SBAR

THE UNIVERSITY OF ARIZONA

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
COOPERATIVE EXTENSION
School of Plant Sciences

USDA United States Department of Agriculture National Institute of Food and Agriculture

Progress Towards Managing Weeds in Guayule

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Guayule (“why-oo-lee”)

- Guayule – *Parthenium argentatum* (Gray).
- Perennial xerophytic shrub
- Native to the Chihuahuan desert
- North central Mexico & Big Bend region of Texas.
- Natural rubber latex produced in bark
- Commercial variety can be harvested in two years (2 winters)

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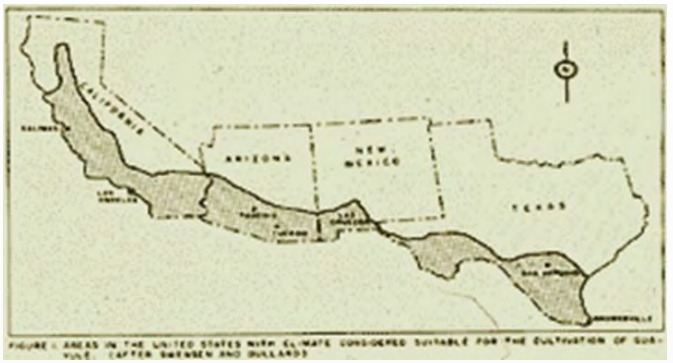
Guayule Rubber

- Primary goal: rubber for tires
- Potential U.S. production area
  - *desert southwest.*
- Guayule and Hevea rubber
  - *same physical and structural properties.*



Weed Control in Guayule is a Challenge

- Hand weeding is expensive
- Few herbicides are registered for guayule.

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Established Guayule is competitive

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Guayule Weed Research

- Preemergence Herbicides
- Postemergence Broadleaf Herbicides
- Postemergence Grass Herbicides
- Possible tactics control weeds during guayule establishment

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Guayule Weed Management Research

- Tractor mounted sprayer
- Preemergence Herbicides in recent experiments
  - Prowl H_2O (pendimethalin)
  - Sonalan (ethalfluralin)
  - Dual Magnum (S-metolachlor)
  - Warrant (acetochlor)
  - Spartan (sulfentrazone)
  - Prefar (bensulide, an organophosphate)

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Experimental Procedures

- Model crop = cotton
- Form beds
- Direct seed with a vacuum planter
  - Coated seed
  - Shallow planting depth
  - Some seed on surface
- Irrigate – every other furrow
  - Sprinkler system initially
  - Water every other furrow
  - Irrigate frequently – 3 to 4 times to germinate seed
  - Maintain moisture in seed zone/top of bed

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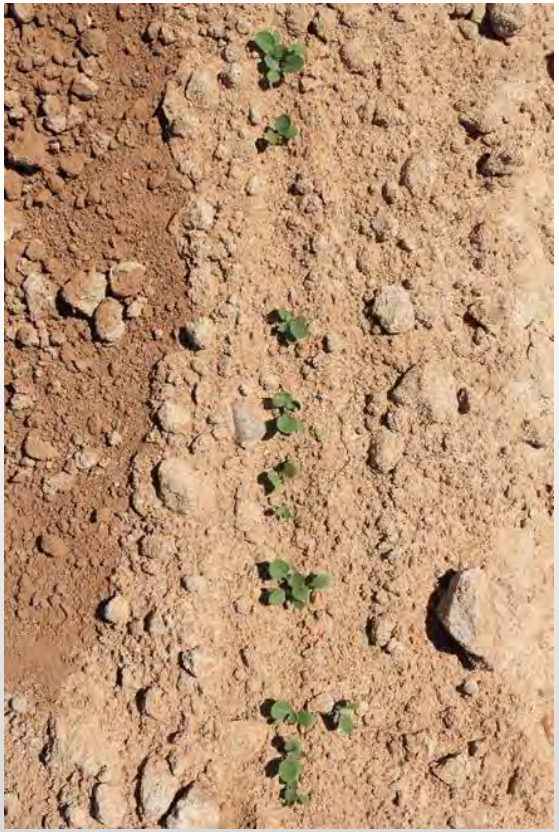
Eloy guayule establishment in with furrow irrigation

Clay loam

Sandy loam



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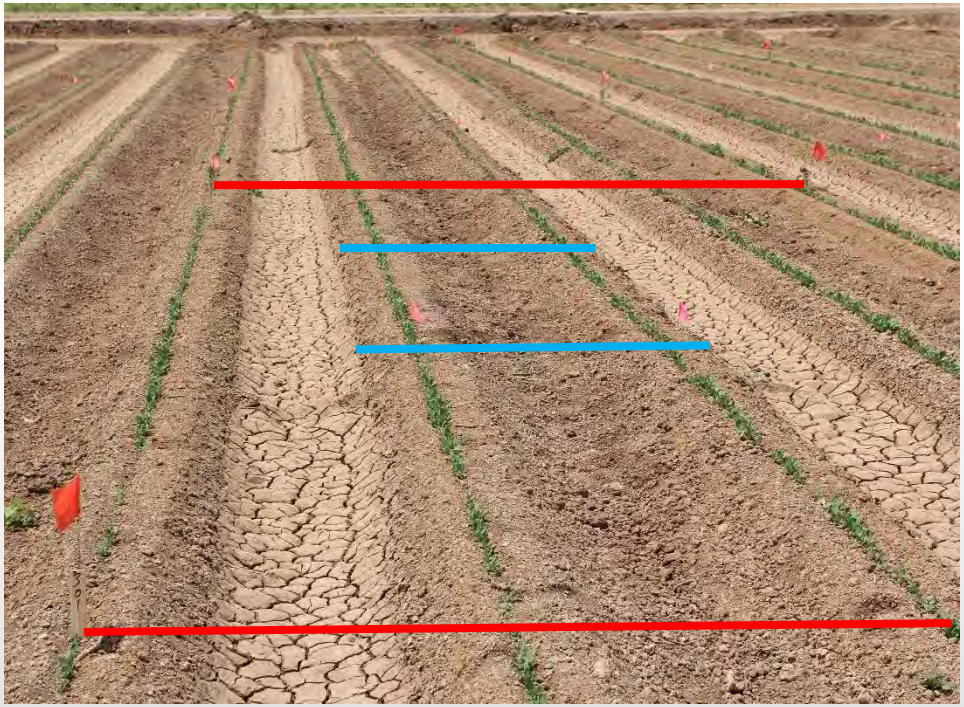
Plots and subplots

- Small plots – 4 to 6 reps.
  - 1 m rows
  - 4 rows by 7.6 or 9.1 m
  - 2 m sub-plots marked with flags
- Sprayed all 4 rows plots
- Collected data in sub-plot seed rows
- Sub-plots were hand weeded as needed



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Spray parameters

- Broadcast spray
- TeeJet AI-11002 flat fan nozzles
- Boom spacing = 20″ (51 cm)
- Pressure = 45 PSI (310 kPa)
- Carrier volume
  - ~20 gallons/acre
  - ~187 L/ha
- Sprayer speed = 3.1 MPH (5 km/hr)

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Data Collection

- Post-emergence stand counts
  - *# of plants/2-m (stand count)*
- Visual estimates of phytotoxicity
  - *Necrosis*
  - *Stunting*
- Plant heights
- Nadir photographs

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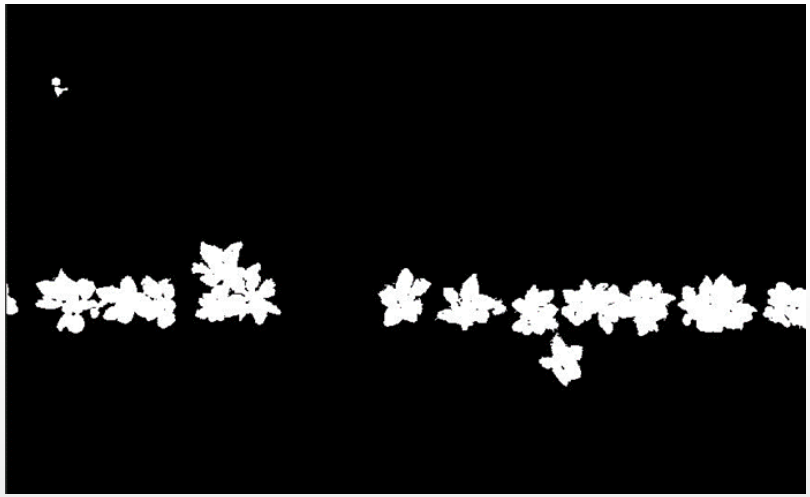
Nadir photographs and pixel analysis

Programs: Easy Leaf (2018) and Canopeo (2019)



Pixel analysis used to calculate:

- % canopy ground cover/row-meter
- cm^2 canopy/row-meter

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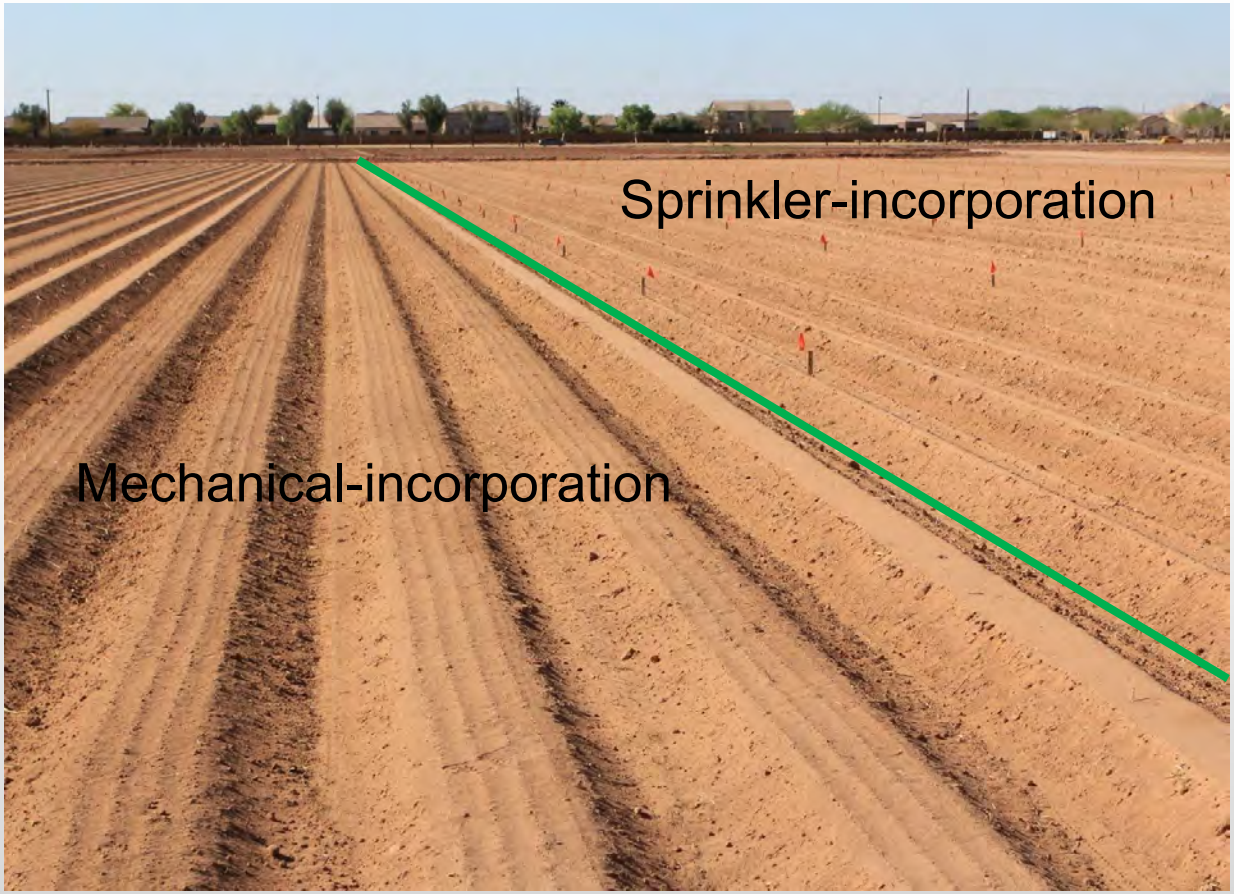
Mechanical incorporation *versus* sprinkler incorporation

Both were sprinkler irrigated to germinate guayule

Maricopa Ag. Center – 2018



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Bed-top herbicide incorporation versus on the flat prior to bed formation

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Soil Characteristics at Guayule Study Sites

Soil	Texture			Organic Matter	pH	CEC
	Sand	Silt	Clay			
	(%)	*(%)*	*(%)*	*(%)*		*(Meq/100 g)*
Bridgestone – Eloy	20	46	34	1.7	8.2	38.3
MAC – Field 1, Borders 36-41	68.3	19	12.7	1.1	8.7	16.2

Bridgestone – Clay loams or silt loams

MAC – Sandy loams

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Maricopa Ag Center – Fall 2018
Field 1, Borders 36-41

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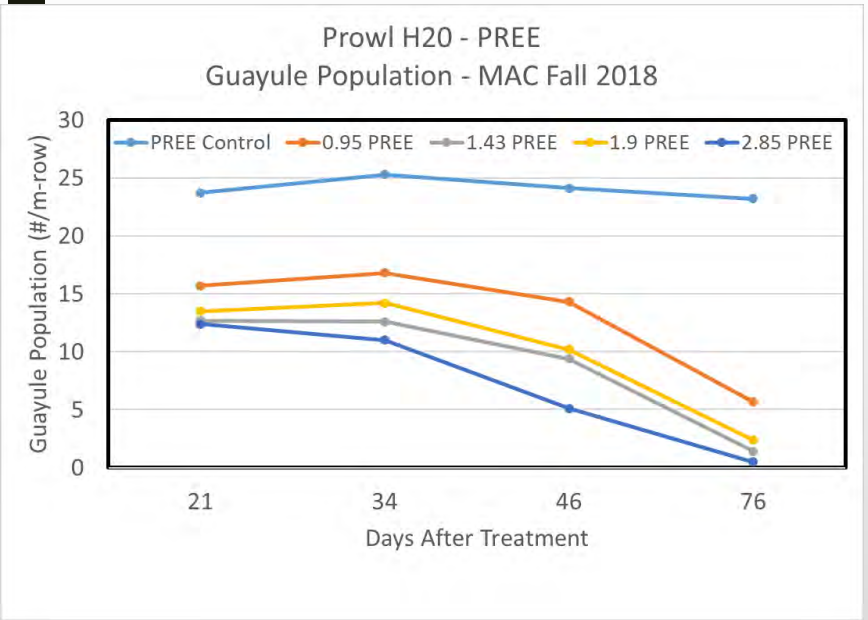
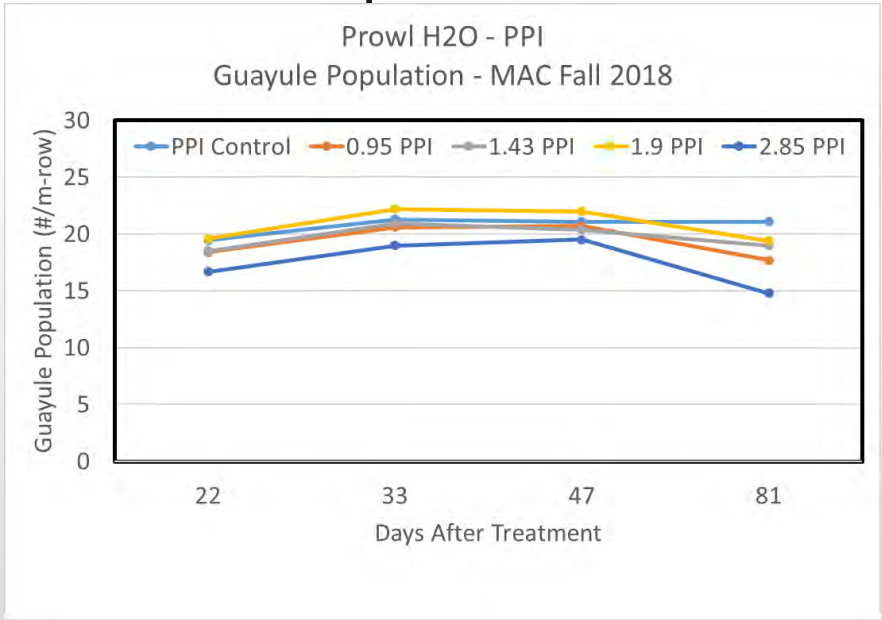
Guayule response – pendimethalin MAC – Fall 2018

- Sprinkler irrigation during establishment followed by furrow irrigation
- Herbicide rates are lb. a.i./A

Sprinkler incorporation



Mechanical incorporation - PPI bed top



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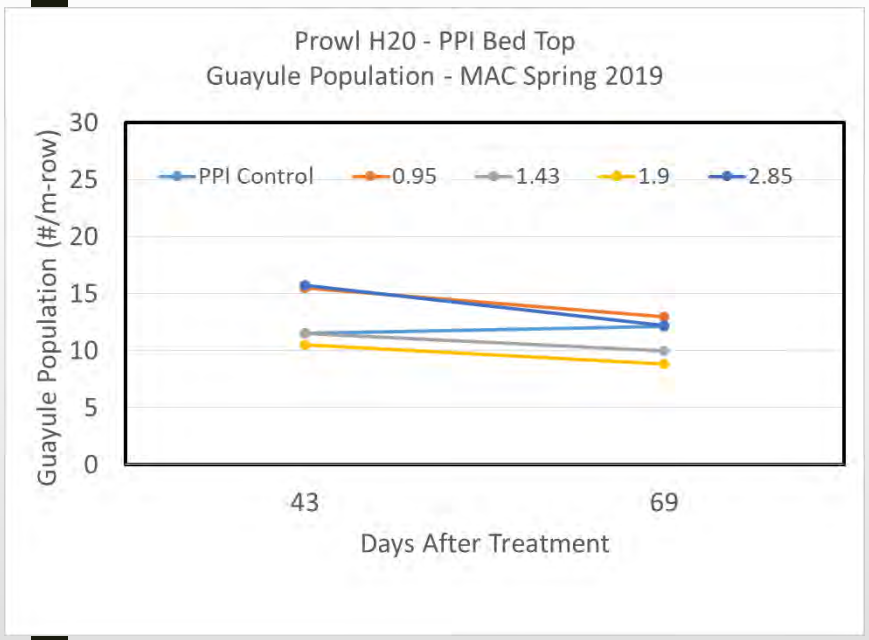
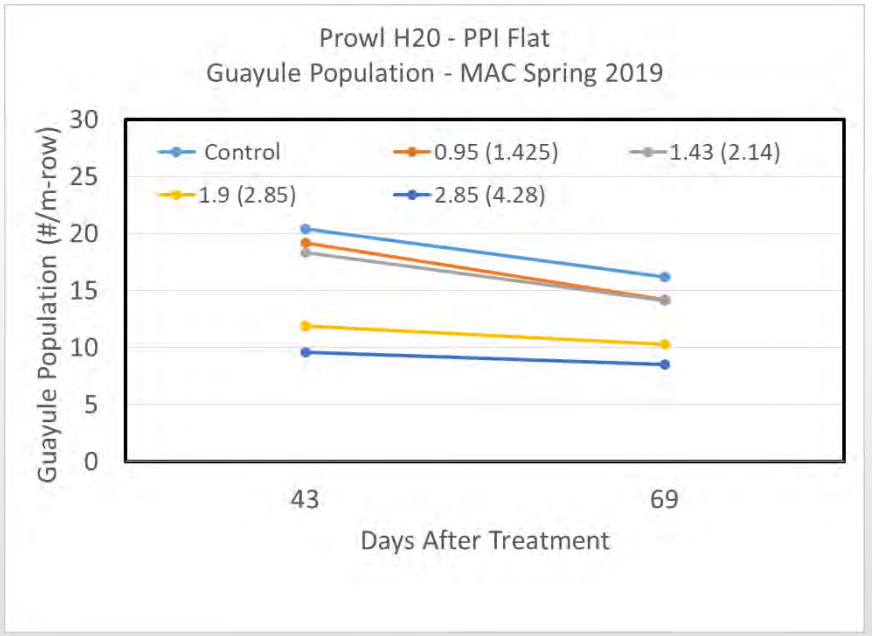
Guayule response to Prowl H_2O MAC – Spring 2019

PPI Bed Top (lb. a.i./A)



PPI Flat (lb. a.i./A)



Furrow irrigated during establishment

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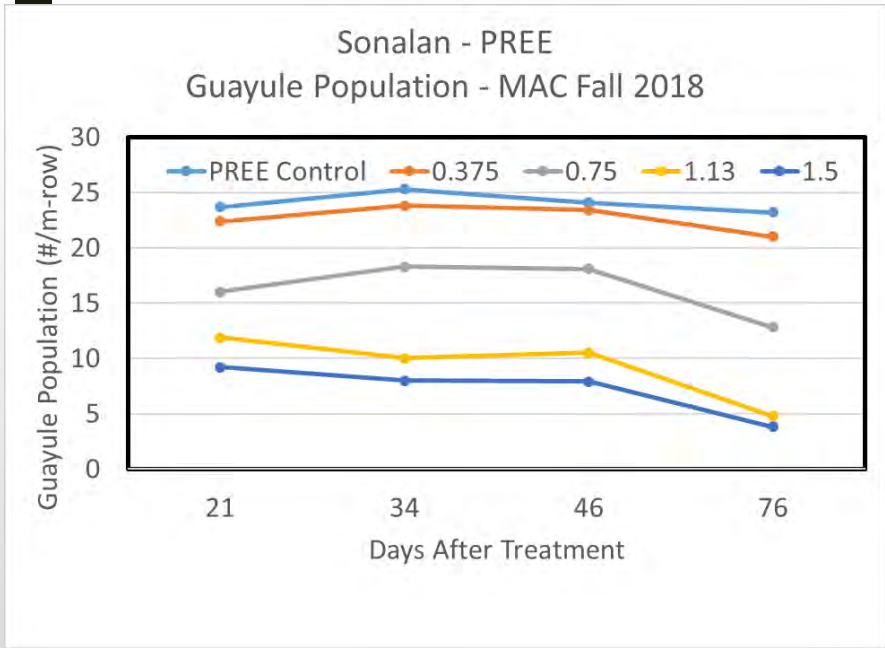
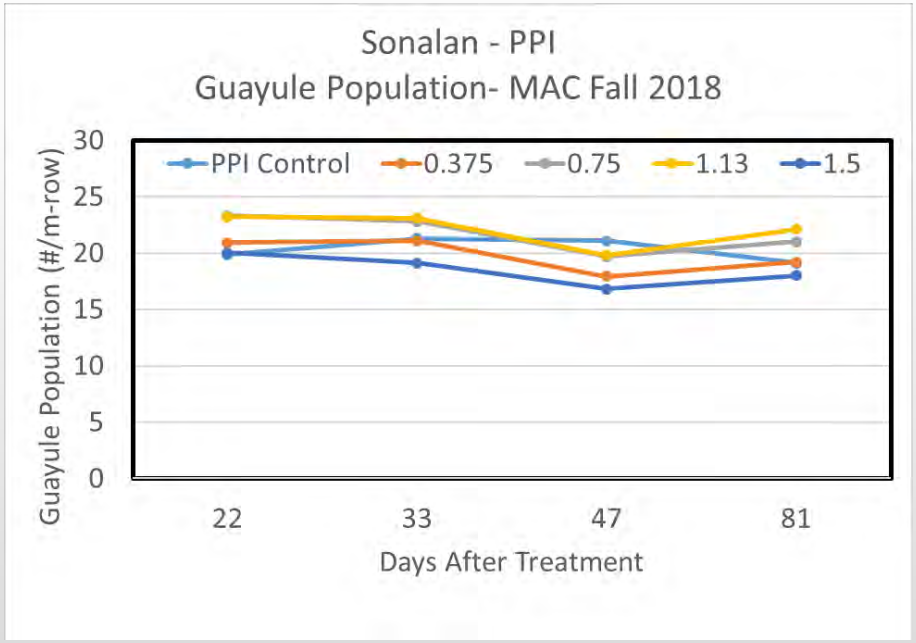
Guayule response - ethalfluralin MAC – Fall 2018

- Sprinkler irrigation during establishment followed by furrow irrigation
- Herbicide rates are lb. a.i./A

Sprinkler incorporation



Mechanical incorporation - PPI Bed top



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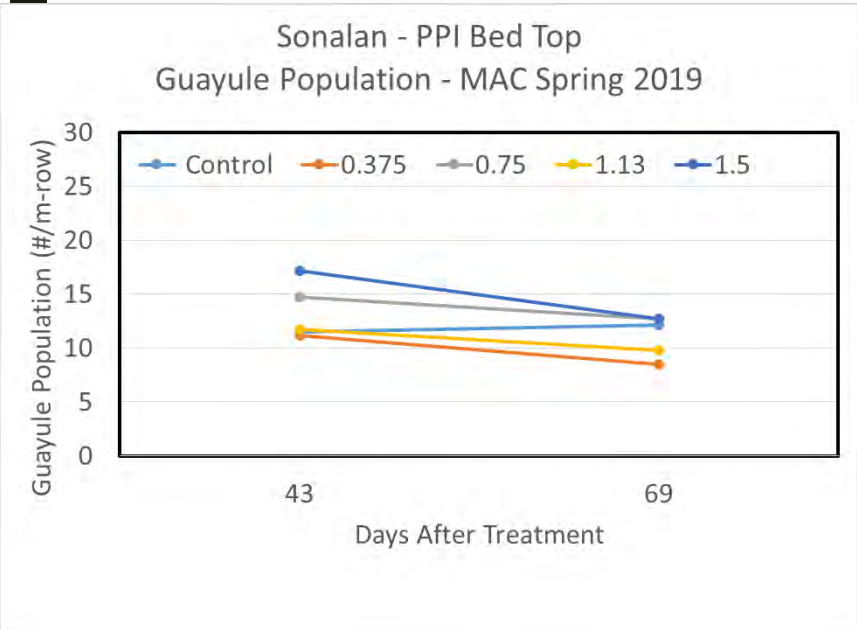
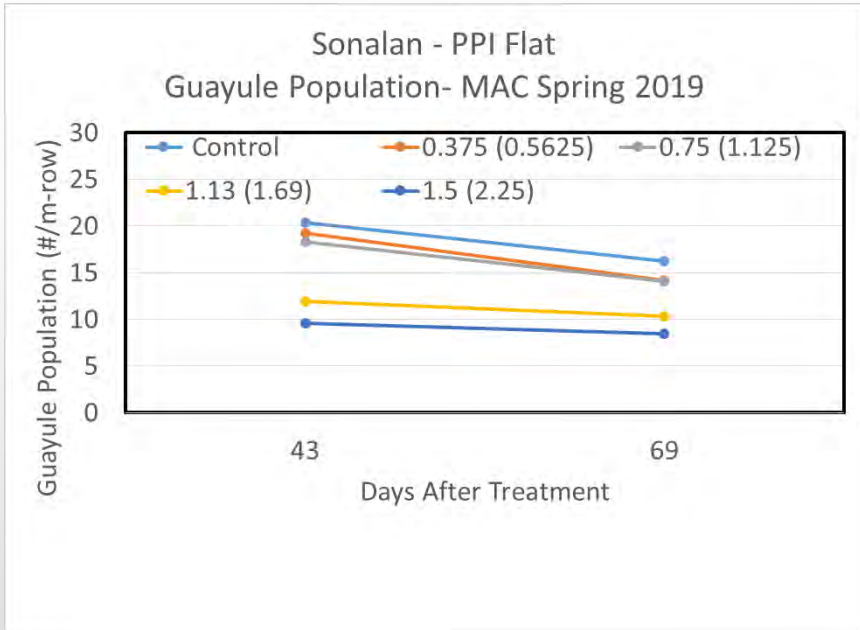
Guayule response to Sonalan MAC – Spring 2019

PPI Bed Top (lb. a.i./A)



PPI Flat (lb. a.i./A)



Furrow irrigated during establishment

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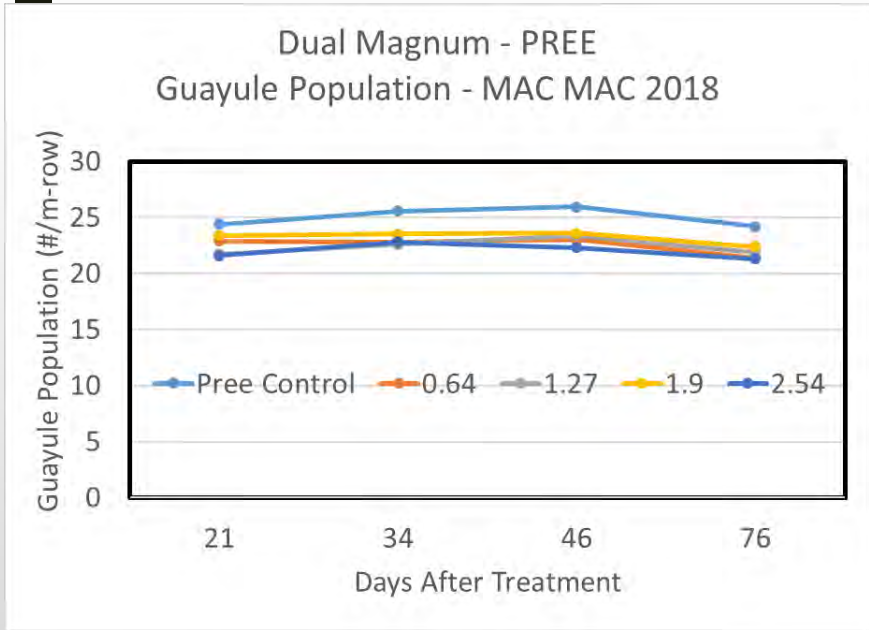
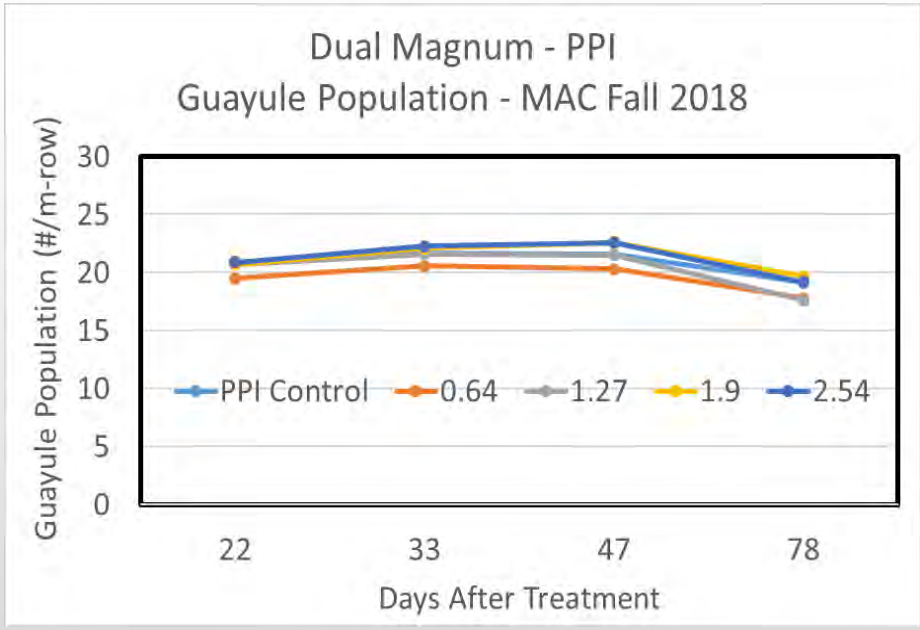
Guayule response – metolachlor MAC – Fall 2018

- Sprinkler irrigation during establishment followed by furrow irrigation
- Herbicide rates are lb. a.i./A

Sprinkler incorporation



Mechanical incorporation



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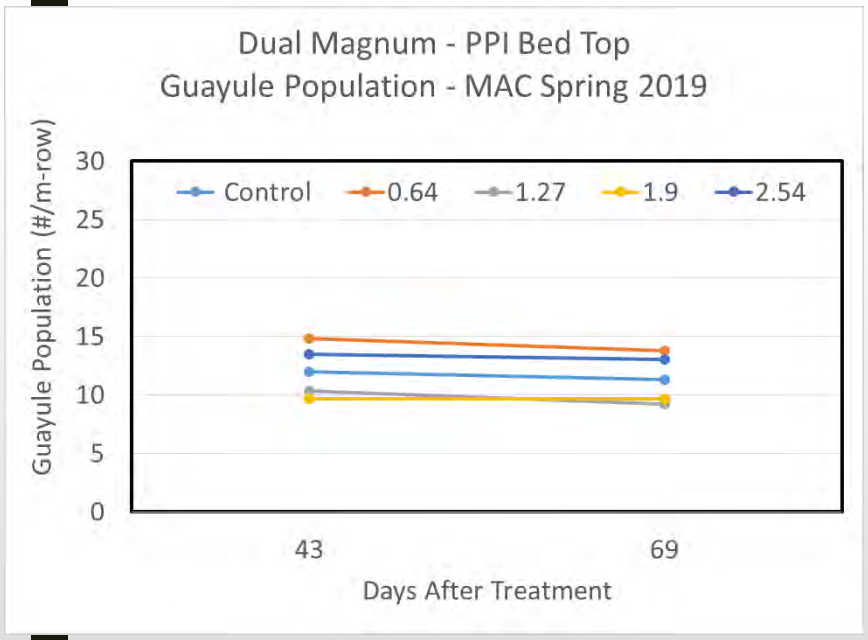
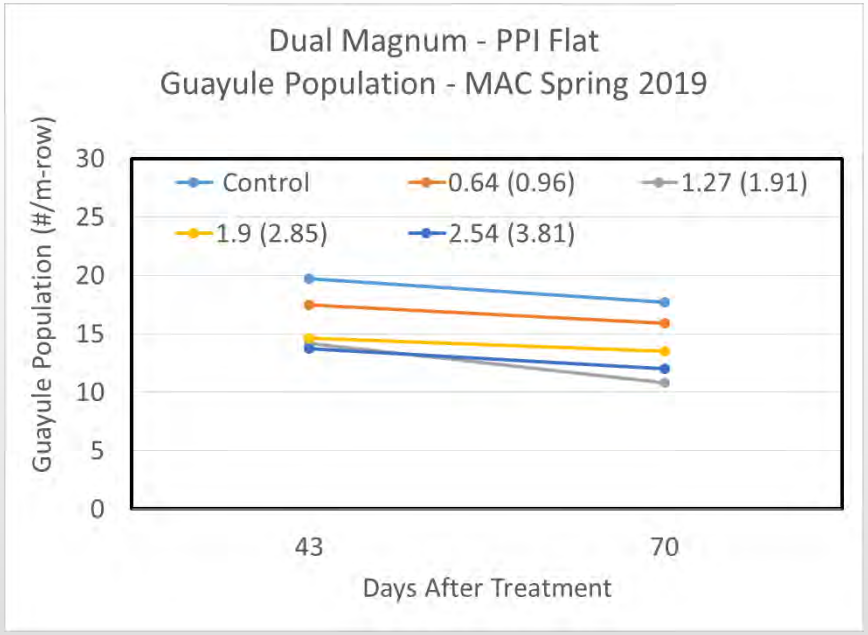
Guayule response to Dual Magnum MAC – Spring 2019

PPI Bed Top (lb. a.i./A)



PPI Flat (lb. a.i./A)



Furrow irrigated during establishment

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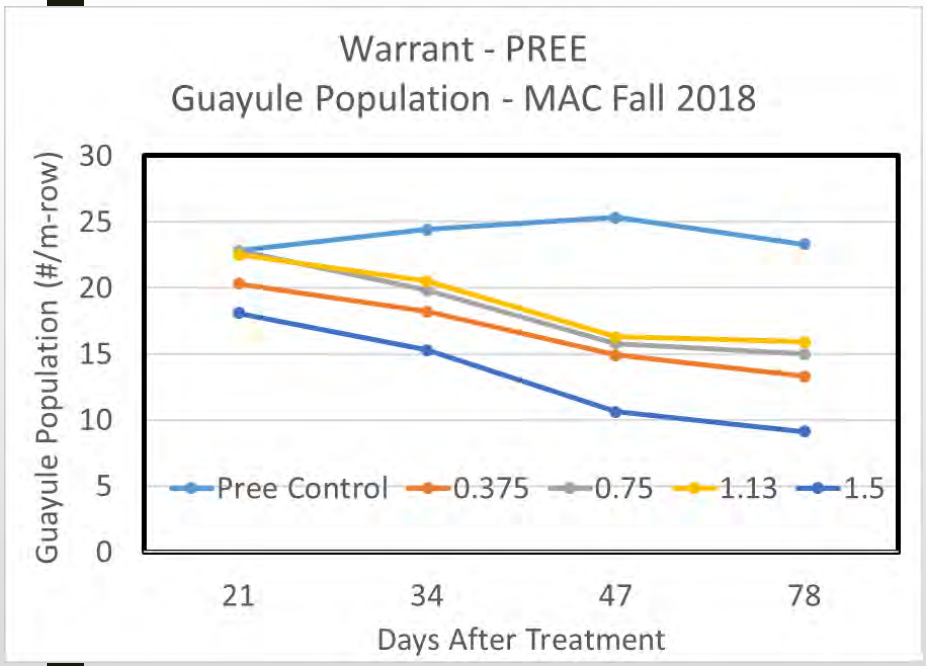
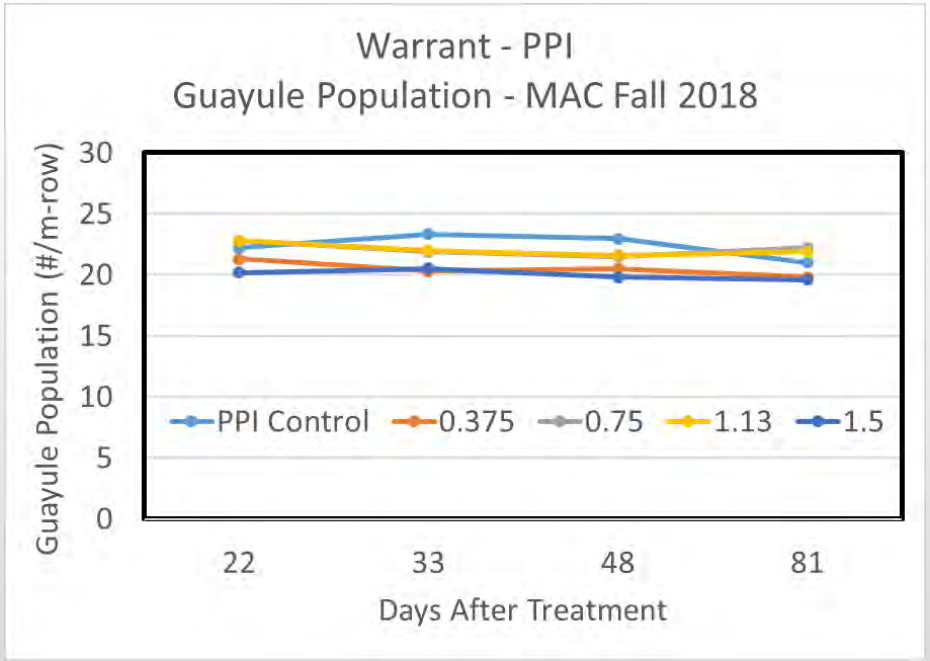
Guayule response - acetochlor MAC – Fall 2018

- Sprinkler irrigation during establishment followed by furrow irrigation
- Herbicide rates are lb. a.i./A

Sprinkler incorporation



Mechanical incorporation



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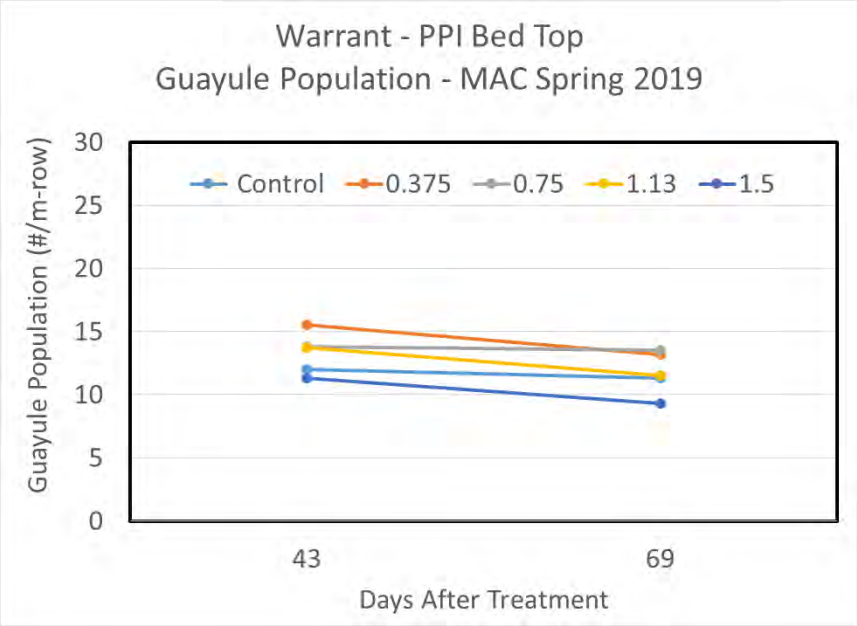
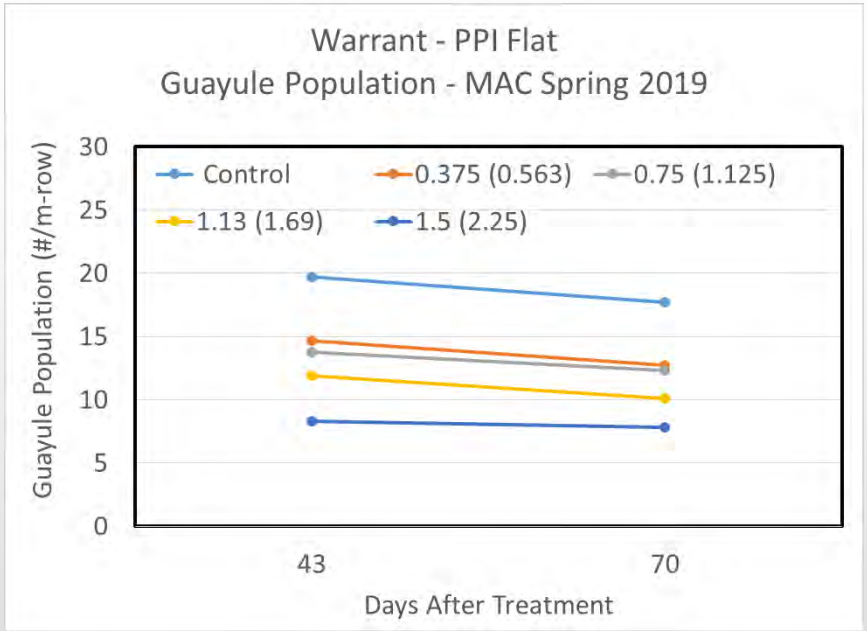
Guayule response to Warrant MAC – Spring 2019

PPI Bed Top (lb. a.i./A)



PPI Flat (lb. a.i./A)



Furrow irrigated during establishment

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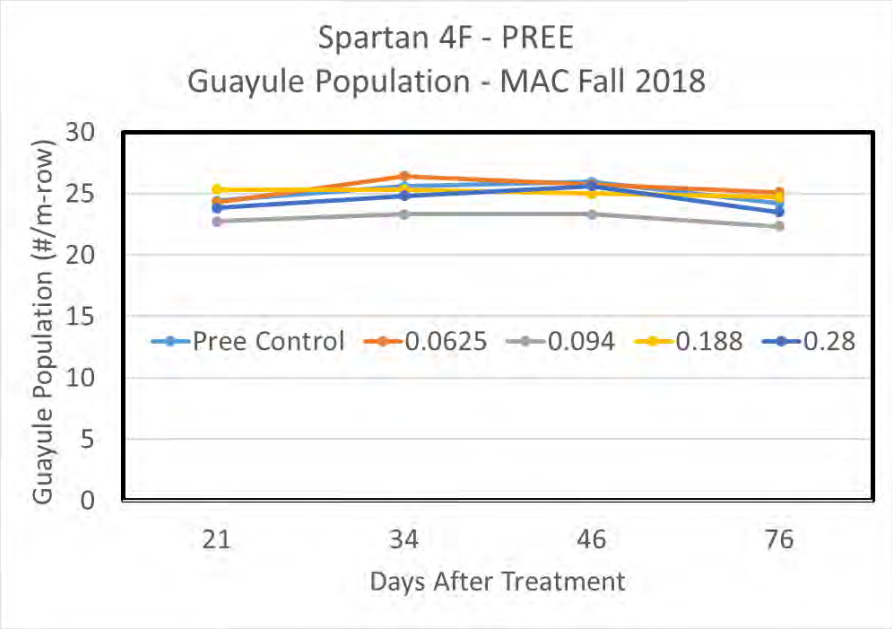
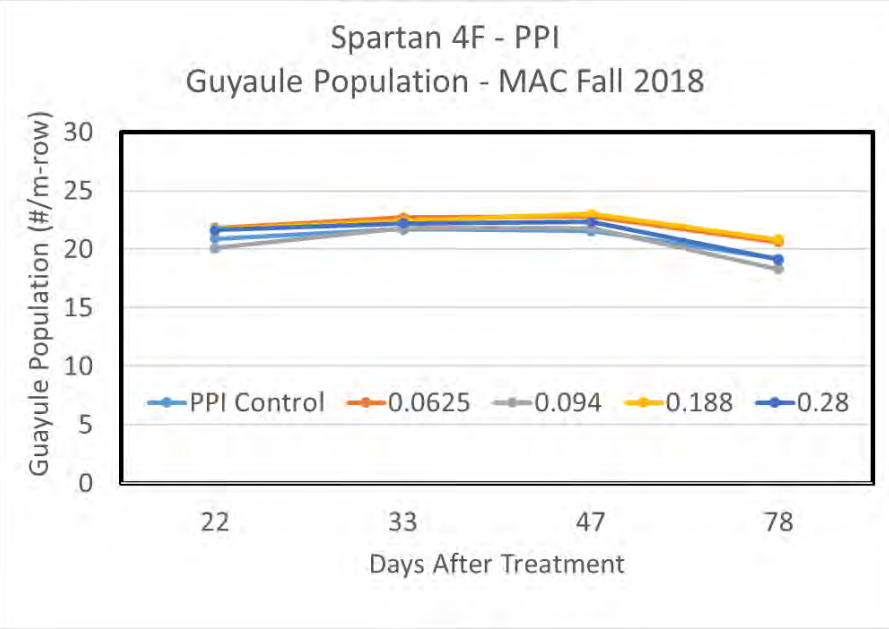
Guayule response - sulfentrazone MAC – Fall 2018

- Sprinkler irrigation during establishment followed by furrow irrigation
- Herbicide rates are lb. a.i./A

Sprinkler incorporation



Mechanical incorporation



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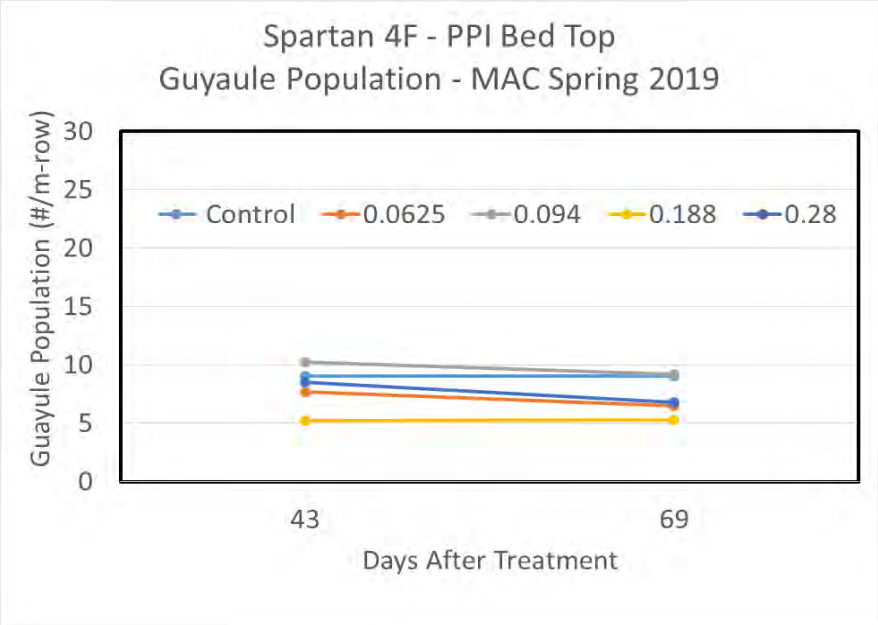
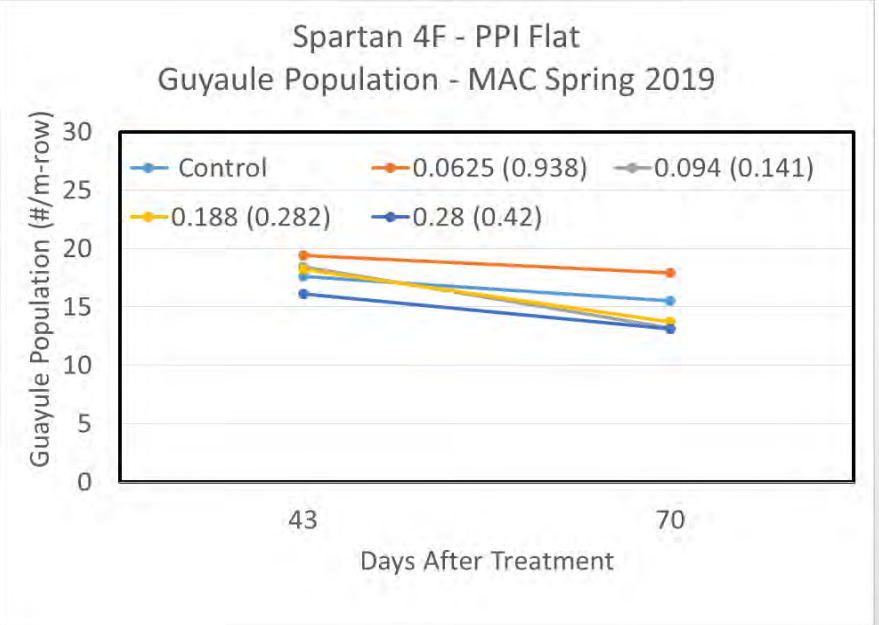
Guayule response to Spartan 4F MAC – Spring 2019

PPI Bed Top (lb. a.i./A)



PPI Flat (lb. a.i./A)



Furrow irrigated during establishment

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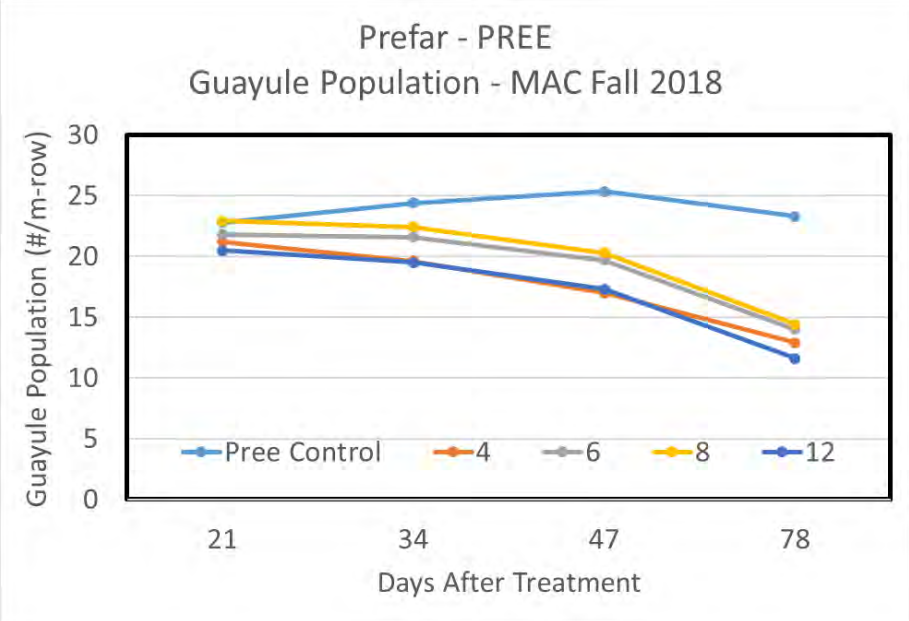
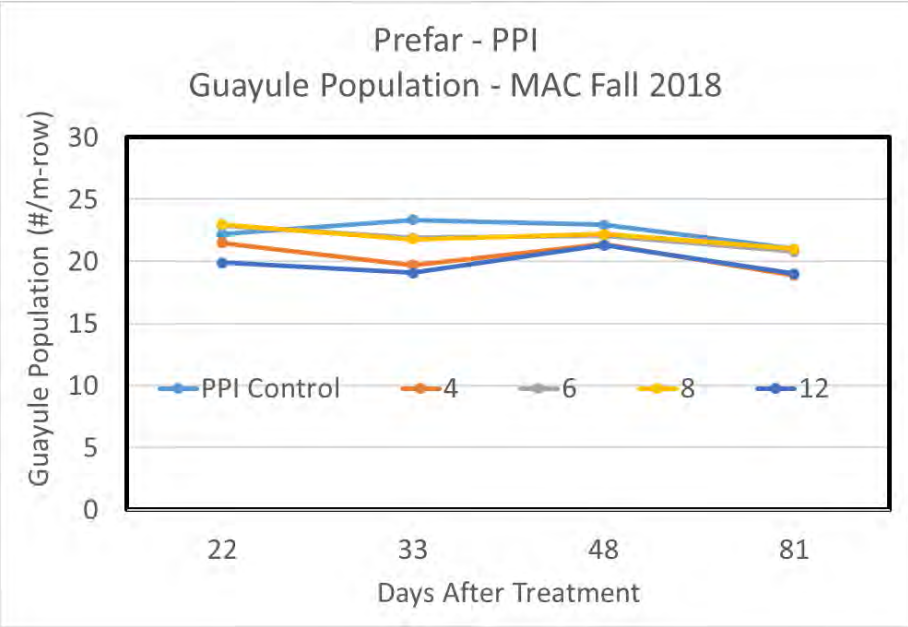
Guayule response - bensulide MAC – Fall 2018

- Sprinkler irrigation during establishment followed by furrow irrigation
- Herbicide rates are lb. a.i./A

Sprinkler incorporation



Mechanical incorporation



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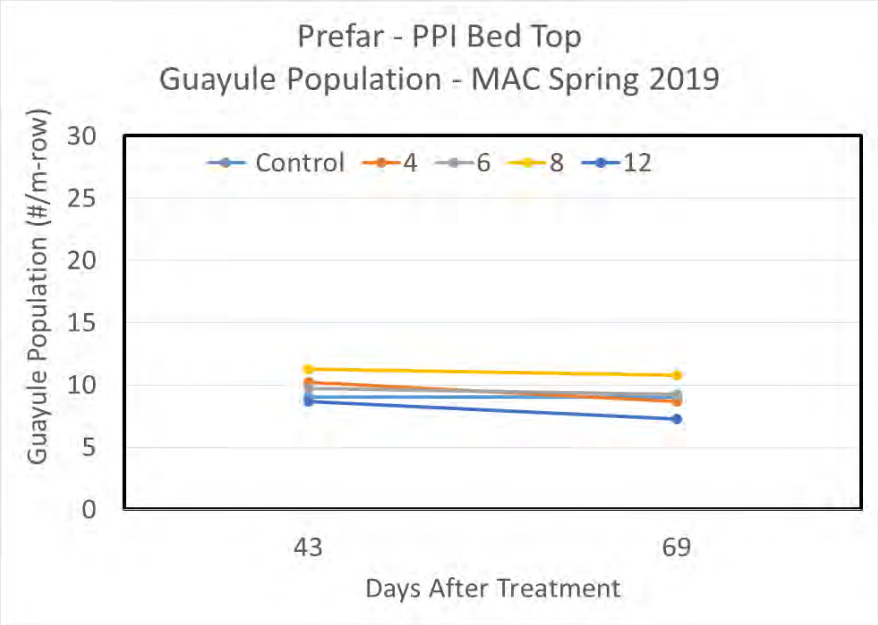
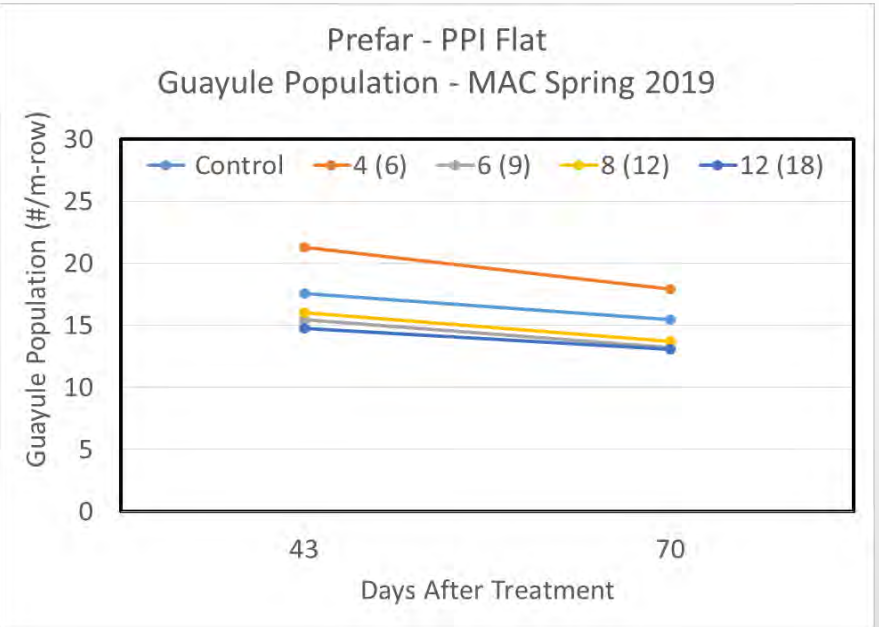
Guayule response to Prefar MAC – Spring 2019

PPI Bed Top (lb. a.i./A)



PPI Flat (lb. a.i./A)



Furrow irrigated during establishment

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Conclusions

- Metolachlor (Dual Magnum) & sulfentrazone (Spartan)
  - *Safe at 2X rate*
  - *PREE & PPI on both sandy loams & clay loams*
- Acetochlor (Warrant), bensulide (Prefar)
  - *Safe at 2X rate incorporated*
  - *Can tolerate 2X rate preemergence and obtain good stand*
- Ethalfluralin (Sonalan), pendimethalin (Prowl H_2O)
  - *Safe at 2X rate when incorporated*
  - *Preemergence use caused loss of plants in sandy loam soils and less so in clay loam soils*
  - *Need to adjust rate for soil type*
  - *Guayule may grow slower initially*

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Guayule (*Parthenium argentatum*) Seedling Tolerance to Topically Applied Carfentrazone-ethyl Herbicide

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  Bridgestone Agro Operations
  Eloy, AZ
- Bryan Pastor
  Research Technician, University of Arizona

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POST herbicide tolerance is a challenge – Spring 2018 Aim Study in Eloy

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Aim Study at Bridgestone Farm – Spring 2018 Study in Eloy

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Pre-spray counting, spraying, and post-spray counting dates

Planting Date was 5/4/2018

Sprayed Plant Size	Spraying Dates – pre-spray counts on same day or 1 day before spraying				Post-spray counting	Days After Treatment
2 leaf	5-25-18				7-11-18	47
3.6 leaf		6-1-18			7-11-18	41
5.6 leaf			6-8-18		7-11-18	33
10.4 leaf				6-20-18	7-11-18	21

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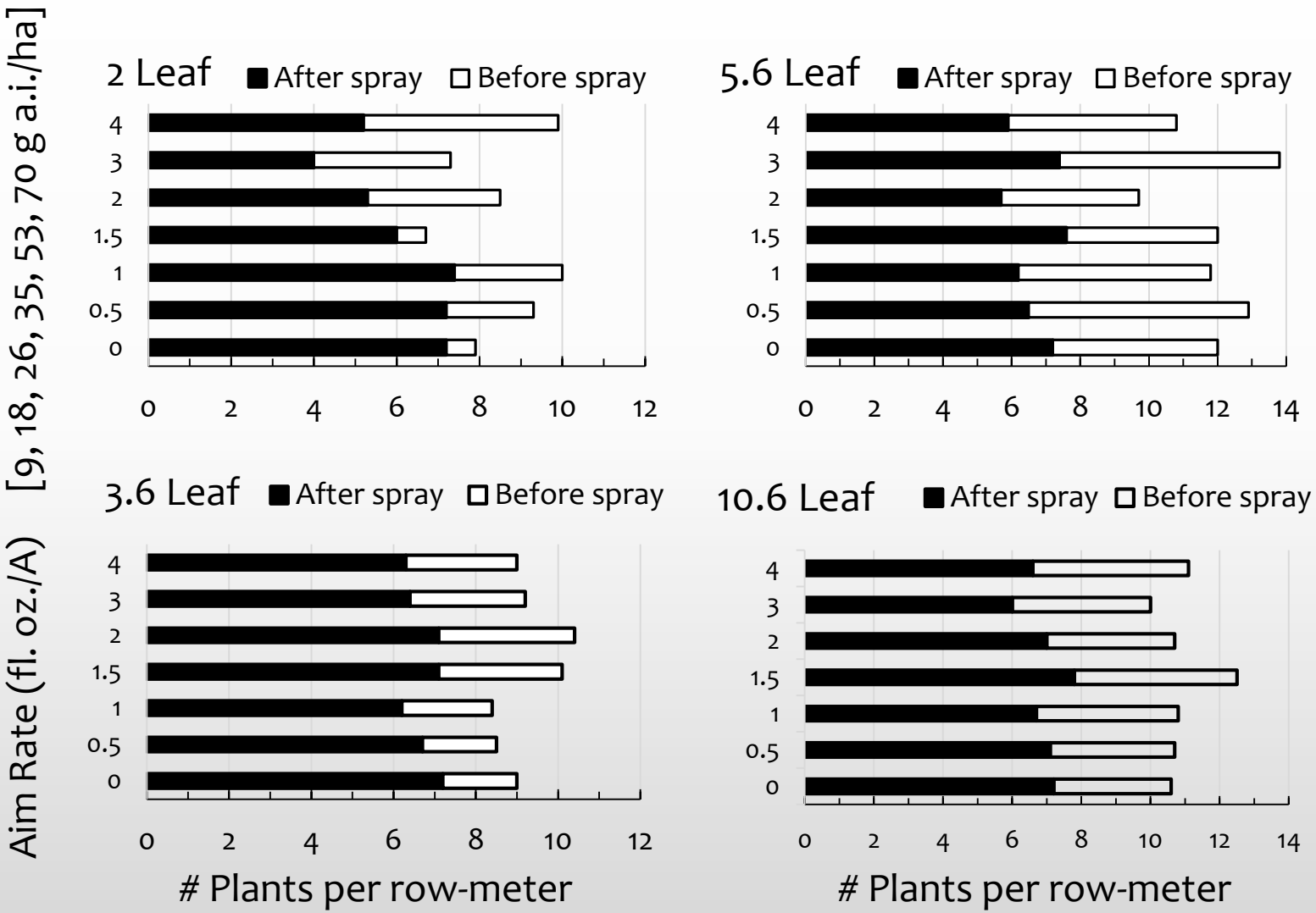
Aim (carfentrazone) effect on pre- and post-spray plant population (2018)



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Aim (carfentrazone) effect on guayule canopy cover

Treatment	Rate			Canopy Ground Cover 6/8/2018	
Size at treatment				2 true leaves	3.6 true leaves
Days After Treatment				14 DAT	7 DAT
	fl. oz./A	lb. ai./A	g a.i./ha	(cm^2/row-m)	(cm^2/row-m)
Aim 2EC	0.5	0.0078	8.7	14.7 ± 3.3 a	10.3 ± 3.7 ab
Aim 2EC	1.0	0.0156	17.5	9.5 ± 3.3 ab	5.9 ± 2.9 bc
Aim 2EC	1.5	0.0234	26.2	5.4 ± 5.6 bc	5.2 ± 2.9 bc
Aim 2EC	2.0	0.0313	35.1	3.7 ± 2.0 cd	3.1 ± 1.3 cd
Aim 2EC	3.0	0.047	52.7	2.9 ± 1.5 cd	2.4 ± 0.6 cd
Aim 2EC	4.0	0.0625	70.1	3.6 ± 5.7 cd	1.9 ± 1.0 cd
Untreated	0	0	0	16.6 ±0.2 a	

Data were transformed prior to analysis (log transformation of X+1). Data are means ± SD (n=5); means followed by the same letter within the table do not significantly differ (P=0.5, Student-Newman-Keuls)

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Aim @ 2 fl. oz./A on 3.5 leaf guayule

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Pre-spray counting, spraying, and post-spray counting dates

Planting Date was 5/9/2019

Sprayed Plant Size	Spraying Dates – pre-spray counts on same day or 1 day before spraying				Post-spray counting	Days After Treatment
2 leaf	6-4-19				7-12-19	38
4 leaf			6-13-19		7-12-19	29
7 leaf				6-25-19	7-12-19	17

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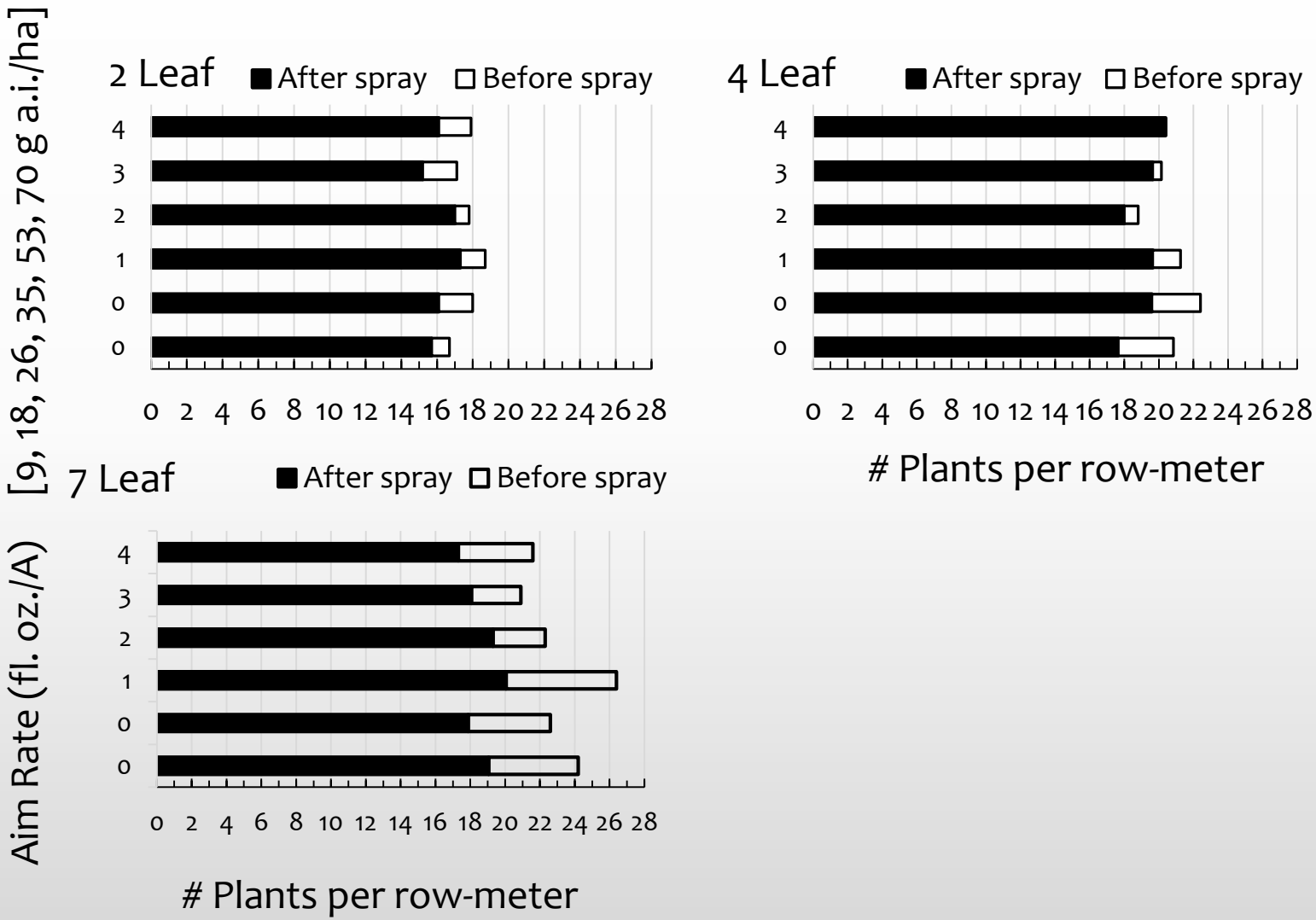
Aim (carfentrazone) effect on pre- and post-spray plant population (2019)



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Guayule Tolerance to Aim 2EC (Carfentrazone-ethyl)

- Carfentrazone symptoms: necrotic spots on leaves, and loss of leaves
- Injury increased with carfentrazone rate
- Injury decreased with guayule plant size
- Carfentrazone injury caused some stand loss at higher rates and stunted plants
- Plants grew out of the injury
- Aim rates of 17 to 35 g/ha (1 to 2 fl. oz./A of Aim) can be used provided growers are educated to expect some injury

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Tactics for Guayule Weed Control

- Plant in a field with low weed density
- Preplant incorporated herbicide (e.g., Prowl or Sonalan)
- Grass herbicide if needed when guayule has **2 leaves**
- Spray Aim at 1.6 oz/A when guayule has **4 leaves**
- Carefully cultivate (avoid covering guayule)
- Apply preemergence herbicide topically before irrigating (e.g., Dual, Spartan, Prowl H2O)
- Spray Aim at 1.6 to 2 oz/A
- A repeat cultivation may be necessary

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