

Influence of Glufosinate Tank-mix Combinations with PPO-inhibitors on Waterhemp Control and Soybean Development and Yield

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Cropping Systems Weed Science
UNIVERSITY OF WISCONSIN-MADISON

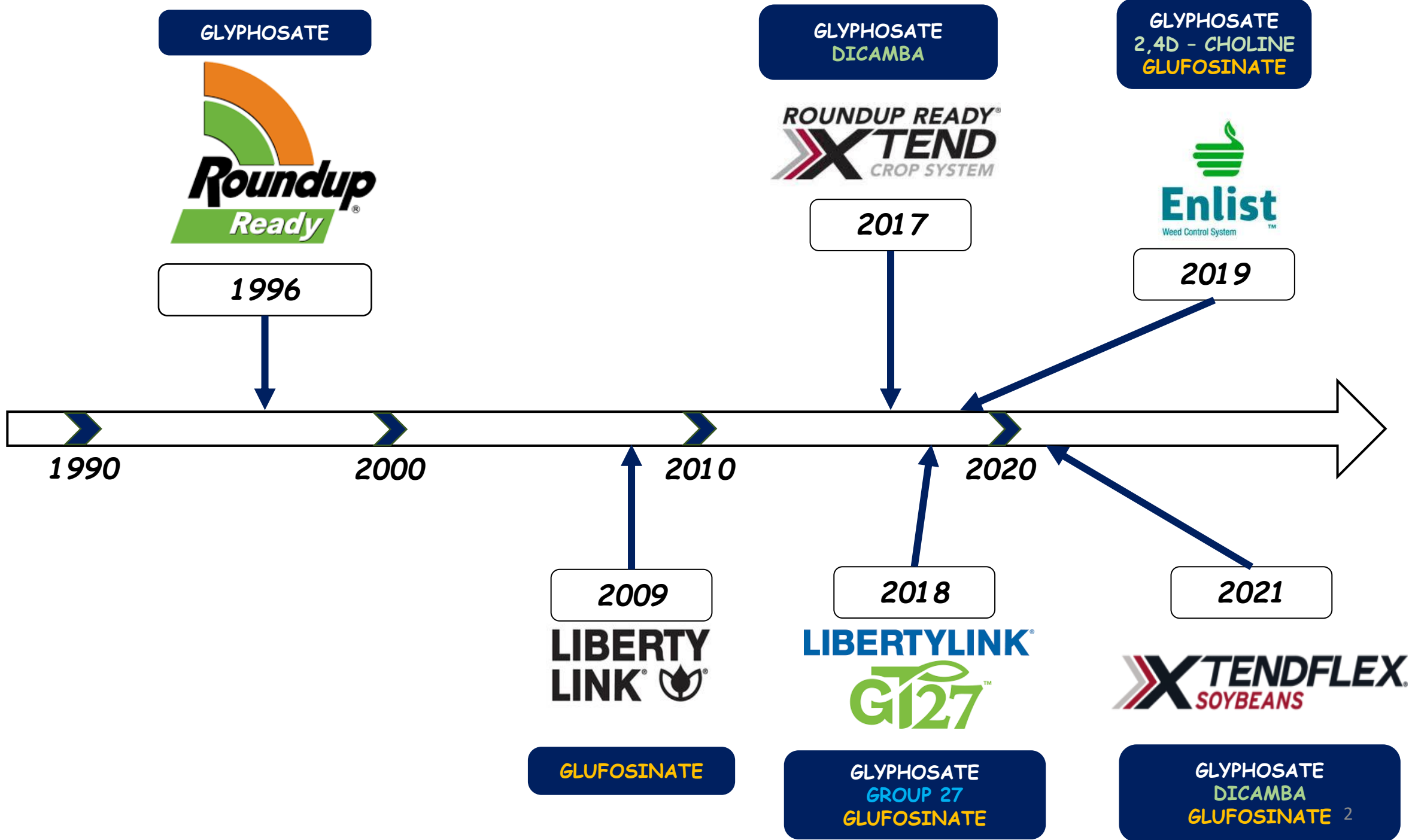


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“According to our latest study, due to COVID-19 pandemic, the global glufosinate market size is estimated to be worth \$ 422.9 million in 2021 and is forecast to a readjusted size of \$816.6 million by 2028 with a CAGR of 9.9% during review period.”

Search, locate, and access a wide range of global market report titles for a variety of industries, sectors, verticals etc.

Source: marketsandresearch.biz

January 2022

TOP INDUSTRIES

We are driven by a constant urge to scan and research market scenarios across all regions and continuously update and upgrade existing reports, and create and add new, unique, and meaningful reports to our ever-growing repository.

- Aerospace & Defense
- Agriculture
- Animal Healthcare
- Automotive and Transportation
- Biotechnology

- Business Services
- Chemicals & Materials
- Consumer Goods
- Electronics
- Energy & Mining

- Equipment and Machinery
- Financial Services
- Food and Beverages
- Healthcare
- Manufacturing and Construction

- Medical Devices
- Metals and Minerals
- Packaging
- Pharmaceutical
- Semiconductor and Electronics



A common scenario in the field



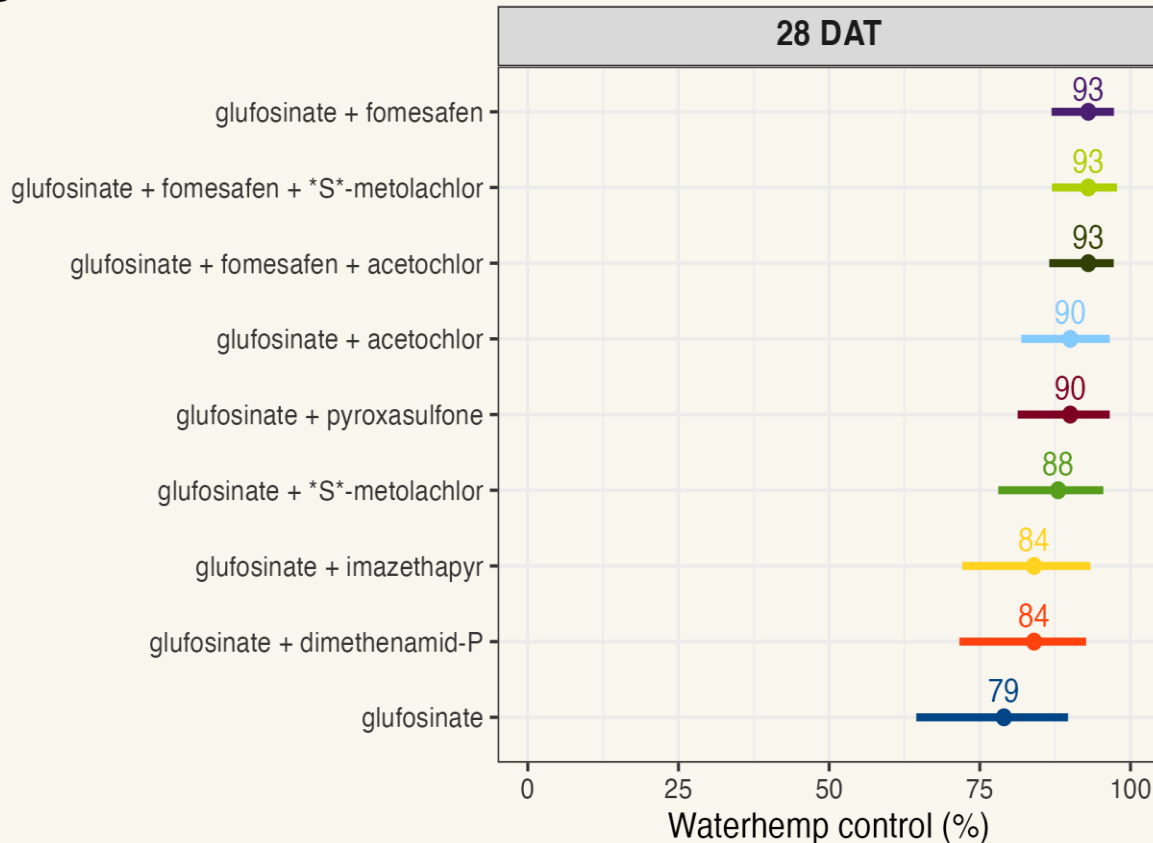
Credit: Dr. Rodrigo Werle

4 Site-Year Study

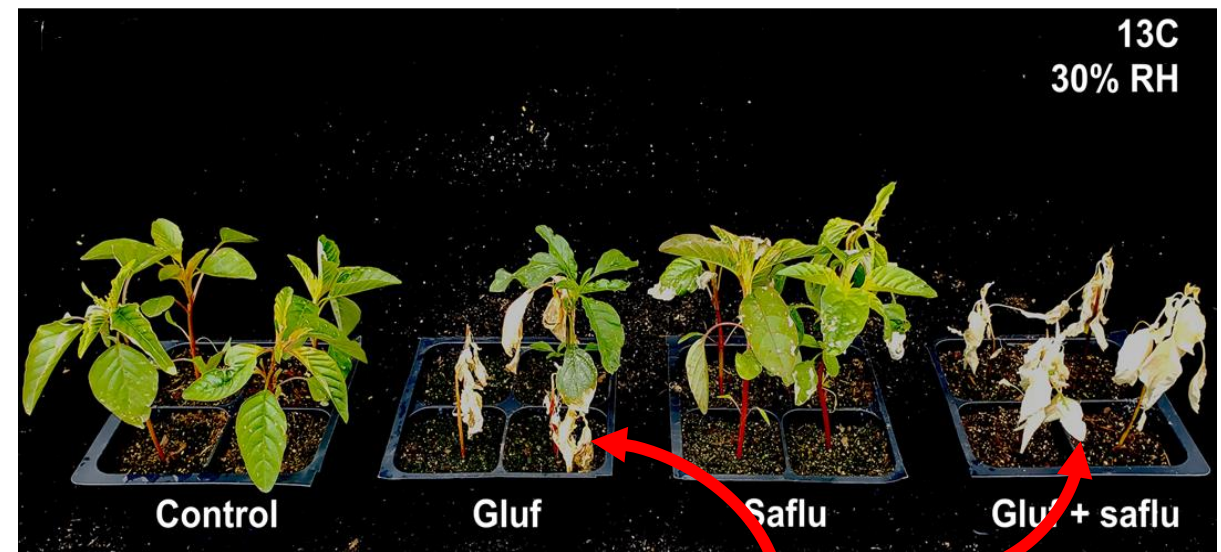
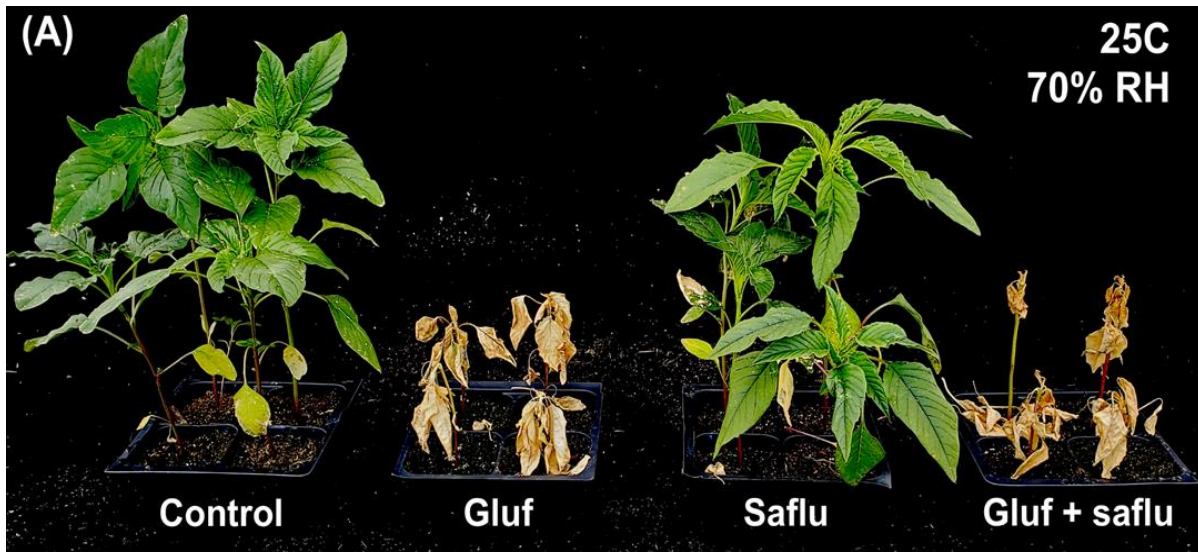
Wisconsin (2019 & 2020)

Waterhemp Management in Southern Wisconsin Using a Layered Residual Approach in Glufosinate-Resistant Soybeans

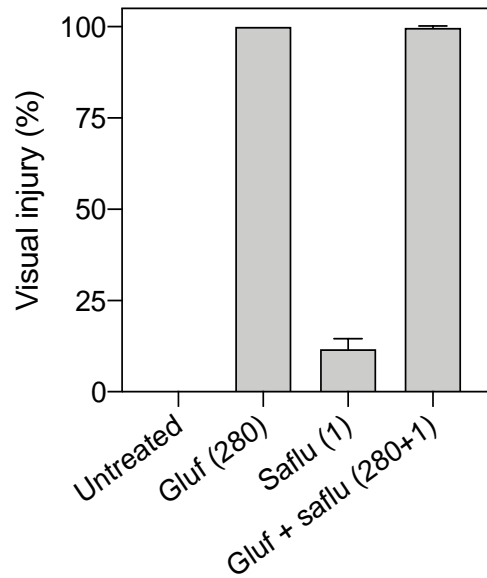
B



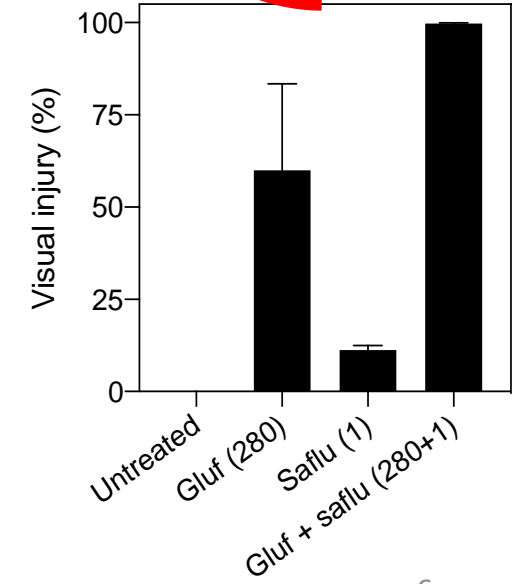
< Consistent waterhemp control over 90%



Overcoming Low Temperature/Humidity?



Slide courtesy of Dr. Hudson Takano; see Takano et al. (2020): <https://doi.org/10.1017/wsc.2020.39>



Objective & Hypothesis

Objective: Evaluate the influence of *glufosinate* (Liberty 280 SL; Glutamine Synthetase Inhibitor, group 10) tank-mix combinations on waterhemp control, crop injury and yield in Enlist E3 soybeans

Hypothesis: Glufosinate tank-mix combinations will increase the levels of waterhemp control, with no major impact on soybean development and yield

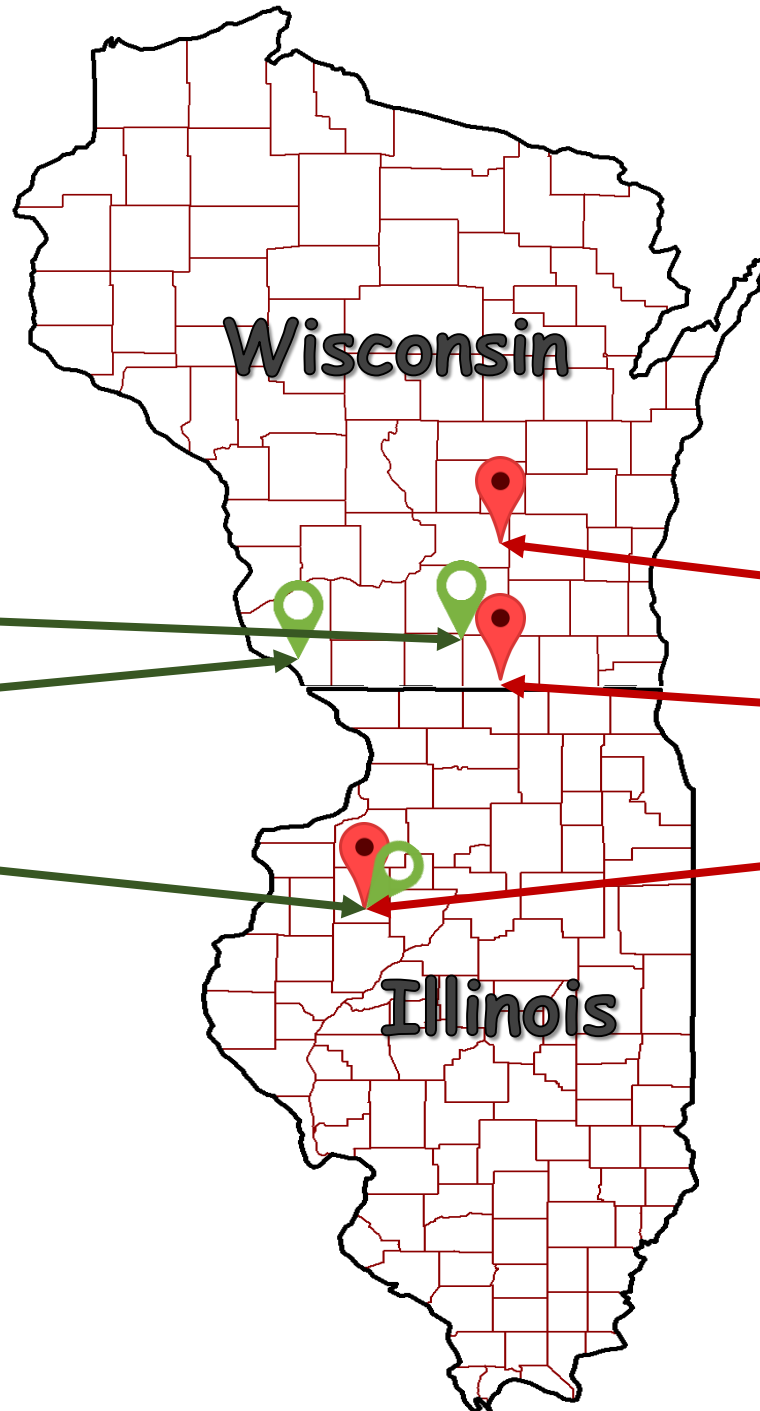
2020 & 2021

Waterhemp
Response
Study

Brooklyn, WI

Lancaster, WI

Macomb, IL



2020 & 2021

Soybean
Response
Study

Arlington, WI

Janesville, WI

Macomb, IL

Study Information

| Herbicide | Rate (g ai ha ⁻¹) | |
|------------------------------|-------------------------------|------|
| | 1x | 1/3x |
| lactofen (Cobra) | 219 | 73 |
| fomesafen (Flexstar) | 264 | 88 |
| fluthiacet-methyl (Cadet) | 7.2 | 2.4 |
| flumiclorac (Resource) | 60.3 | 20.1 |
| bentazon (Basagran) | 897 | 299 |
| 2,4-D choline (EnlistOne) | 1067 | --- |
| glufosinate (Liberty 280 SL) | 657 | --- |

| PRE | Valor (flumioxazin) | 112 |
|-----|------------------------------------|-------------|
| | Fierce (flumioxazin+pyroxasulfone) | 70.4 + 89.3 |

| Waterhemp Response Study | | | Herbicide Treatment | Soybean Response Study | | |
|--------------------------|----------------|-----------|----------------------|------------------------|----------------|------------|
| Weed Free? | Pre @ Planting | Rate | | Rate | PRE @ Planting | Weed Free? |
| NO! | NO | --- | No PRE | --- | NO | YES! |
| | YES | VALOR | PRE only | FIERCE | YES | |
| | | 1x | Cobra | 1x | | |
| | | 1x + 1x | Cobra + Liberty | 1x + 1x | | |
| | | 1x + 1/3x | Cobra + Liberty | 1/3x + 1x | | |
| | | 1x | Flexstar | 1x | | |
| | | 1x + 1x | Flexstar + Liberty | 1x + 1x | | |
| | | 1x + 1/3x | Flexstar + Liberty | 1/3x + 1x | | |
| | | 1x | Resource | 1x | | |
| | | 1x + 1x | Resource + Liberty | 1x + 1x | | |
| | | 1x + 1/3x | Resource + Liberty | 1/3x + 1x | | |
| | | 1x | Cadet | 1x | | |
| | | 1x + 1x | Cadet + Liberty | 1x + 1x | | |
| | | 1x + 1/3x | Cadet + Liberty | 1/3x + 1x | | |
| | | 1x | Basagran | 1x | | |
| | | 1x + 1x | Basagran + Liberty | 1x + 1x | | |
| | | 1x + 1/3x | Basagran + Liberty | 1/3x + 1x | | |
| | | 1x | Liberty | 1x | | |
| | | 1x + 1x | Enlist One | 1x | | |
| | | 1x + 1/3x | Enlist One + Liberty | 1x + 1x | | |

Study Information

| | Waterhemp Response Study | | | Soybean Response Study | | |
|--|--|---|------------------------------------|--|---|--------------------------|
| Location | Brooklyn, WI | Lancaster, WI | Macomb, IL | Arlington, WI | Janesville, WI | Macomb, IL |
| Variety | P22T86E | P22T86E | 36EA02 | P22T86E | P22T86E | 36EA02 |
| Planting Date | May 22, 2020 May 25, 2021 | May 20, 2020 May 17, 2021 | May 5, 2020 NA | May 1, 2020 May 12, 2021 | May 8, 2020 April 29, 2021 | May 25, 2020 NA |
| PRE application | May 22, 2020 May 26, 2021 | May 20, 2020 May 19, 2021 | May 21, 2020 NA | May 1, 2020 May 12, 2021 | May 8, 2020 April 29, 2021 | May 28, 2020 NA |
| POST application (growth stage) | June 24, 2020 (V4) June 30, 2021 (V5) | July 1, 2020 (V6) June 17, 2021 (V6) | July 3, 2020 (V3) | June 25, 2020 (V4) June 26, 2021 (V4) | July 2, 2020 (V4) June 18, 2021 (V4) | June 29, 2020 (V5) NA |
| Waterhemp height @ POST | 2-20 cm (2020) 2-22 cm (2021) | 7-28 cm (2020) 4-13 cm (2021) | 6-23 cm NA | Weed Free | | |
| Waterhemp density @ POST | 16-33 plants m ⁻² (2020) 12-40 plants m ⁻² (2021) | 18-34 plants m ⁻² (2020) 1-13 plants m ⁻² (2021) | 12-60 plants m ⁻² NA | | | |

Data Collection

Waterhemp Response Study

1) Visual Control (%)

Soybean Response Study

- 1) Phytotoxicity (visual) (%)
- 2) Green Canopy Coverage (%)
- 3) Soybean Yield (kg ha^{-1})



response variable ~ herbicide+ (1|rep:siteyear)

Adjustment: Tukey's HSD

alpha = 0.05

Results

Waterhemp Response

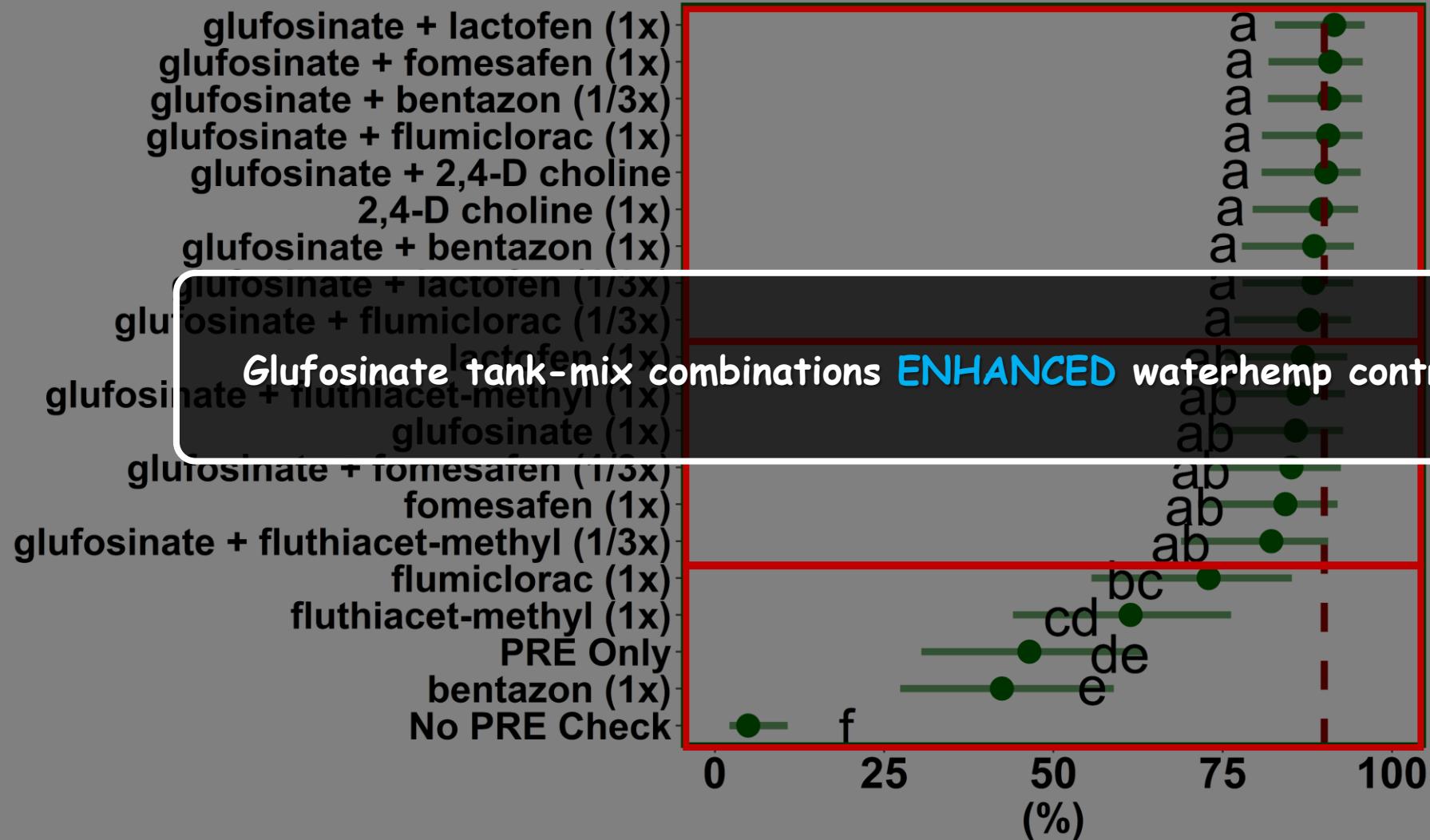
Visual Control (14 DAT)

```
model = glmmTMB(waterhempcontrol ~ herbicide + (1|rep:siteyear), beta_family(link = "logit"))
```

herbicide

p-value = <0.0001

Waterhemp Control - 14 DAT



Glufosinate tank-mix combinations **ENHANCED** waterhemp control.

Results

Soybean Response

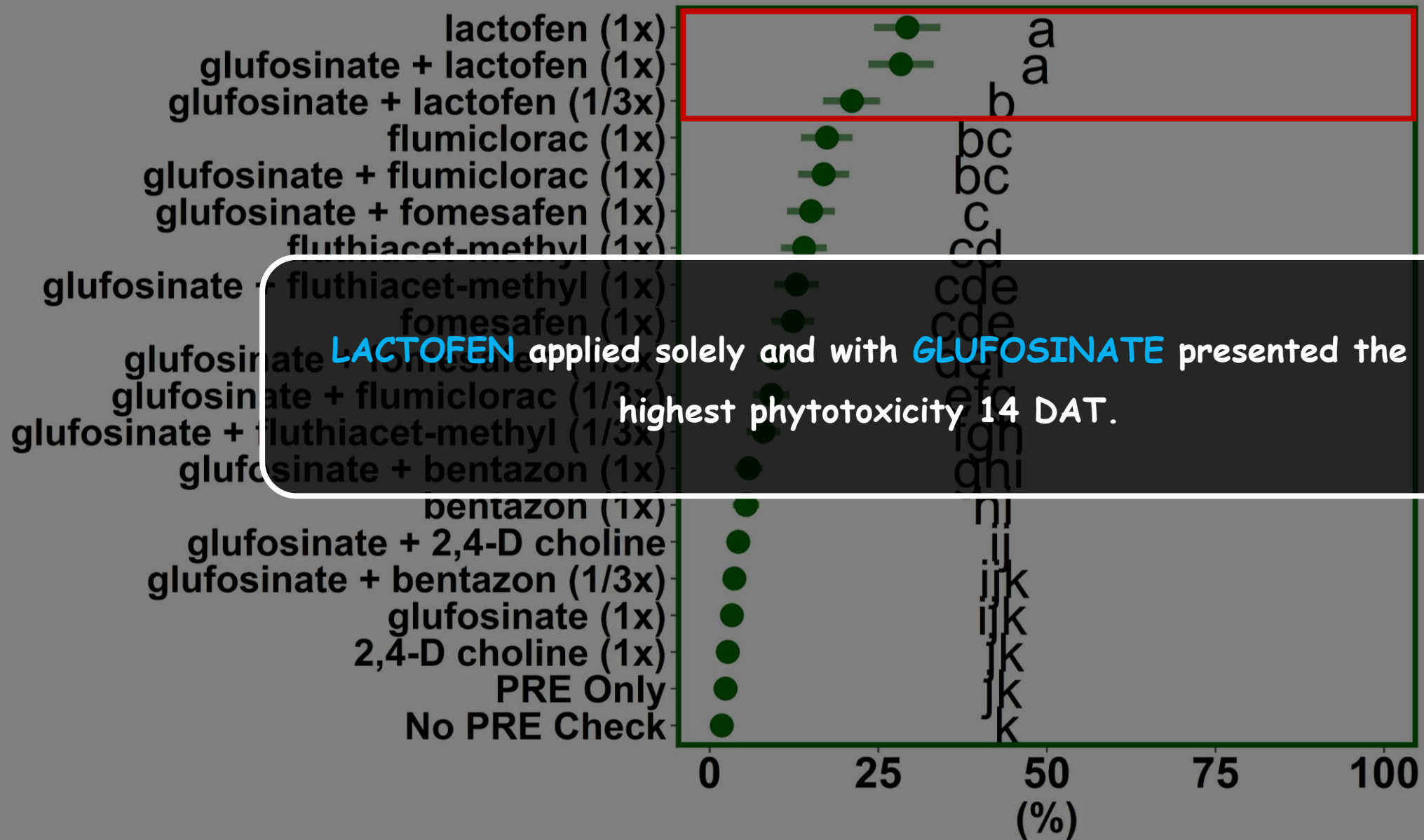
Phytotoxicity (14 DAT)

```
model = glmmTMB(phyto_p ~ herbicide + (1|rep:siteyear), beta_family(link = "logit"))
```

herbicide

p-value = <0.0001

Herbicide Phytotoxicity - 14 DAT



Results

Soybean Response

Green Cover Percentage - Canopeo (14 DAT)

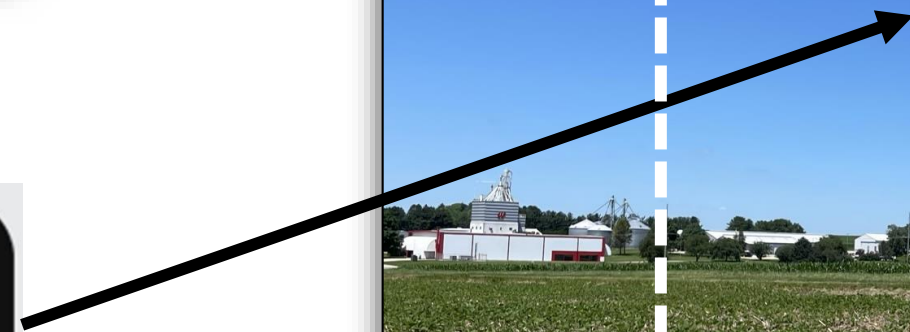
```
model = glmmTMB(canopeo ~ herbicide + (1|rep:siteyear), beta_family(link = "logit"))
```

herbicide

p-value = <0.0001

Green Cover Percentage (Canopeo)

Credit: Tatiane Severo da Silva

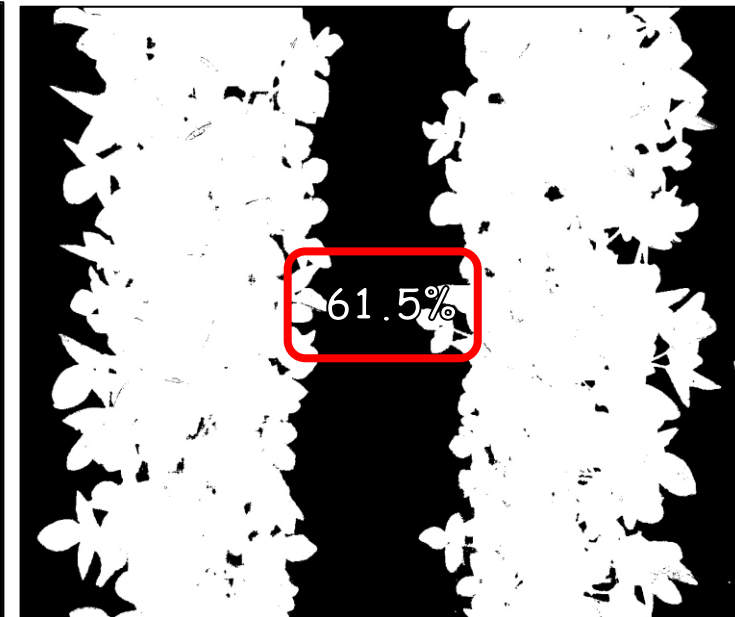
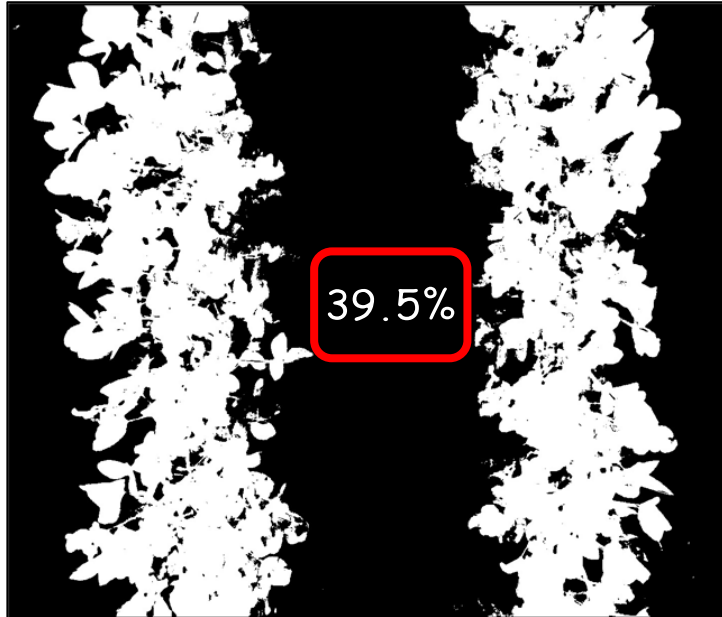
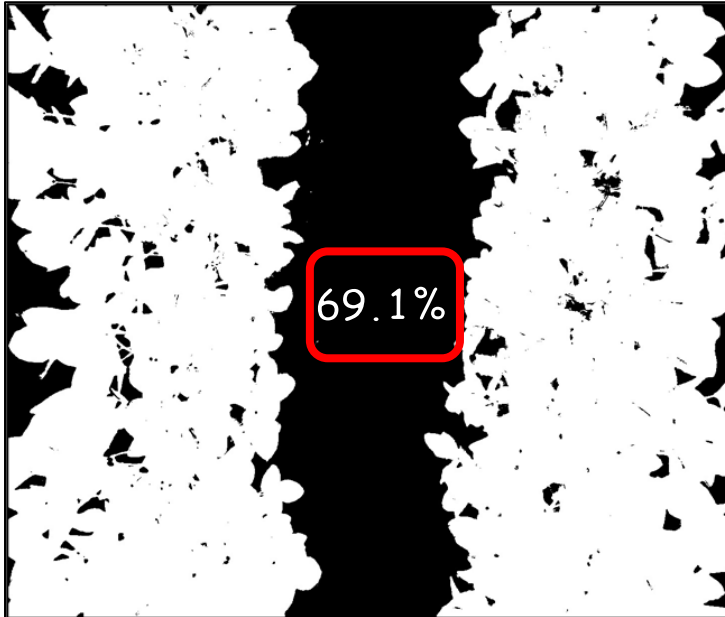


GoPro Hero 8 Black

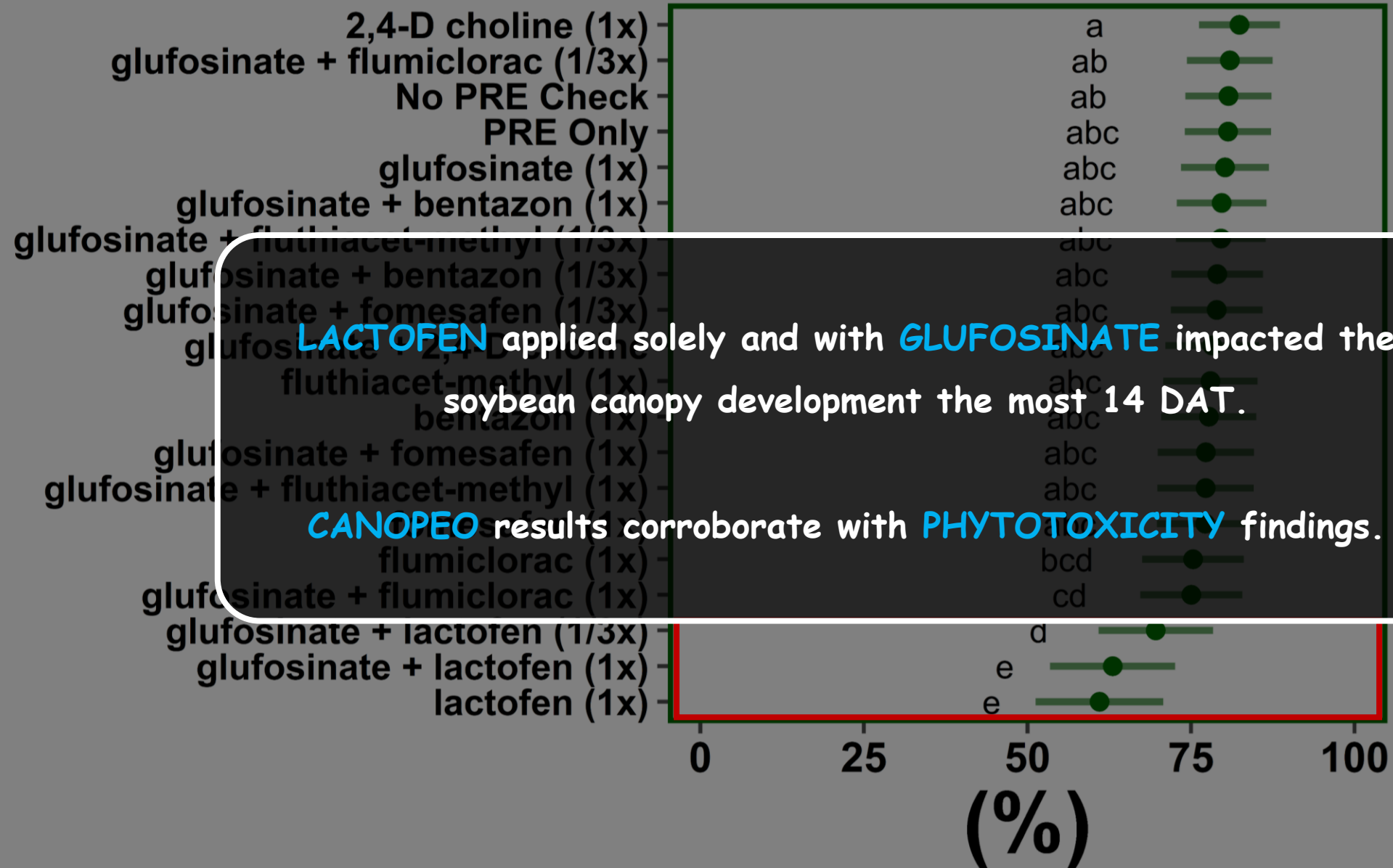


Maintain constant height!

Green Cover Percentage (Canopeo)



Soybean Green Cover Percentage - 14 DAT



LACTOFEN applied solely and with GLUFOSINATE impacted the soybean canopy development the most 14 DAT.

CANOPEO results corroborate with PHYTOTOXICITY findings.

Results

Soybean Response

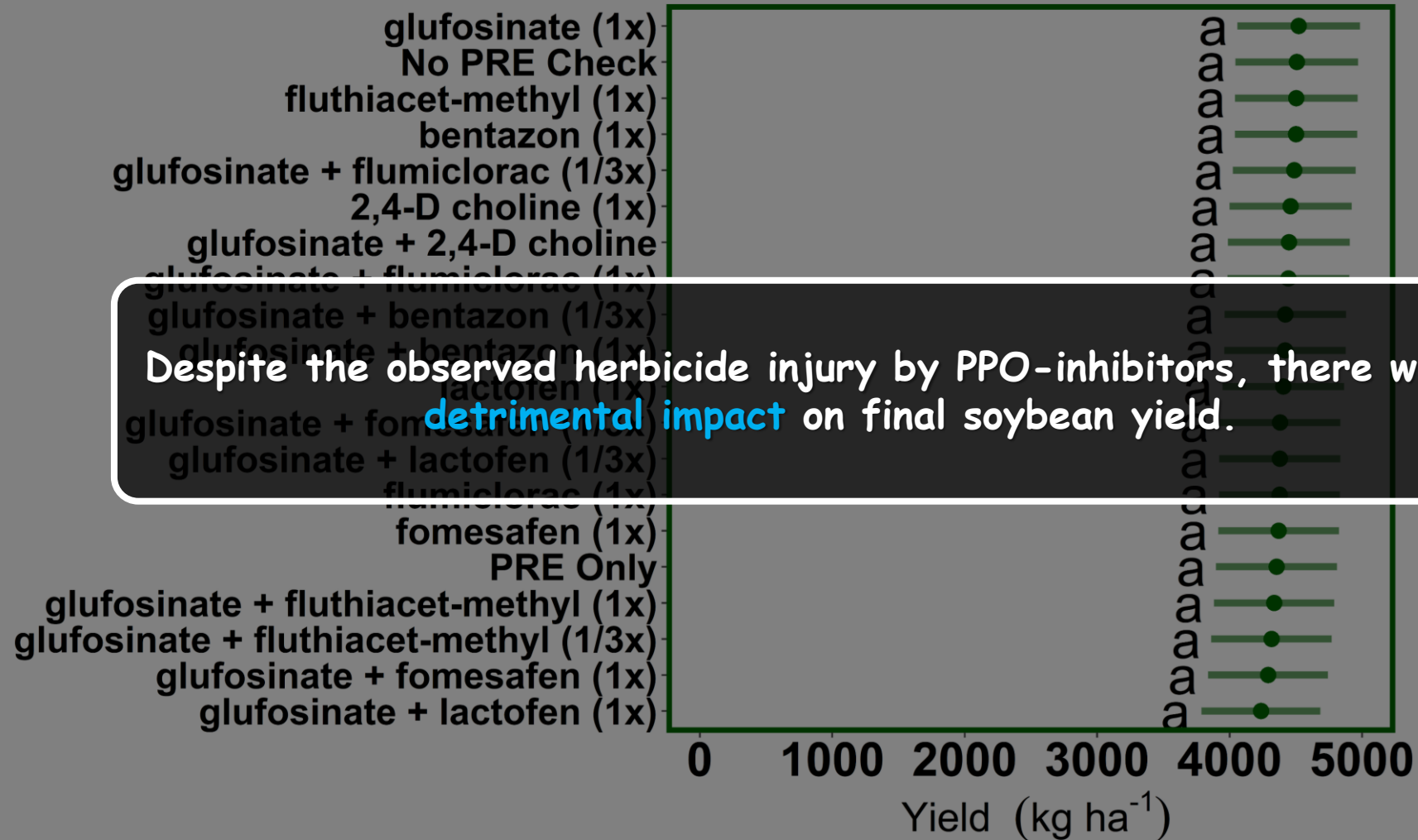
Soybean Yield

```
model = lmer(sqrt(yield_kg) ~ herbicide + (1|rep:siteyear))
```

herbicide

p-value = 0.09901

Soybean Yield



Take-Home Messages

- 1) Glufosinate tank-mix combinations **enhanced** POST-emergence waterhemp control.
- 2) Lactofen as a tank-mix partner can present a **higher phytotoxicity** risk, which is **not necessarily** translated into soybean yield loss.
- 3) Glufosinate tank-mix combinations could **postpone herbicide resistance evolution**.

Future Research

Investigate what influence does different carrier volume and nozzle selection with glufosinate tank-mix combinations have on waterhemp control, and soybean herbicide injury.

References

- Takano, H., Beffa, R., Preston, C., Westra, P., & Dayan, F. (2020). *Glufosinate enhances the activity of protoporphyrinogen oxidase inhibitors*. *Weed Science*, 68(4), 324-332. doi:10.1017/wsc.2020.39
- <https://marketresearch.biz/report/herbicides-market/>

Acknowledgements

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BRIEN HYBRIDS



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