

FIELD BINDWEED MANAGEMENT IN PROCESSING TOMATOES

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Non-treated control
(No PPI/PRE or POST/SHIELD)

Glyphosate Pre-Plant

No Glyphosate Pre-Plant





T · H · E
**OHIO
STATE**
UNIVERSITY

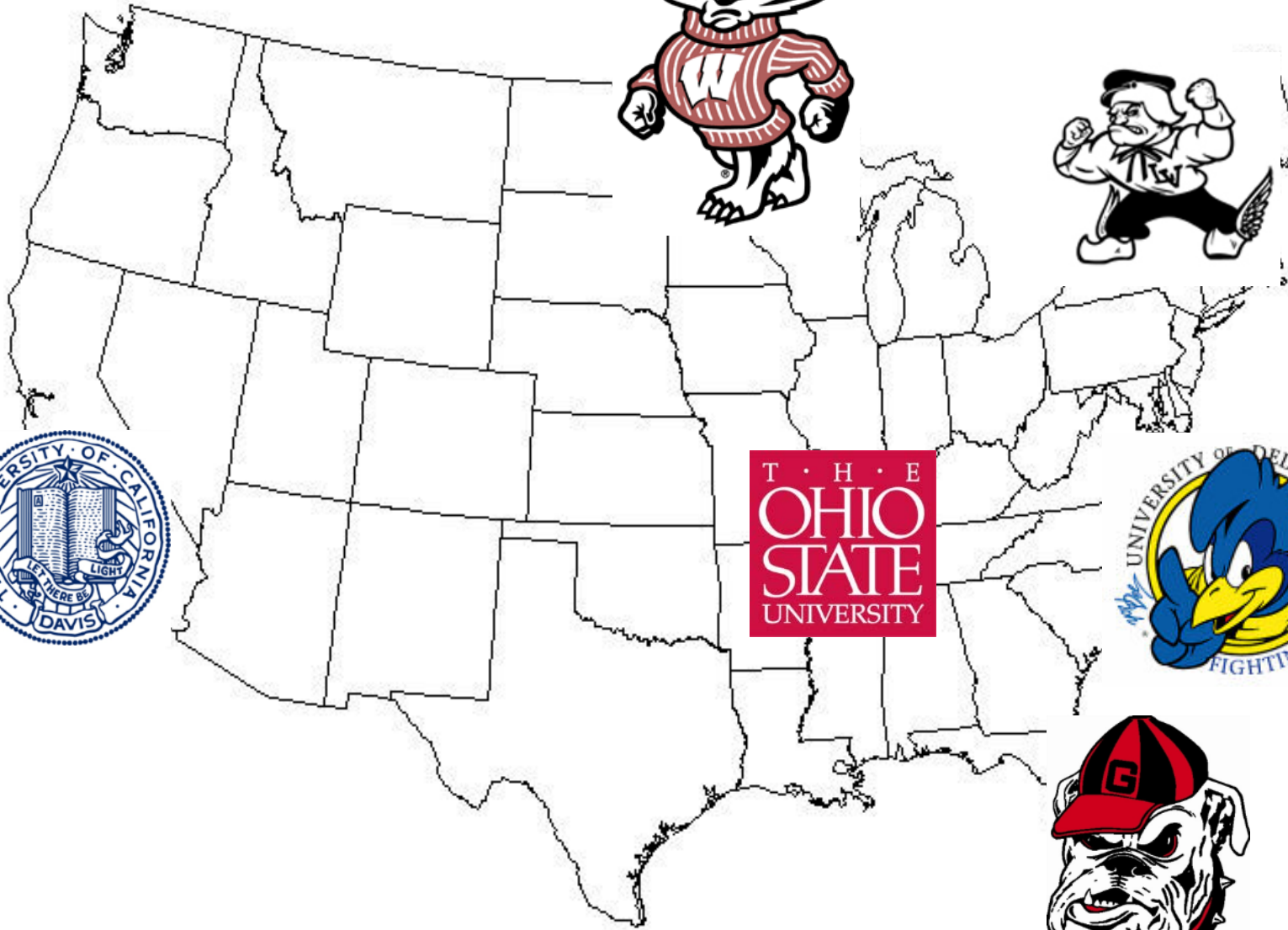
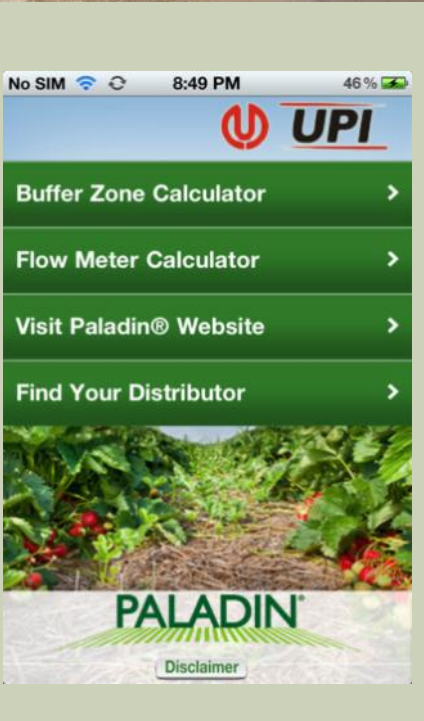


Image provided by Stanley Culpepper: University of Georgia

**Methyl-bromide alternatives for the management of weeds
in raised-bed, plasticulture, fresh-market
tomato and pepper production**



Images borrowed from Stanley Culpepper (UGA) and Ted Webster (USDA ARS)

UCD RESEARCH

“...BINDWEEDS ARE NOT FIT FOR MEDICINE BUT ARE UNPROFITABLE WEEDS, AND HURTFULL UNTO EACH THING THAT GROWETH NEXT UNTO THEM.”



THE HERBALL – THE GENERALL HISTORIE OF PLANTES

JOHN GERARD (1633)



FIELD BINDWEED

- 🍅 **Native to Europe and Asia**

- 🍅 *Adapted to and successful in tropical, temperate and Mediterranean climates*

- 🍅 **First noted in US (Virginia) in 1739**

- 🍅 *Probably arrived as a contaminant of crop seed*

- 🍅 **Western movement with settlers**

- 🍅 *Again, likely imported with western-bound settlers in crop seed*

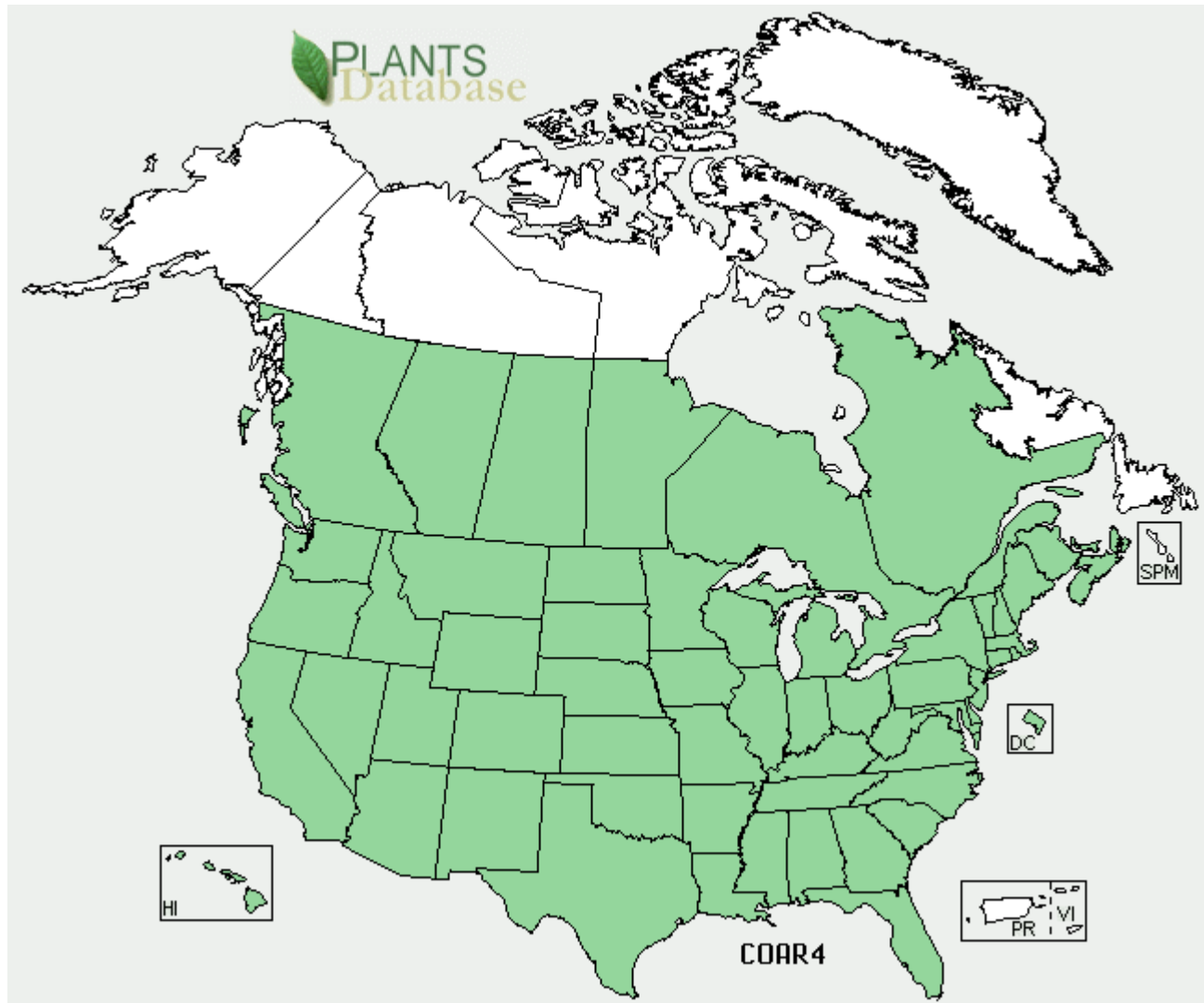
- 🍅 **PNV rumors**

- 🍅 *Planted in an Oregon orchard as a cover crop?*

- 🍅 **California occurrence**

- 🍅 *Competing dates of establishment 1838 and 1884*

Field Bindweed Distribution



FIELD BINDWEED

- 🍅 Spreading perennial weed
 - 🍅 *Seeds*
 - 🍅 *Rhizomes (underground stem)*
 - 🍅 *Creeping roots*
- 🍅 Massive root network
 - 🍅 *2.5-5 tons/A roots/rhizomes*
 - 🍅 *Root penetration can exceed 10-20 feet*
- 🍅 Vining stems
- 🍅 Seeds can survive >20 years in soil

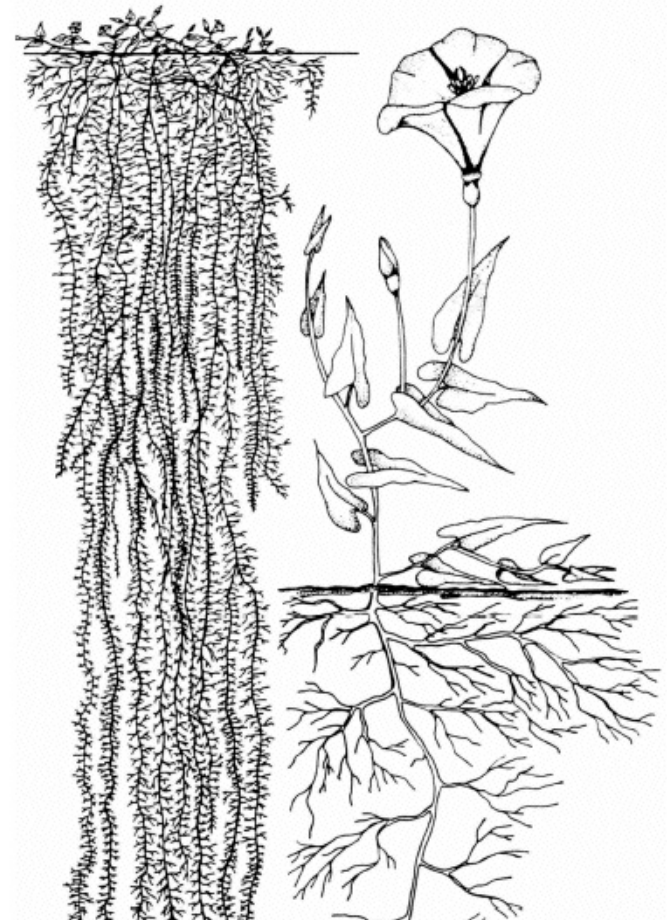


Image borrowed from <http://www.ipm.ucdavis.edu>
Redrawn from B. F. Kiltz, 1930.
J. Amer. Soc. Agron. 22:216-234.

FIELD BINDWEED



Images provided by Seth Gersdorf: Bayer Crop Sciences

FIELD BINDWEED

- 🍅 Bindweed difficult to manage? Let's blame biology!
- 🍅 Roots and rhizomes
 - 🍅 *Extensive root system supports top-growth injured by weed control*
 - 🍅 *Can be difficult to apply enough systemic herbicide to kill roots*
 - 🍅 *Broken roots and rhizomes (via cultivation) can generate new plants*
- 🍅 Vining and twining
 - 🍅 *Competitive crops can shade-out and suppress bindweed...*
 - 🍅 *But shading is suggested to induce twining (prostrate → vining habit)*
- 🍅 Seeds and seedlings
 - 🍅 *Seeds can germinate long after the perennial plant has been managed*
 - 🍅 *Seedlings can develop a taproot and creeping, lateral roots within 6 weeks*

Previous UCD Field Bindweed Research (W. Thomas Lanini)

- 2010, 2011, 2012
- PPI, PRE
 - Treflan
 - Best product for suppression of perennial plants
 - Zeus, Matrix (4 oz/A)
 - Good at suppressing perennial plants
 - Dual Magnum, Zeus, Matrix
 - Good for managing bindweed seedlings
 - Good for managing species Treflan misses
- POST, SHIELD
 - Matrix, Shark
 - Good for extended weed control



**2013 CTTRI-SPONSORED
TOMATO RESEARCH**

TREATMENTS EVALUATED ACROSS TWO PLANTING DATES ('EARLY' AND 'LATE') IN 2013

- 🍅 **Control (no PPI/PRE or POST/SHIELD)**
- 🍅 **Burndown**
 - 🍅 Glyphosate (Roundup at 56 oz/A)
 - 🍅 No burndown
- 🍅 **PPI/PRE**
 - 🍅 Trifluralin (Treflan at 32 oz/A)
 - 🍅 Treflan + S-metolachlor (Dual Magnum at 27 oz/A)
 - 🍅 Treflan + Rimsulfuron (Matrix at 2 oz/A)
 - 🍅 Treflan + Sulfentrazone (Zeus at 3.2 oz/A)
- 🍅 **POST/SHIELD**
 - 🍅 Rimsulfuron (Matrix at 2 oz/A)
 - 🍅 Carfentrazone (Shark at 2 oz/A)

Herbicide Treatments - 2013

Glyphosate PP

No PPI/PRE and No POST/SHIELD (CONTROL)	
Treflan PPI	Matrix POST or Shark SHIELD
Treflan PPI + Dual Magnum PPI	Matrix POST or Shark SHIELD
Treflan PPI + Matrix PRE	Matrix POST or Shark SHIELD
Treflan PPI + Zeus PPI	Matrix POST or Shark SHIELD

No Glyphosate PP

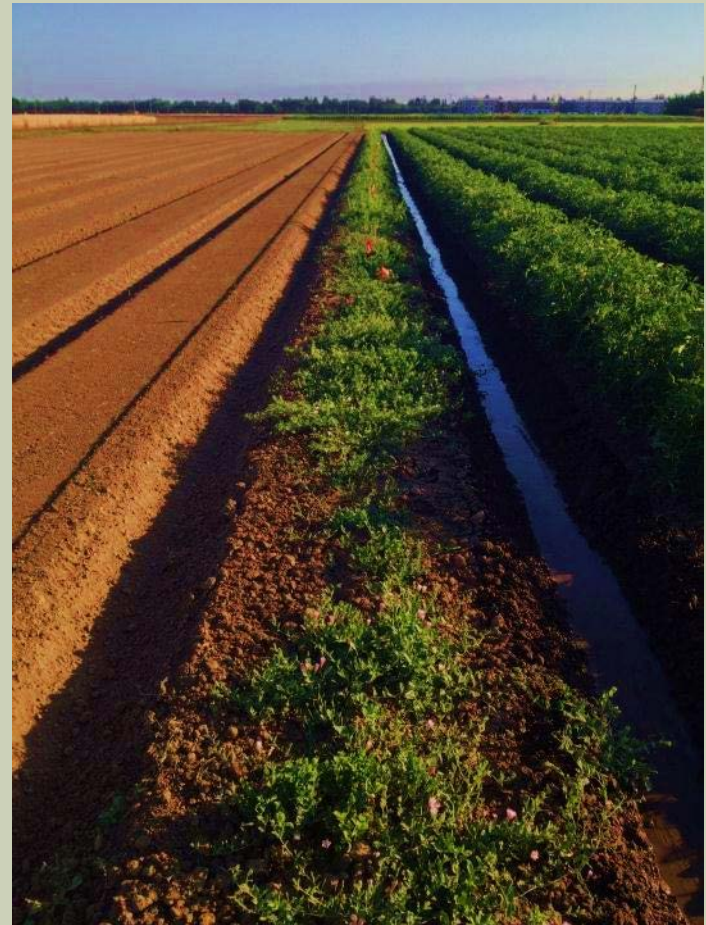
No PPI/PRE and No POST/SHIELD (CONTROL)	
Treflan PPI	Matrix POST or Shark SHIELD
Treflan PPI + Dual Magnum PPI	Matrix POST or Shark SHIELD
Treflan PPI + Matrix PRE	Matrix POST or Shark SHIELD
Treflan PPI + Zeus PPI	Matrix POST or Shark SHIELD

WHY THESE HERBICIDES?

- 🍅 Treflan (PRE)
 - 🍅 Most effective herbicide product at suppressing ESTABLISHED field bindweed
- 🍅 Dual Magnum, Matrix, Zeus (PRE)
 - 🍅 Good at suppressing SEEDLING field bindweed
 - 🍅 Good at suppressing other troublesome weed species
 - 🍅 Nutsedge, small-seeded broadleaves
- 🍅 Shark (SHIELD) and Matrix (POST)
 - 🍅 Improved total weed control over all treatments

WHY TIMING?

- 🍅 Dates were selected to simulate a range of planting opportunities available to growers to meet season-long processing needs
- 🍅 All weeds aren't created equal
 - 🍅 Plant growth and development are affected by calendar date and associated environmental conditions
 - 🍅 Growth and development directly related to fitness and vigor, which then affects herbicide sensitivity



STUDY DETAILS

- 🍅 UCD research farm, Yolo series soil
- 🍅 Herbicides applied/incorporated according to labels
- 🍅 Plots were 2 rows by 25 feet
- 🍅 Transplants
 - 🍅 *AB2 (10 April)*
 - 🍅 *BOS 3155 (4 June)*
- 🍅 Sprinkler-set, furrow-irrigated
- 🍅 Data collection
 - 🍅 *Weed cover*
 - 🍅 *Weed density*
 - 🍅 *Crop injury*
 - 🍅 *Yield*



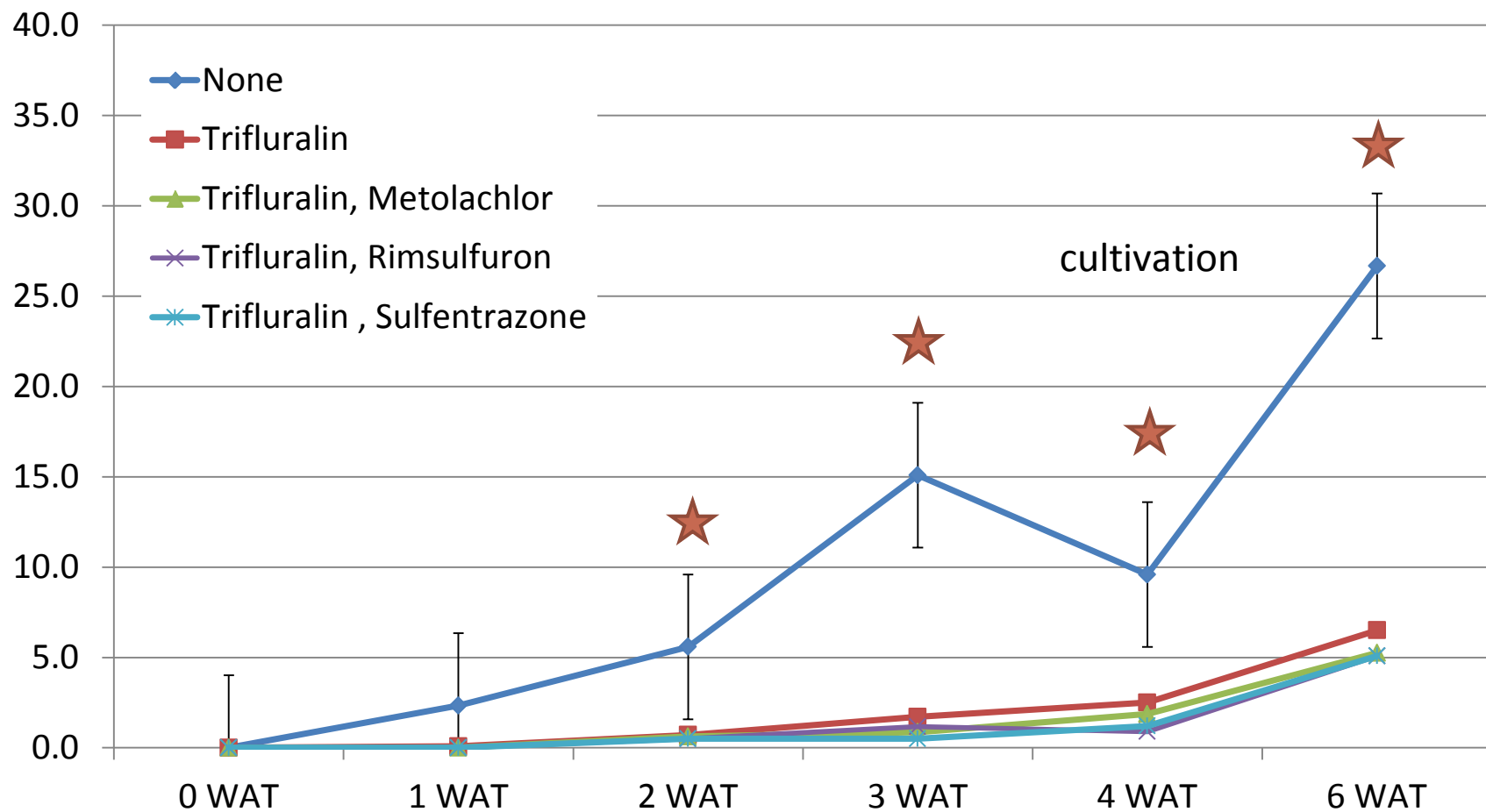
RESULTS

EARLY PLANTING (10 APRIL)

- 🍅 No emerged field bindweed at transplanting
 - 🍅 *No glyphosate PP application*
- 🍅 PPI/PRE herbicides significantly influenced bindweed early-season cover in the field
 - 🍅 *Bindweed was main weed observed*
 - 🍅 *Emerged within 2-4 weeks after transplanting*
 - 🍅 *None-few small-seeded broadleaves at any time*
- 🍅 No significant herbicide injury (>10-15%) observed with PPI/PRE or POST/SHIELD herbicide applications
- 🍅 Total fruit yield (lbs) significantly affected by PPI/PRE and POST/SHIELD Herbicide applications
 - 🍅 *Although up to 40% cover at harvest, weed suppression improved yields*

EARLY PLANTING (10 APRIL)

PERCENT (%) FIELD BINDWEED COVER



CULTIVATION

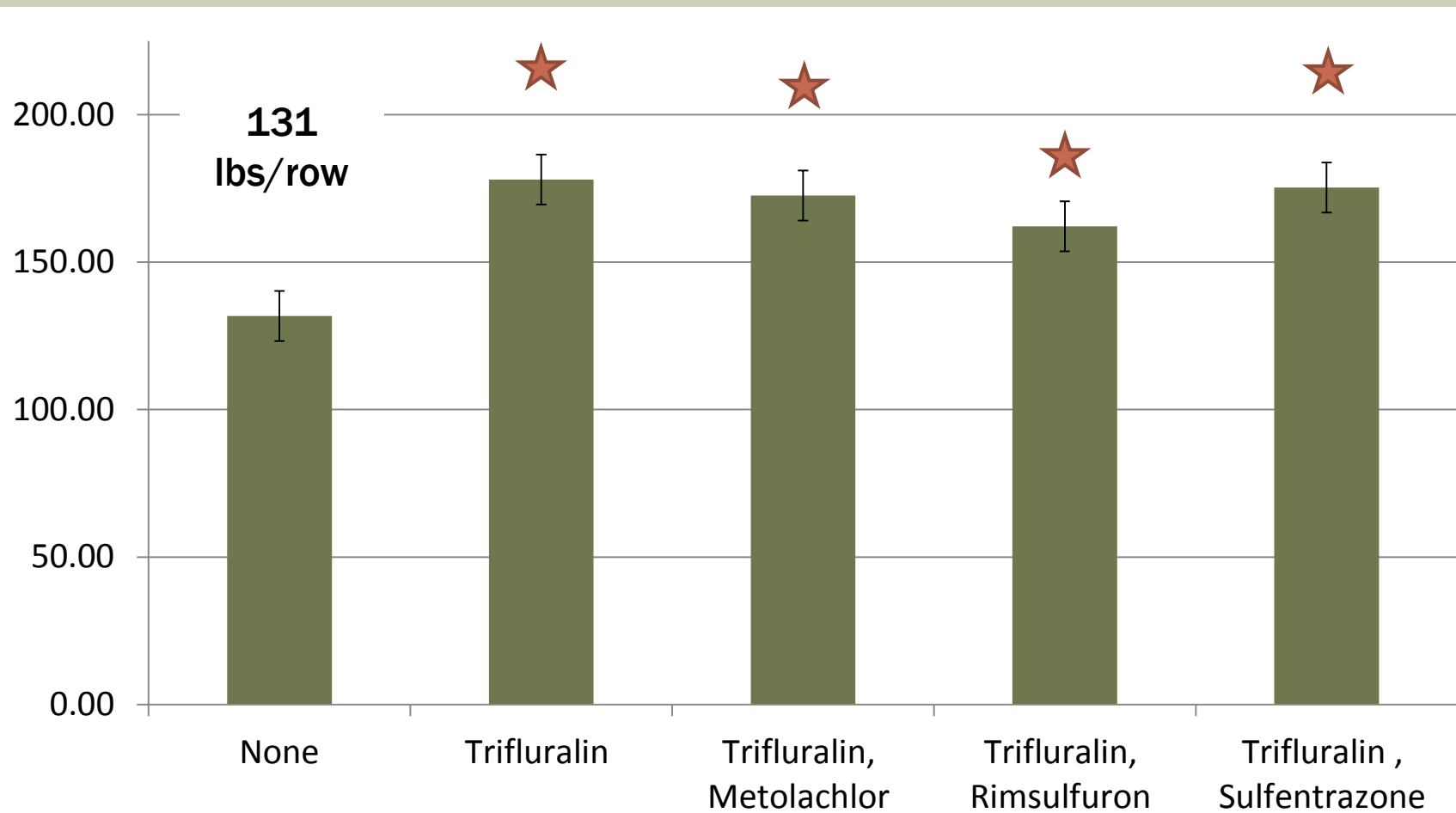


TOMATO HARVEST



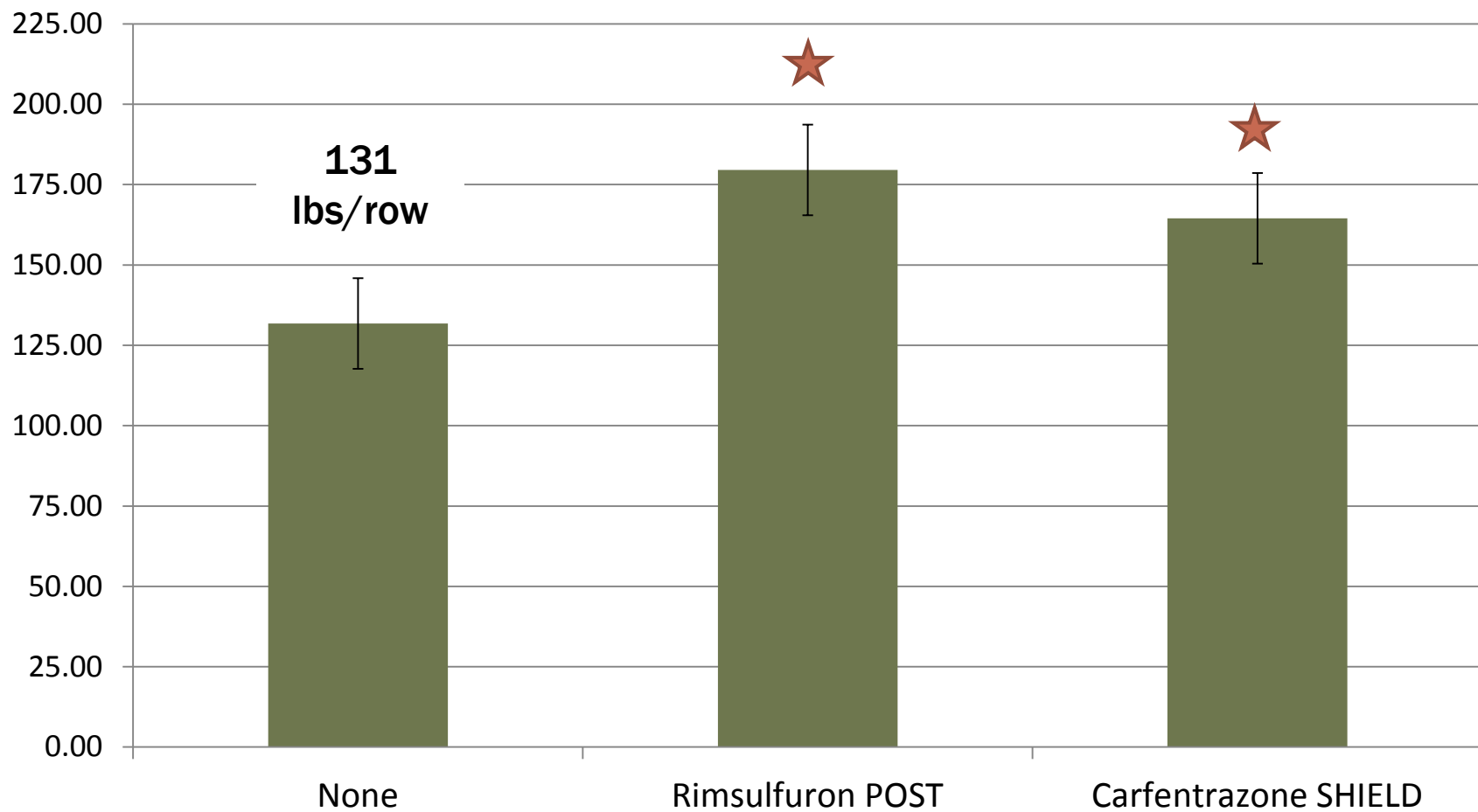
EARLY PLANTING (10 APRIL)

TOMATO YIELD (LBS/ROW)



EARLY PLANTING (10 APRIL)

TOMATO YIELD (LBS/ROW)



LATE PLANTING (4 JUNE)

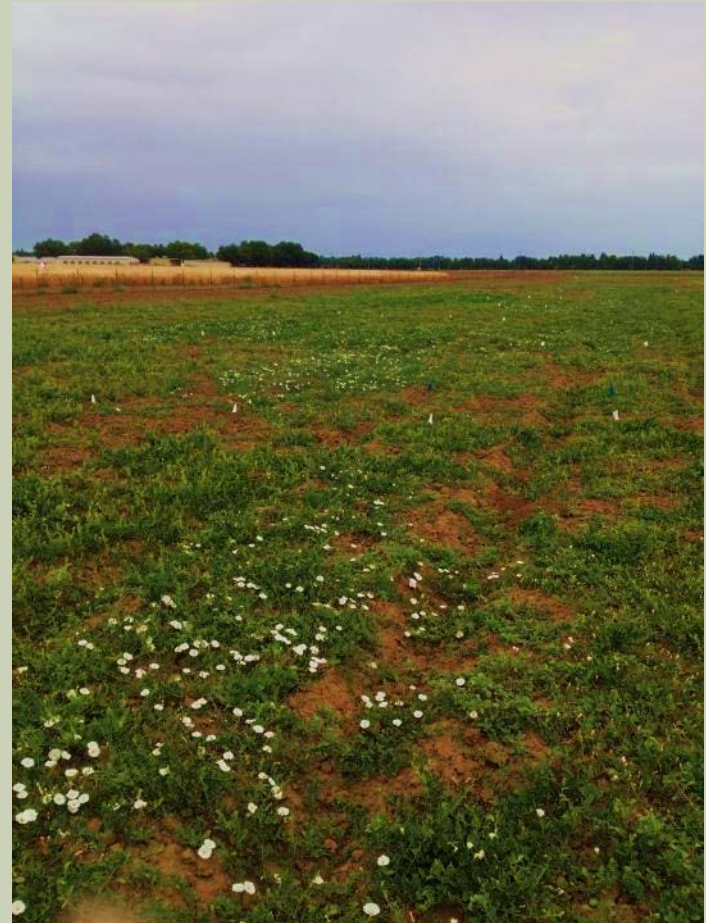
- 🍅 Site was heavily infested with field bindweed (up to 97% cover 2-3 weeks before transplanting)

- 🍅 PP, PPI/PRE influenced early season weed cover and density

 - 🍅 *Bindweed and small-seeded broadleaves present*

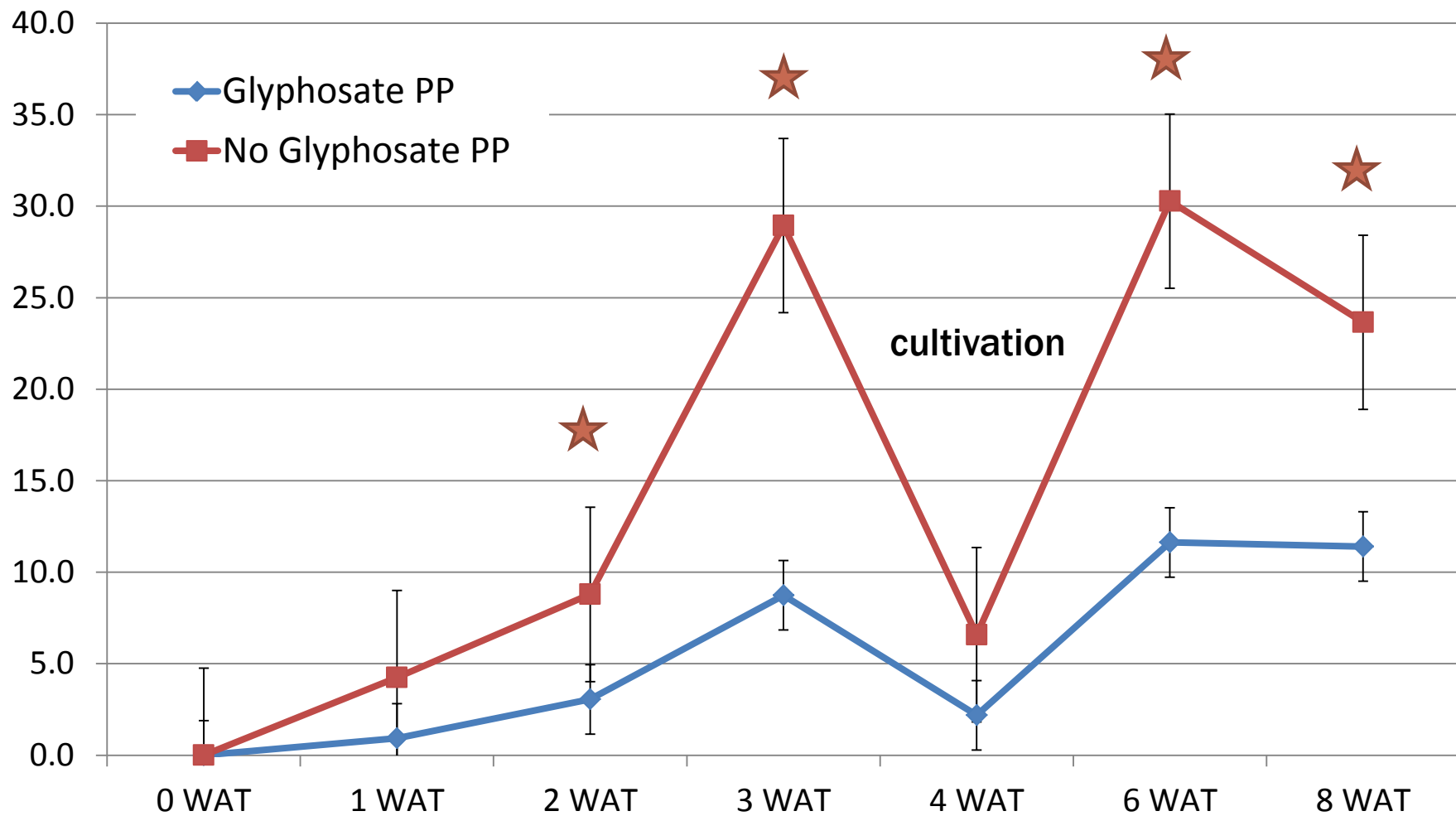
 - 🍅 *Additional herbicides improved total control above Treflan, alone*

- 🍅 PPI/PRE, POST/SHIELD significantly influenced yield



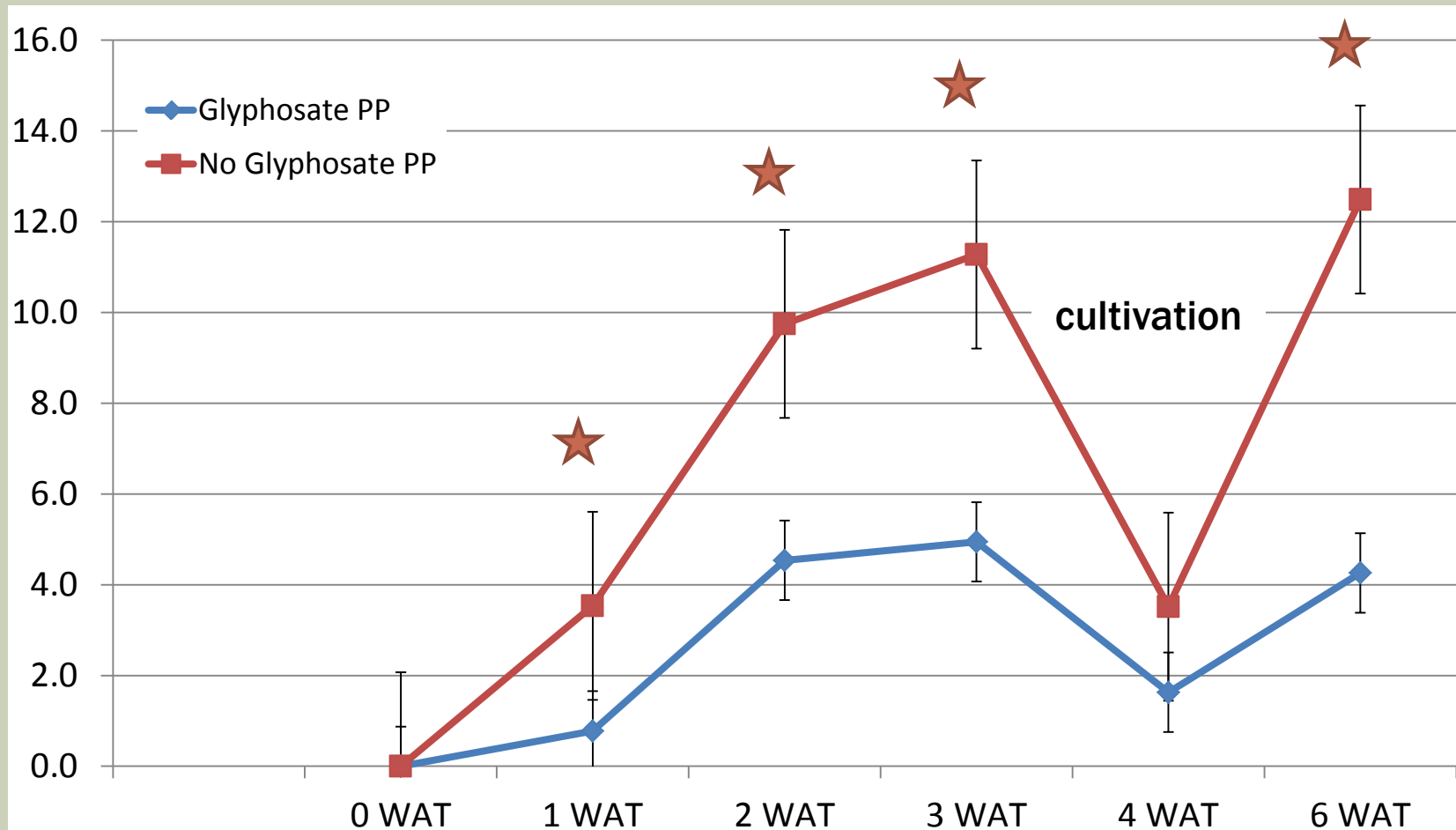
LATE PLANTING (4 JUNE)

PERCENT (%) WEED COVER



LATE PLANTING (4 JUNE)

FIELD BINDWEED PLANTS/M²

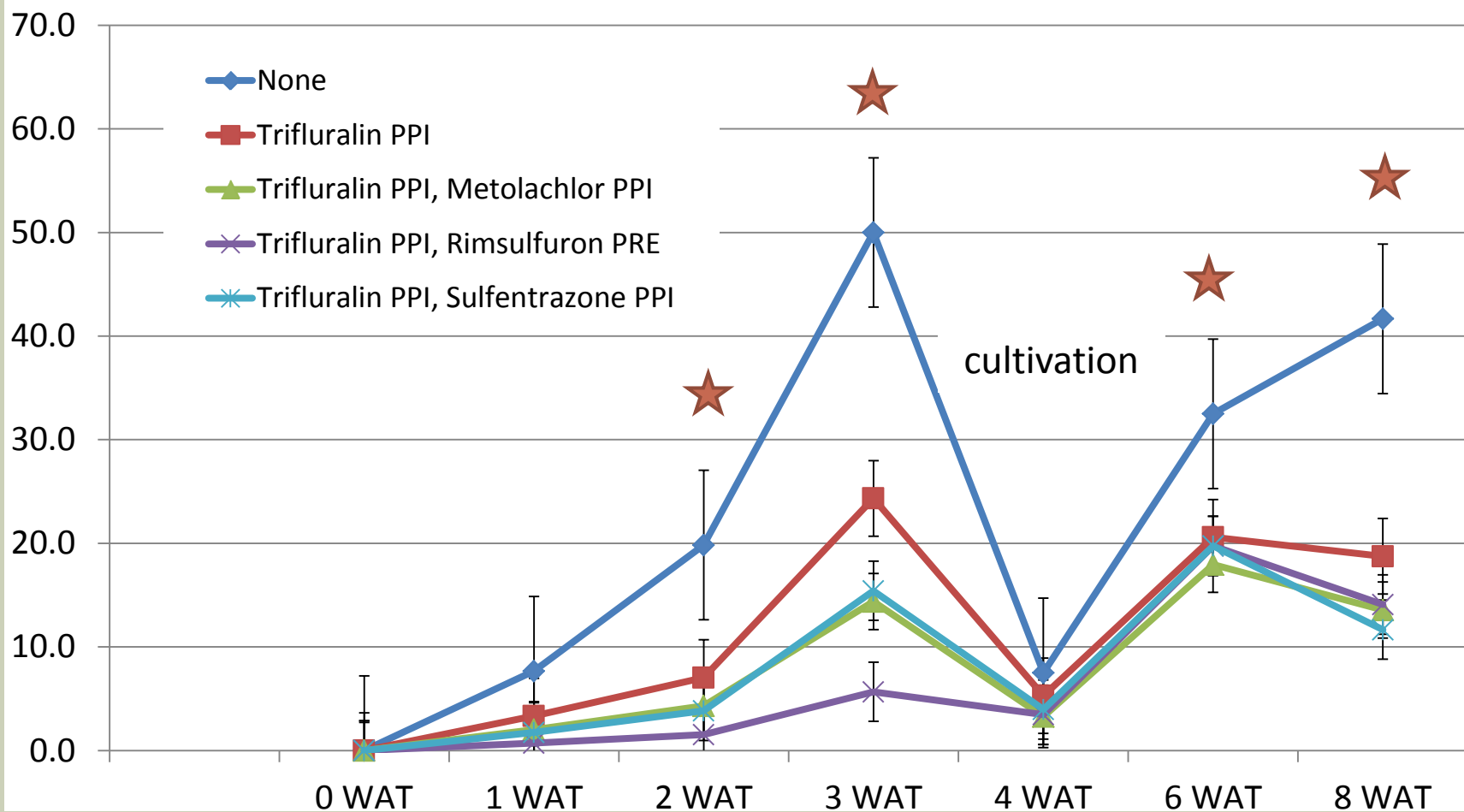


GLYPHOSATE PP VS NO BURNDOWN



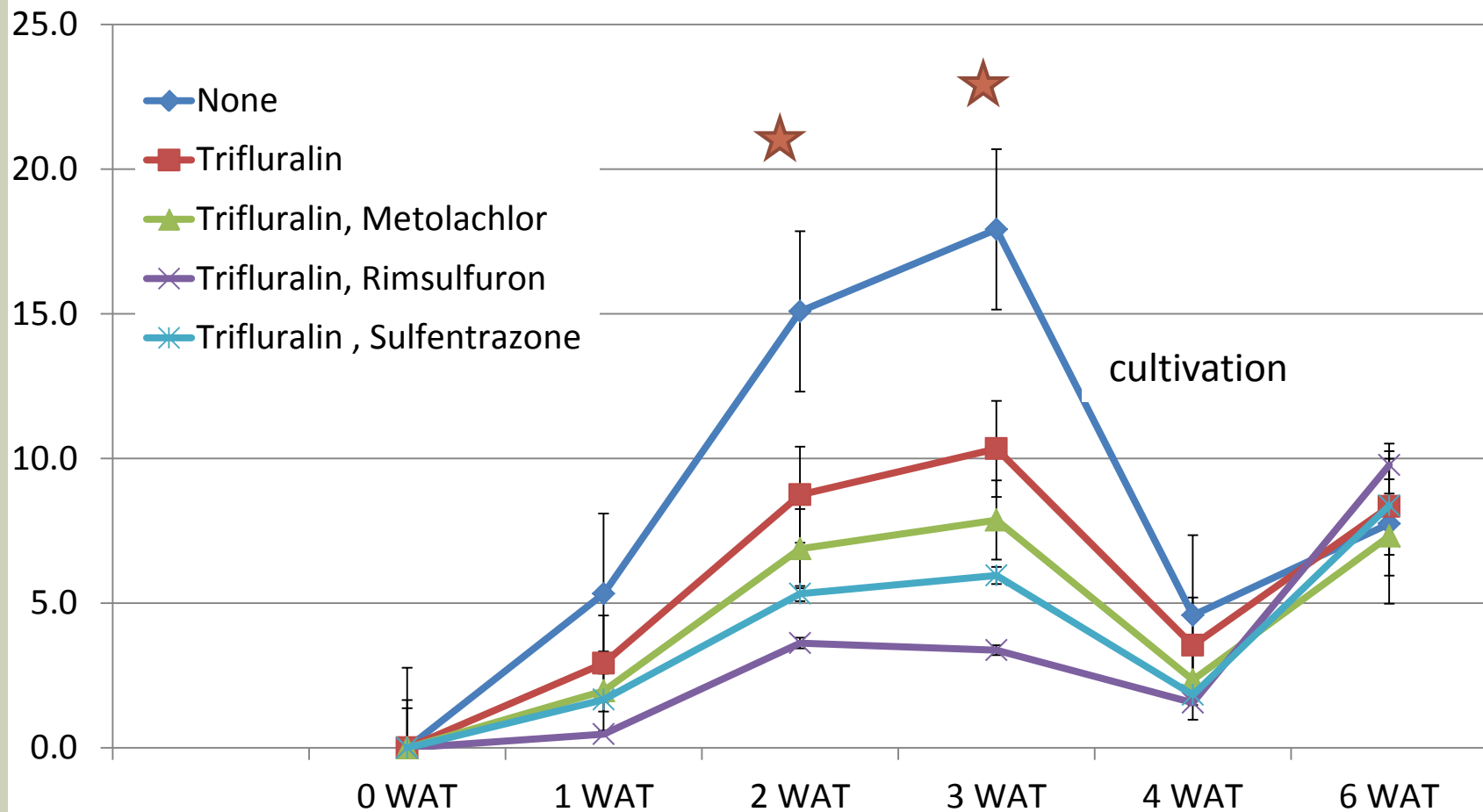
LATE PLANTING (4 JUNE)

PERCENT (%) WEED COVER



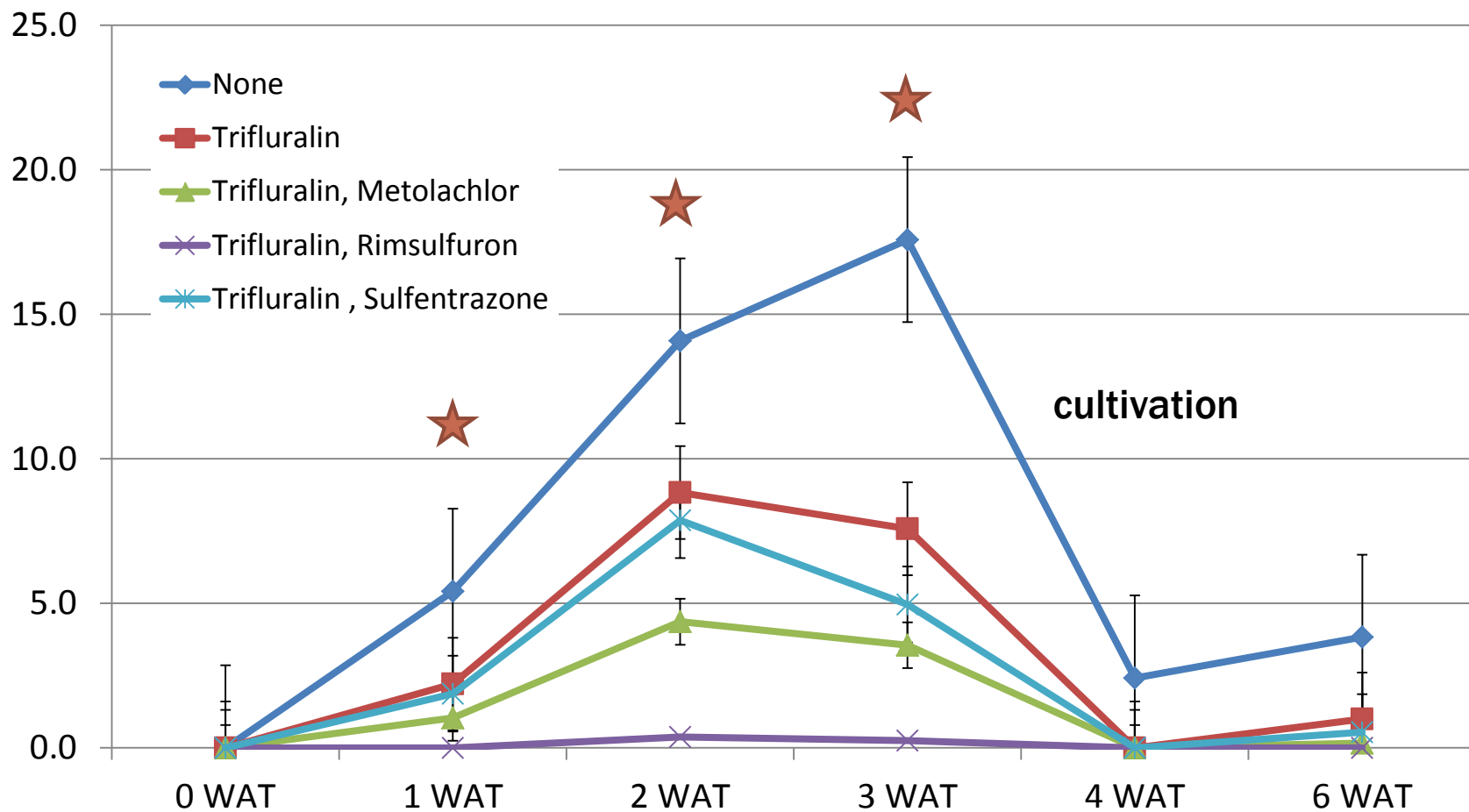
LATE PLANTING (4 JUNE)

FIELD BINDWEED PLANTS/M²



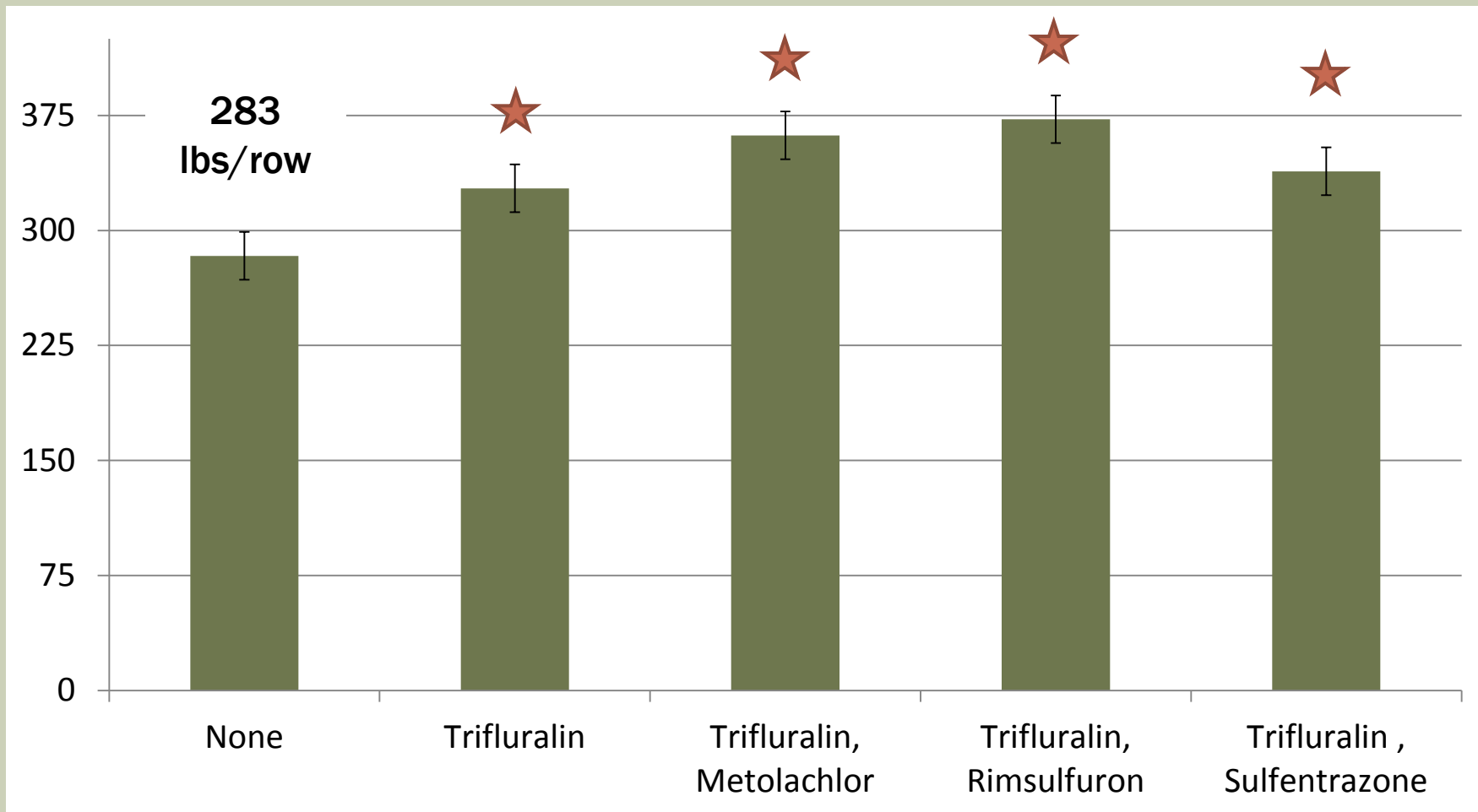
LATE PLANTING (4 JUNE)

SMALL-SEED, BROADLEAF PLANTS/M²



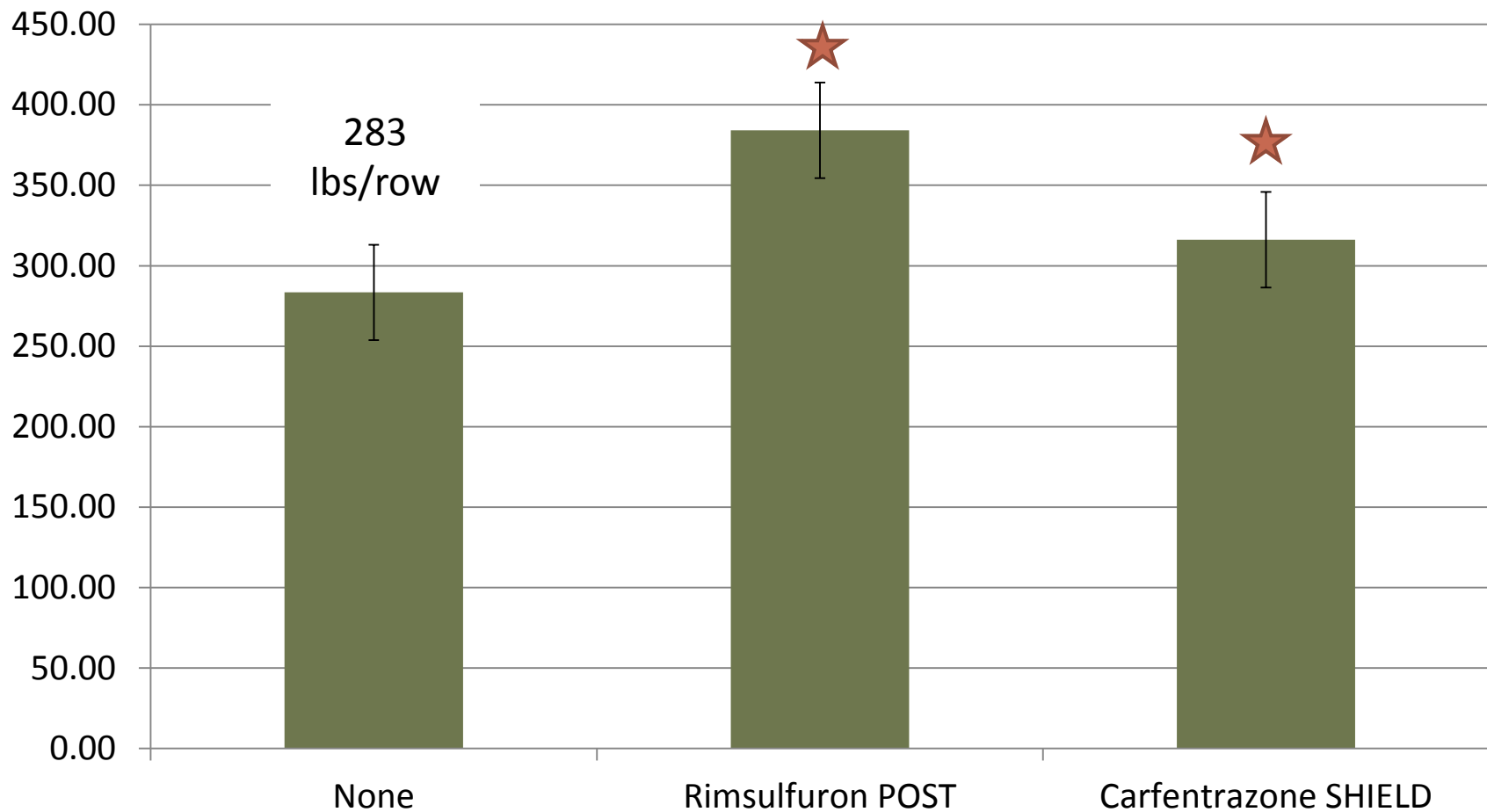
LATE PLANTING (4 JUNE)

TOMATO YIELD (LBS/ROW)



LATE PLANTING (4 JUNE)

TOMATO YIELD (LBS/ROW)



SUMMARY

- 🍅 The use of PP, PPI/PRE and POST/SHIELD herbicides, in combination, improved weed suppression over the control, which relied only on cultivation events for weed management
- 🍅 Especially true for the late planting where the additional PPI/PRE chemistries helped to suppress broadleaves that can be missed by Treflan
- 🍅 Start with clean fields; post-harvest or fallow operations, alternate competitive crops that allow for the use of alternate herbicides

SUMMARY

- 🍅 Herbicide (glyphosate) applications need to be timed so that the bindweed is actively growing (sufficient top growth for herbicide capture and not drought stressed) and sugars are moving to the roots (after flowering)
- 🍅 The herbicide treated zone is only so deep; bindweed will eventually grow through it; need to use multiple strategies within a cropping season to keep it in check

NEXT?

RESEARCH PLANS

- 🍅 Repeat 2013 study
- 🍅 Herbicide performance and crop safety in a paired drip- and furrow-irrigated study
- 🍅 Evaluate Treflan vs Dual Magnum at layby for bindweed suppression
- 🍅 Sequential applications of Matrix (POST) and Shark (SHIELD)
- 🍅 Evaluate Zeus PPI vs Zeus PRE (+/- Treflan), Treflan PPI vs Zeus PRE, Treflan + Matrix (4 oz/A)
- 🍅 Compare Dual Magnum, Sandea and Zeus for nutsedge control

RESEARCH PLANS

- 🍅 **Herbicide carryover and drift (auxinics, Shark, Roundup) on tomato yields**
- 🍅 **Evaluate soil additives to improve crop safety from residual herbicides**
- 🍅 **Evaluate the specific affects of Treflan, Dual Magnum, Matrix and Zeus on bud and vine development; interactions with rhizome size and depth of burial below the herbicide treated zone**
- 🍅 **Collaborative studies with researchers at Pontifical University in Santiago, Chile to study bindweed biology and ecology in Mediterranean climates**

MORE INFORMATION

- 🍅 <http://anrcatalog.ucdavis.edu/pdf/7228.pdf>
- 🍅 <http://www.ipm.ucdavis.edu/PMG/selectnewpest.tomatoes.html>
- 🍅 <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7462.html>
- 🍅 <http://www.cdfa.ca.gov/plant/ipc/weedinfo/convolvulus.htm>
- 🍅 <http://www-personal.umich.edu/~rburnham/SpeciesAccountspdfs/ConvarveCONFIDENTIAL.pdf>
- 🍅 <http://www.fs.fed.us/database/feis/plants/vine/conarv/all.html>
- 🍅 <http://extension.psu.edu/pests/weeds/weed-id/field-bindweed>
- 🍅 http://www.colostate.edu/Dept/CoopExt/Adams/weed/pdf/Field_bindweed.pdf

TREE, VINE AND VEGETABLE WEED RESEARCH

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🍅 Sorkel Kadir

🍅 Bahar Kutman

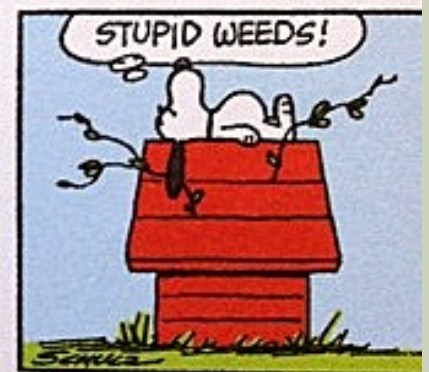
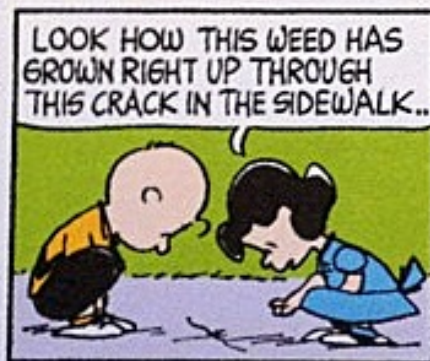
🍅 Seth Watkins

🍅 Marcelo Moretti

🍅 Oscar Morales (*Tomato research student assistant*)

MANY THANKS!

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