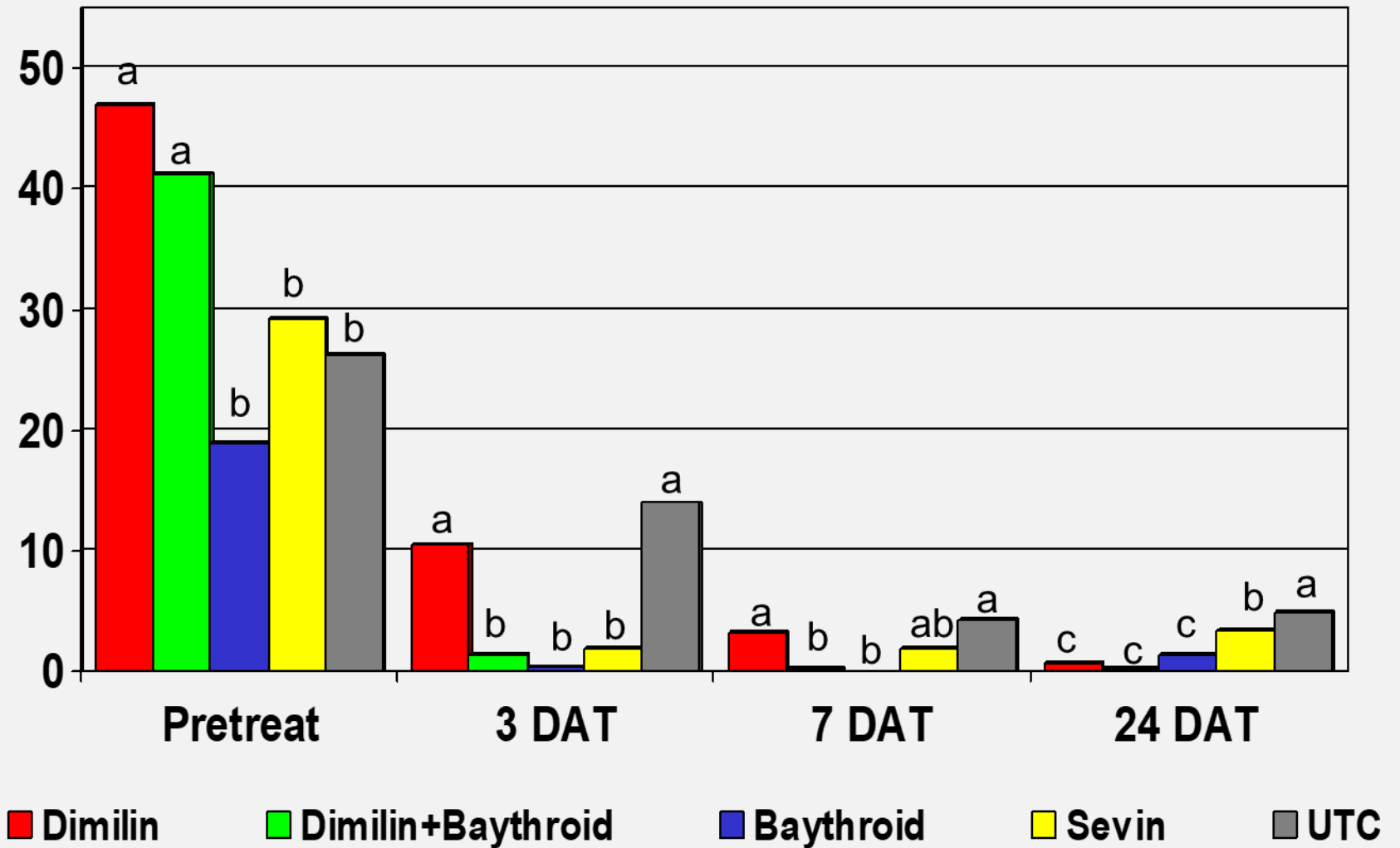
# KEY THINGS TO CONSIDER

- How severe and widespread is the grasshopper problem?
  - If re-infestation is not a big concern, you can go cheap and use a pyrethroid or pyrethroid + Dimilin for a little added residual control if not rainy
  - If there is a substantial risk of re-infestation, use Vantacor or Besiege to get residual control of migrating hoppers.

Insecticide	Rate	Acres covered per gallon	\$/gallon	\$/acre
Besiege	4 fl-oz/ac	32.0	\$290.00	\$9.06
	6 fl-oz/ac	21.3		\$13.62
	9 fl-oz/ac	14.2		\$20.43
Lambda-Cy	3.8 fl-oz/ac	33.7	\$80.00	\$2.38
Carbaryl	32 fl-oz/ac	4.0	\$44.00	\$11.00
Dimilin	2 fl-oz/ac	64.0	\$240.00	\$3.75
Vantacor (Prevathon)	0.7 fl-oz/ac (8 fl-oz/ac)	45.7/qt (16/gal)	\$450/qt	\$9.84
	1.2 fl-oz/ac (14 fl-oz/ac)	26.7/qt (9.1/gal)		\$16.88
	1.7 fl-oz/ac (20 fl-oz/ac)	18.8/qt (6.4/gal)		\$23.90

Lambda Cy + Dimilin = \$6.13/ac

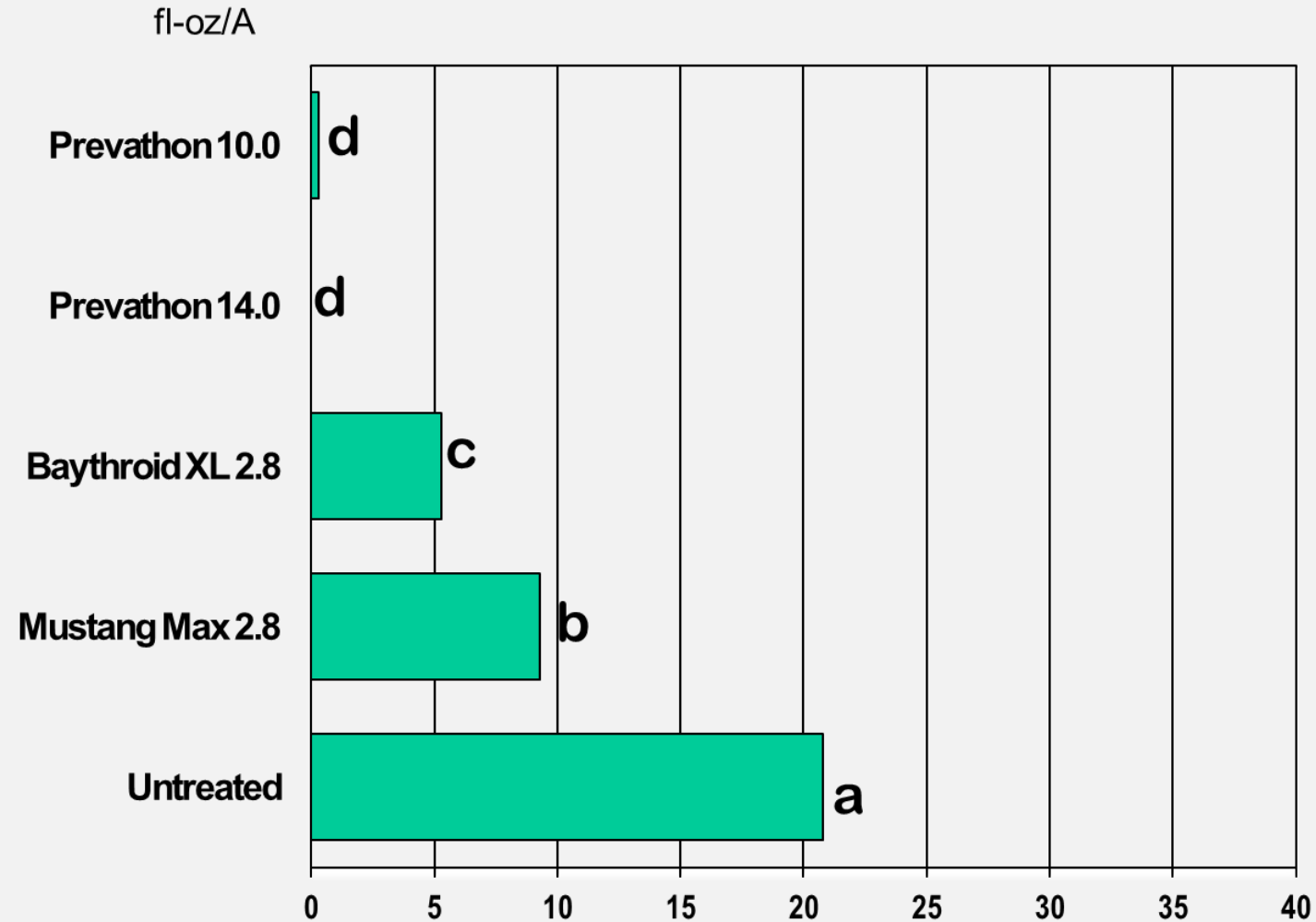
# GRASSHOPPERS PER 5 SWEEPS AUSTIN COUNTY, 2010



DAT = days after trt.

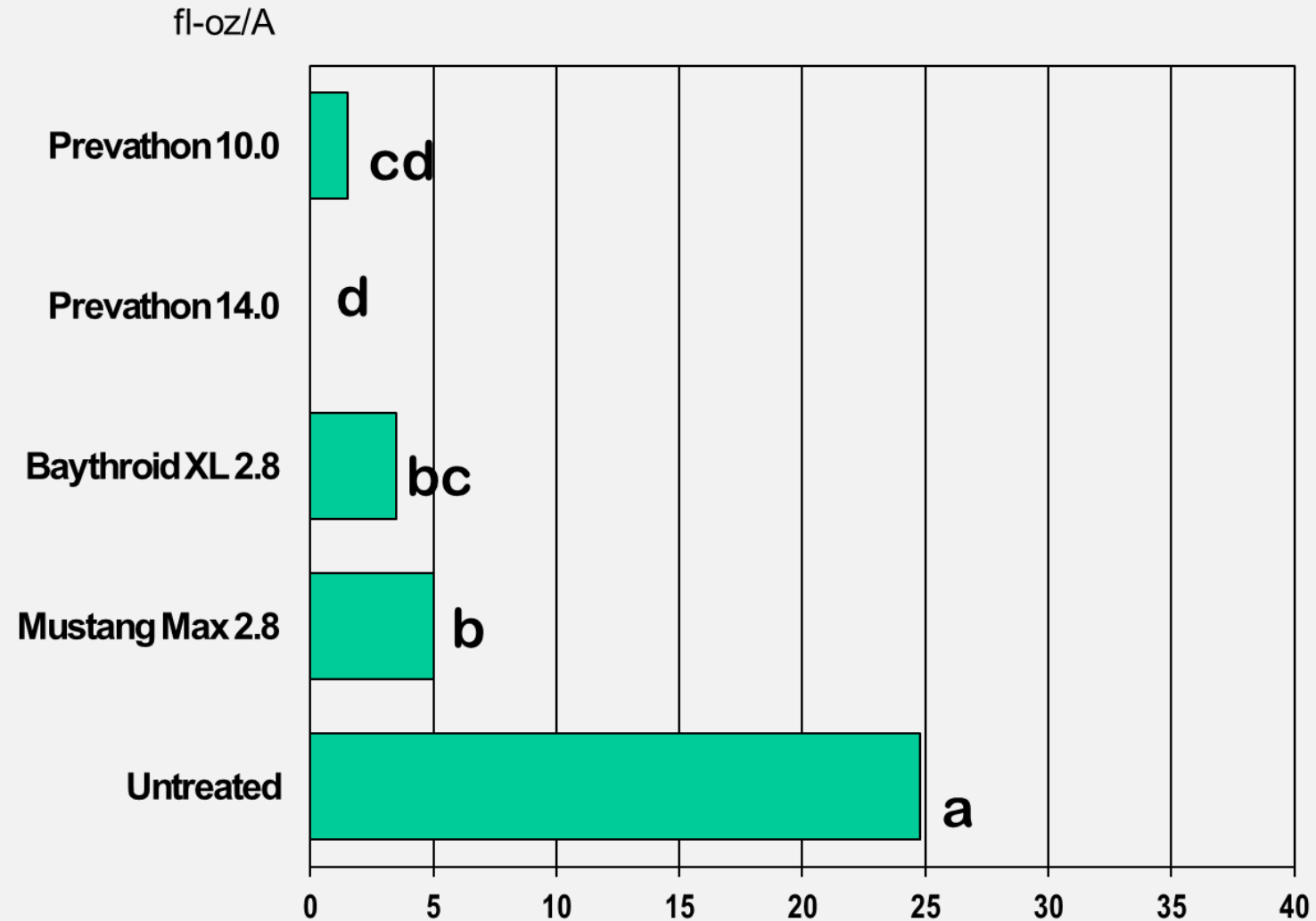
# GRASSHOPPER CONTROL

## NUMBER PER 5 SWEEPS @ 28 DAT



# GRASSHOPPER CONTROL

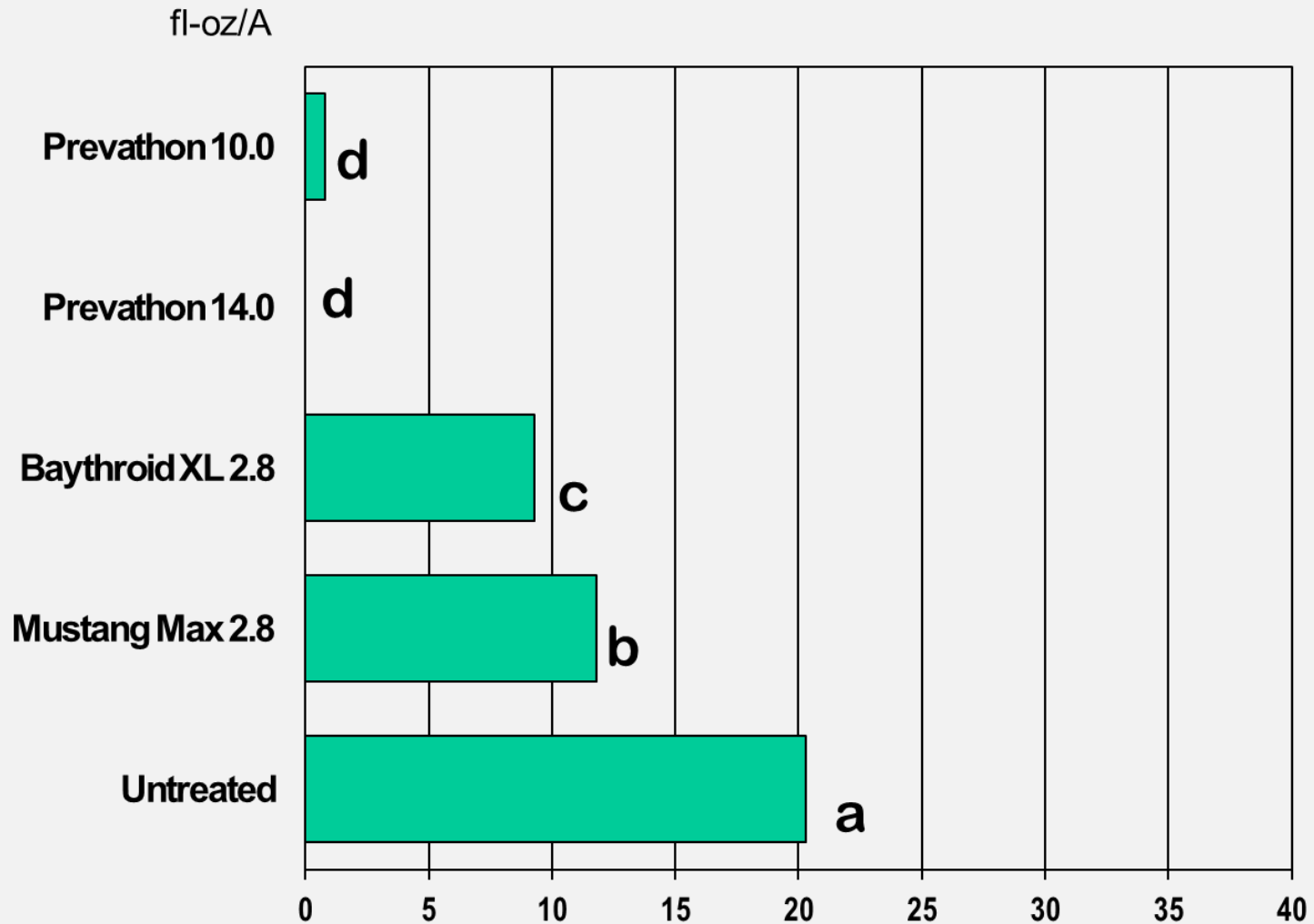
## NUMBER PER 5 SWEEPS @ 42 DAT





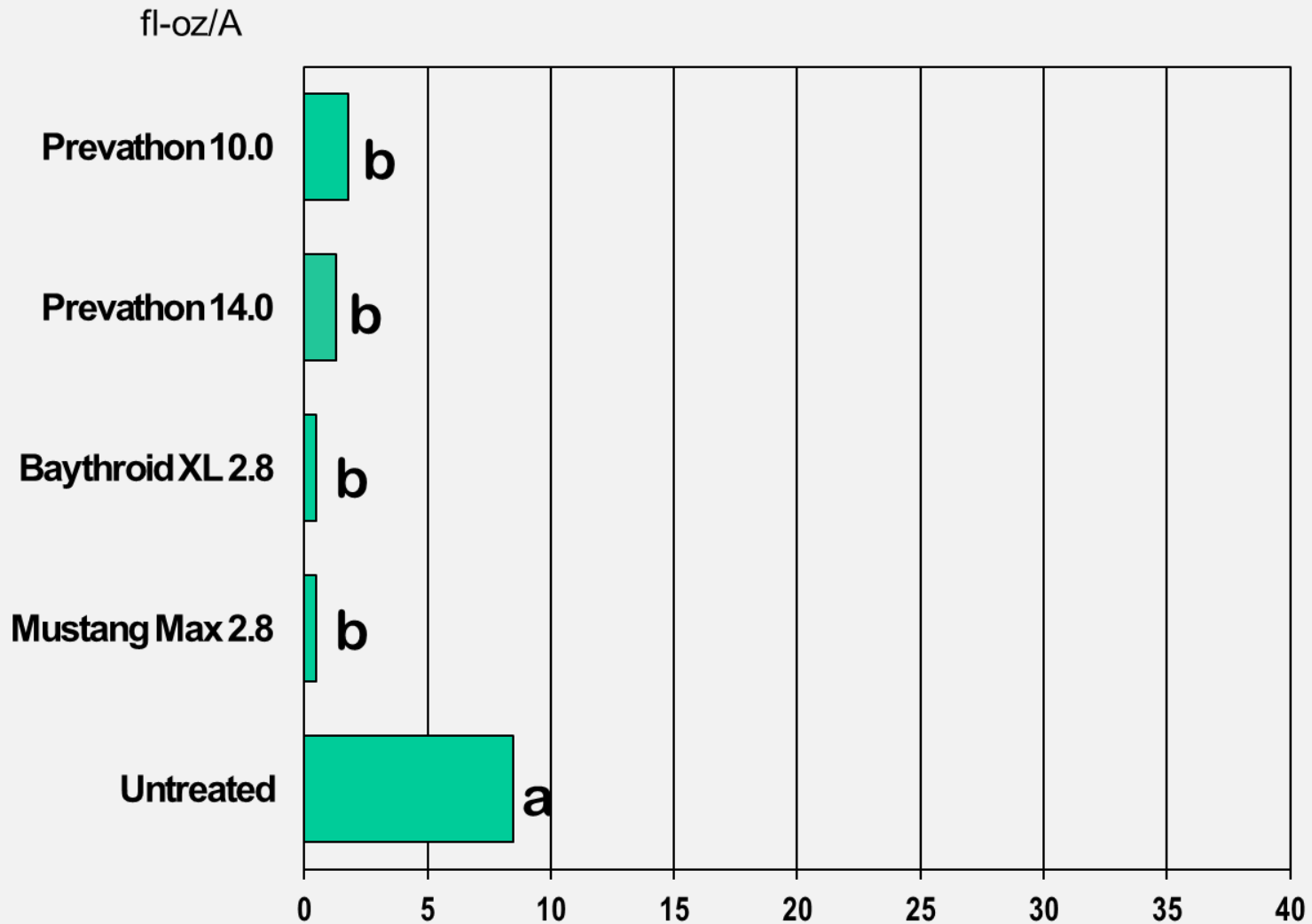
# GRASSHOPPER CONTROL

## NUMBER PER 5 SWEEPS @ 56 DAT



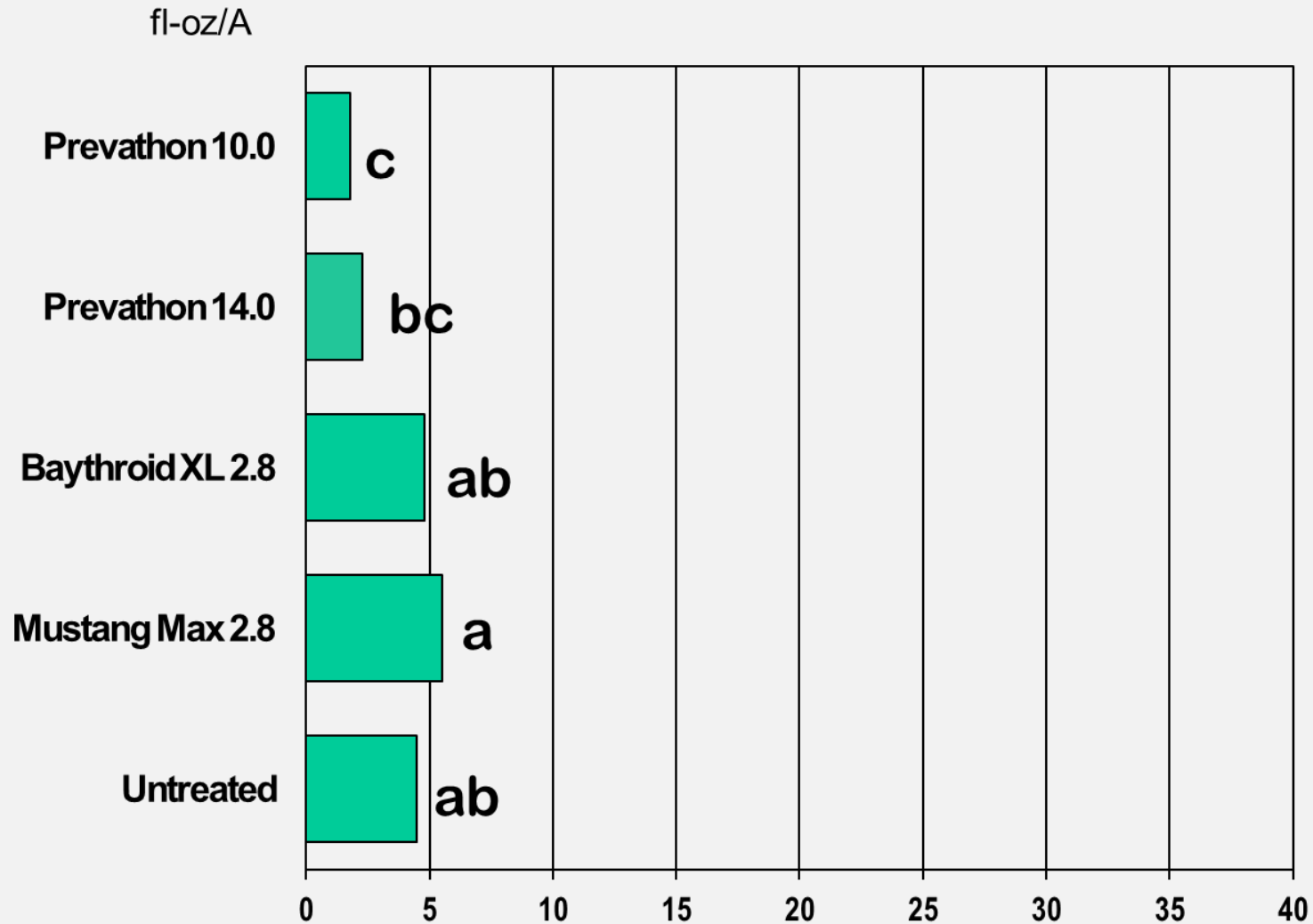
# GRASSHOPPER CONTROL

## NUMBER PER 5 SWEEPS @ 62 DAT



# GRASSHOPPER CONTROL

## NUMBER PER 5 SWEEPS @ 122 DAT

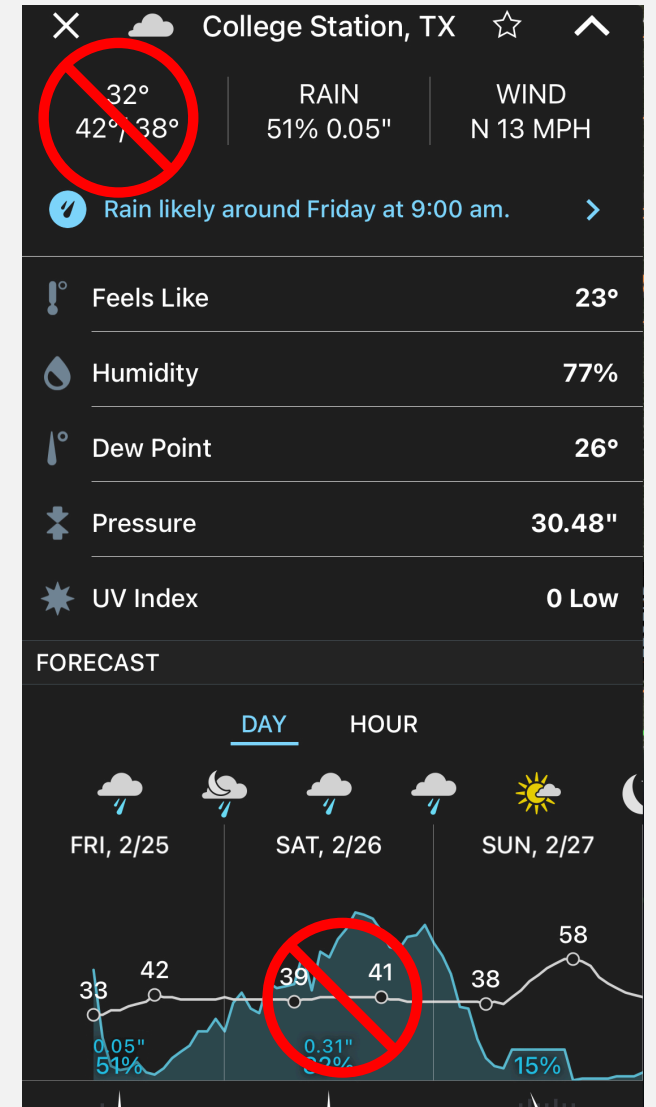


# RED IMPORTED FIRE ANTS



# FIRE ANT BAITING TIPS

- Ants must be actively foraging for bait success
  - Apply when temps are between 75° - 95° with no rain in forecast for 48 hrs
- Place food lures (hot dog slice or potato chip) in area to be treated. Return after 30 minutes and inspect lures for foraging fire ants
- Gaining control of a heavy infestation will require 2 applications
  - Spring: When ants are hungry
  - Early fall: When ant are going dormant
- Once under control, single spring applications with keep them suppressed



# FIRE ANT BAITS FOR USE IN PASTURES



- **Advion Fire Ant Bait**
- **Fenced pastures, but only non-crop/non-grazed**
- **Active Ingredients:**
  - Indoxacarb
    - Direct toxicant, will kill whatever eats it
- **Application Rate:**
  - 1.5 lbs/ac
- **Cost:**
  - \$325 / 25 lb bag
  - \$19.50 / acre

# FIRE ANT BAITS FOR USE IN PASTURES



- **Extinguish Professional**
- **Active Ingredients:**
  - Methoprene
    - IGR, will kill larvae and can sterilize the queen
- **Application Rate:**
  - 1.0 – 1.5 lbs/ac
- **Cost:**
  - \$204 / 25 lb bag
  - \$8.16 / acre (low rate)
  - \$12.24 / acre (high rate)

# FIRE ANT BAITS FOR USE IN PASTURES



- **Extinguish Plus**

- **Active Ingredients:**

- Hydramethylnon
  - Direct toxicant to whatever eats it
- Methoprene
  - IGR, will kill larvae and can sterilize the queen

- **Application Rate:**

- 1.5 – 2.0 lbs/ac

- **Cost:**

- \$218 / 25 lb bag
- \$13.08 / acre (low rate)
- \$17.44 / acre (high rate)



# FIRE ANT BAITS FOR USE IN PASTURES



- **Esteem Ant Bait**
- **Active Ingredients:**
  - Pyriproxifen
    - IGR, will kill larvae and can sterilize the queen
- **Application Rate:**
  - 1.0 – 2.0 lbs/ac
- **Cost:**
  - \$302 / 25 lb bag
  - \$12.08 / acre (low rate)
  - \$24.16 / acre (high rate)

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THANK YOU & QUESTIONS?

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**AGRI**LIFE  
EXTENSION



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