

# Purdue Weed Science

## Belchim Evaluation of Tough R and Tough R plus Atrazine for Waterhemp Control in Corn

Trial ID: 23-MGS-Corn-04  
 Protocol ID: 23-MGS-Corn-04 Location: MEIGS Trial Year: 2023  
 Study Director: Dr. Bill Johnson Sponsor Contact: Dennis Long

Investigator: Dr. Bill Johnson

### General Trial Information

**Study Director:** Dr. Bill Johnson **Title:** Professor  
**Investigator:** Dr. Bill Johnson **Title:** Professor

**Discipline:** H herbicide  
**Status:** E established

**ARM Trial Created On:** Mar-25-2023  
**Initiation Date:** May-5-2023 **Planned Completion Date:** Oct-15-2023  
**Completion Date:** Jul-18-2023

### Trial Location

**City:** Lafayette **Country:** USA United States  
**State/Prov.:** Indiana  
**Postal Code:** 47907

### Regulations

**Conducted Under GLP:** No  
**Conducted Under GEP:** No

### Contacts

**Role:** STYDIR study director  
**Study Director:** Dr. Bill Johnson **Title:** Professor  
**Organization:** Purdue University  
**Address 1:** 915 W. State Street  
**Country:** USA United States **E-mail:** wgj@purdue.edu  
**City:** West Lafayette **State/Prov:** IN **Postal Code:** 47907  
**Role:** INVEST investigator  
**Investigator:** Dr. Bill Johnson **Title:** Professor  
**Organization:** Purdue University  
**Address 1:** 915 W. State Street  
**Country:** USA United States **E-mail:** wgj@purdue.edu  
**City:** West Lafayette **State/Prov:** IN **Postal Code:** 47907  
**Role:** SPONSR sponsor  
**Sponsor:** Dennis Long  
**Organization:** Belchim  
**Role:** COOPER cooperator  
**Cooperator:** Jay Young **Title:** Superintendent  
**Organization:** Purdue University  
**Address 1:** 8343 US 231 S **Phone No.:** (765) 538-3422  
**Country:** USA United States **E-mail:** jayyoung@purdue.edu  
**City:** Lafayette **State/Prov:** IN **Postal Code:** 47907

### Crop Description

**Crop 1:** C ZEAMX Zea mays Corn  
**Entry Date:** May-24-2023 **Stage Scale:** BBCH  
**Variety:** DKC 50-87 RIB  
**Attributes:** Glyphosate-R and Glufosinate-R  
**Planting Date:** May-5-2023 **Planting Rate:** 35000 S/A  
**Depth:** 1.5 IN  
**Rows per Plot:** 4 **Planting Method:** PLANTD planted  
**Row Spacing:** 30 IN **Planting Equipment:** PP plot planter  
**Soil Temperature:** 72 F **Soil Moisture:** NORMAL normal, adequate  
**Emergence Date:** May-12-2023

### Pest Description

**Pest 1 Type:** W **Code:** AMATU *Amaranthus tuberculatus* **Entry Date:** Jun-15-2023  
**Common Name:** tall waterhemp **Stage Scale:** BBCH  
**Attributes:** Glyphosate-R and PPO-R

**Pest 2 Type:** W **Code:** SETFA *Setaria faberi* **Entry Date:** Jun-15-2023  
**Common Name:** Giant foxtail **Stage Scale:** BBCH

### Site and Design

**Treated Plot Width:** 6.67 FT **Site Type:** FIELD field  
**Treated Plot Length:** 30 FT **Experimental Unit:** 1 PLOT plot  
**Treated Plot Area:** 200.1 FT2 **Tillage Type:** NOTILL no-till  
**Replications:** 4 **Treatments:** 6 **Plots:** 24 **Study Design:** RACOBL Randomized Complete Block (RCB)

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**Field Prep./Maintenance:**

Roundup PowerMax 3 (30 fl oz/A) + 2,4-D (1 pint/A) applied 04/12/2023.  
 Gramoxone (3 pt/A) applied 05/04/2023.  
 180 lbs of N applied as 28% UAN on 5/9/23.

**Soil Description**

**Description Name:** MEIGS-S3  
**% Sand:** 21      **% OM:** 2.2      **Texture:** SIL      silt loam  
**% Silt:** 54      **Soil Name:** Starks-Fincastle complex  
**% Clay:** 25      **Fert. Level:** G      good  
**pH:** 6.8      **CEC:** 8.3

**Soil Drainage:** G      good

| No. | Date        | Moisture Total | Unit | Min Temp | Max Temp | Avg Temp | Temp Unit | Max Wind | Avg Wind | Unit |
|-----|-------------|----------------|------|----------|----------|----------|-----------|----------|----------|------|
| 1.  | May-1-2023  | 0.27           | IN   | 39.7     | 46.4     | 42.6     | F         | 29.3     | 10.7     | MPH  |
| 2.  | May-2-2023  | 0              | IN   | 41       | 57.9     | 47.1     | F         | 25.1     | 7.8      | MPH  |
| 3.  | May-3-2023  | 0              | IN   | 39.2     | 62.4     | 49.3     | F         | 19.7     | 5.4      | MPH  |
| 4.  | May-4-2023  | 0              | IN   | 36.3     | 71.4     | 55.6     | F         | 12.5     | 2        | MPH  |
| 5.  | May-5-2023  | 0              | IN   | 49.1     | 78.1     | 64.2     | F         | 25.1     | 7.2      | MPH  |
| 6.  | May-6-2023  | 0.06           | IN   | 57.7     | 77.5     | 67.1     | F         | 31.5     | 9.2      | MPH  |
| 7.  | May-7-2023  | 0.76           | IN   | 60.8     | 79.7     | 69.1     | F         | 35.1     | 9.2      | MPH  |
| 8.  | May-8-2023  | 0.08           | IN   | 58.3     | 75.9     | 66.9     | F         | 20.8     | 6.7      | MPH  |
| 9.  | May-9-2023  | 0              | IN   | 54       | 75.2     | 64       | F         | 16.8     | 5.4      | MPH  |
| 10. | May-10-2023 | 0              | IN   | 52.9     | 78.3     | 65.8     | F         | 17.2     | 3.1      | MPH  |
| 11. | May-11-2023 | 0              | IN   | 53       | 81.4     | 67.94    | F         | 15       | 1.8      | MPH  |
| 12. | May-12-2023 | 0.02           | IN   | 63.4     | 79       | 70.76    | F         | 17       | 0.9      | MPH  |
| 13. | May-13-2023 | 0.17           | IN   | 66.5     | 80       | 72.06    | F         | 12       | 1.2      | MPH  |
| 14. | May-14-2023 | 0.58           | IN   | 58.7     | 72.8     | 65.19    | F         | 16       | 4.8      | MPH  |
| 15. | May-15-2023 | 0.06           | IN   | 54.3     | 71.8     | 61.5     | F         | 13       | 2.1      | MPH  |
| 16. | May-16-2023 | 0.02           | IN   | 53.9     | 71.4     | 62.06    | F         | 12       | 0.9      | MPH  |
| 17. | May-17-2023 | 0              | IN   | 49.9     | 70.2     | 60.7     | F         | 14       | 2.3      | MPH  |
| 18. | May-18-2023 | 0              | IN   | 44       | 74       | 59.75    | F         | 11       | 2.2      | MPH  |
| 19. | May-19-2023 | 1.15           | IN   | 57.1     | 79.6     | 64.84    | F         | 25       | 1.5      | MPH  |
| 20. | May-20-2023 | 0.01           | IN   | 47.6     | 66.3     | 57.57    | F         | 11       | 0        | MPH  |
| 21. | May-21-2023 | 0              | IN   | 44.3     | 78       | 62.38    | F         | 8        | 0.3      | MPH  |
| 22. | May-22-2023 | 0              | IN   | 51.1     | 80       | 67.15    | F         | 9        | 0.2      | MPH  |
| 23. | May-23-2023 | 0              | IN   | 56.7     | 82       | 70.38    | F         | 9        | 0.3      | MPH  |
| 24. | May-24-2023 | 0              | IN   | 54.4     | 82.9     | 70.73    | F         | 15       | 1        | MPH  |
| 25. | May-25-2023 | 0              | IN   | 48.4     | 68.3     | 59.7     | F         | 17       | 5.9      | MPH  |
| 26. | May-26-2023 | 0              | IN   | 46.8     | 75       | 61.24    | F         | 17       | 4        | MPH  |
| 27. | May-27-2023 | 0              | IN   | 47.2     | 77       | 64.85    | F         | 16       | 2.5      | MPH  |
| 28. | May-28-2023 | 0              | IN   | 57.6     | 79.6     | 68.81    | F         | 13       | 0.5      | MPH  |
| 29. | May-29-2023 | 0              | IN   | 56.4     | 84.6     | 71.88    | F         | 11       | 0.6      | MPH  |
| 30. | May-30-2023 | 0              | IN   | 58.7     | 87.1     | 75.14    | F         | 14       | 1.3      | MPH  |
| 31. | May-31-2023 | 0              | IN   | 65.4     | 87.7     | 77.14    | F         | 11       | 0.6      | MPH  |
| 32. | Jun-1-2023  | 0              | IN   | 64.6     | 89.2     | 77.42    | F         | 17       | 1.6      | MPH  |
| 33. | Jun-2-2023  | 0              | IN   | 61       | 89.9     | 76.83    | F         | 15       | 1.3      | MPH  |
| 34. | Jun-3-2023  | 0              | IN   | 63.1     | 89.9     | 78.15    | F         | 11       | 1.2      | MPH  |
| 35. | Jun-4-2023  | 0              | IN   | 63.5     | 82       | 73.54    | F         | 12       | 2.5      | MPH  |
| 36. | Jun-5-2023  | 0              | IN   | 54.1     | 78.8     | 67.66    | F         | 12       | 1.6      | MPH  |
| 37. | Jun-6-2023  | 0              | IN   | 53.7     | 85.5     | 69.23    | F         | 17       | 0.1      | MPH  |
| 38. | Jun-7-2023  | 0              | IN   | 59.1     | 76.2     | 67.27    | F         | 14       | 1        | MPH  |
| 39. | Jun-8-2023  | 0              | IN   | 45.9     | 76.6     | 62.87    | F         | 10       | 0.6      | MPH  |
| 40. | Jun-9-2023  | 0              | IN   | 44.6     | 79.3     | 64.11    | F         | 11       | 0.2      | MPH  |

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|     |             |      |    |      |      |       |   |    |     |     |
|-----|-------------|------|----|------|------|-------|---|----|-----|-----|
| 41. | Jun-10-2023 | 0    | IN | 56.5 | 84.1 | 71.38 | F | 15 | 1.3 | MPH |
| 42. | Jun-11-2023 | 0.76 | IN | 56.1 | 68.3 | 63.16 | F | 11 | 0.3 | MPH |
| 43. | Jun-12-2023 | 0    | IN | 51.5 | 67.7 | 58.29 | F | 15 | 0.7 | MPH |
| 44. | Jun-13-2023 | 0.03 | IN | 55   | 68.6 | 60.74 | F | 16 | 2.4 | MPH |
| 45. | Jun-14-2023 | 0.04 | IN | 56.9 | 76.7 | 66.76 | F | 7  | 0   | MPH |
| 46. | Jun-15-2023 | 0    | IN | 57.6 | 84.2 | 70.06 | F | 16 | 1.8 | MPH |
| 47. | Jun-16-2023 | 0    | IN | 50.8 | 71.7 | 60.86 | F | 13 | 0.4 | MPH |
| 48. | Jun-17-2023 | 0    | IN | 50.7 | 80.9 | 66.2  | F | 7  | 0   | MPH |
| 49. | Jun-18-2023 | 0    | IN | 57.3 | 82.5 | 70.7  | F | 15 | 1.2 | MPH |
| 50. | Jun-19-2023 | 0    | IN | 65.6 | 84   | 74.05 | F | 17 | 3.3 | MPH |
| 51. | Jun-20-2023 | 0    | IN | 63.8 | 86.9 | 74.64 | F | 22 | 4.4 | MPH |
| 52. | Jun-21-2023 | 0    | IN | 64.4 | 86   | 75.4  | F | 18 | 5.1 | MPH |
| 53. | Jun-22-2023 | 0    | IN | 61.1 | 81.1 | 71.33 | F | 16 | 2.4 | MPH |
| 54. | Jun-23-2023 | 0    | IN | 64.7 | 82.4 | 72.52 | F | 7  | 0   | MPH |
| 55. | Jun-24-2023 | 0    | IN | 59.3 | 89.2 | 75.93 | F | 8  | 0.2 | MPH |
| 56. | Jun-25-2023 | 1.16 | IN | 66.8 | 87.6 | 76.75 | F | 24 | 2.8 | MPH |
| 57. | Jun-26-2023 | 0    | IN | 65.4 | 74.7 | 70.53 | F | 26 | 4.3 | MPH |
| 58. | Jun-27-2023 | 0    | IN | 60.4 | 75.3 | 66.32 | F | 7  | 0.1 | MPH |
| 59. | Jun-28-2023 | 0    | IN | 52.6 | 79.7 | 66.17 | F | 12 | 0.4 | MPH |
| 60. | Jun-29-2023 | 0.82 | IN | 63.7 | 82.9 | 69.49 | F | 30 | 1.3 | MPH |
| 61. | Jun-30-2023 | 0.01 | IN | 62.4 | 83.8 | 73.03 | F | 13 | 0.6 | MPH |
| 62. | Jul-1-2023  | 0.48 | IN | 69   | 82.8 | 74.98 | F | 18 | 1.1 | MPH |
| 63. | Jul-2-2023  | 1.7  | IN | 67.7 | 81.4 | 72.16 | F | 15 | 1.2 | MPH |
| 64. | Jul-3-2023  | 0    | IN | 65.3 | 84.2 | 73.93 | F | 8  | 0.1 | MPH |
| 65. | Jul-4-2023  | 0    | IN | 64.4 | 88   | 76.25 | F | 7  | 0.3 | MPH |
| 66. | Jul-5-2023  | 0.07 | IN | 67.9 | 88.4 | 78.03 | F | 18 | 0.7 | MPH |
| 67. | Jul-6-2023  | 0.01 | IN | 68.8 | 82.9 | 74.17 | F | 11 | 0.6 | MPH |
| 68. | Jul-7-2023  | 0    | IN | 60.5 | 82.2 | 71.58 | F | 8  | 0.3 | MPH |
| 69. | Jul-8-2023  | 0.9  | IN | 62.8 | 74.6 | 68.13 | F | 12 | 0.2 | MPH |
| 70. | Jul-9-2023  | 0    | IN | 56.4 | 81   | 67.51 | F | 7  | 0.1 | MPH |
| 71. | Jul-10-2023 | 0    | IN | 57.6 | 81   | 70.65 | F | 10 | 0.8 | MPH |
| 72. | Jul-11-2023 | 0    | IN | 63.1 | 83.7 | 73.9  | F | 14 | 1.8 | MPH |
| 73. | Jul-12-2023 | 0    | IN | 69.8 | 84.4 | 76.47 | F | 17 | 0.7 | MPH |
| 74. | Jul-13-2023 | 0    | IN | 63.8 | 77.8 | 70.21 | F | 8  | 0.2 | MPH |
| 75. | Jul-14-2023 | 0    | IN | 59.6 | 87   | 73.92 | F | 9  | 0.5 | MPH |
| 76. | Jul-15-2023 | 1.68 | IN | 66.2 | 82.1 | 72.95 | F | 8  | 0.3 | MPH |
| 77. | Jul-16-2023 | 0    | IN | 62.5 | 81.3 | 71.73 | F | 12 | 1.3 | MPH |
| 78. | Jul-17-2023 | 0.15 | IN | 65.5 | 79.1 | 70.6  | F | 9  | 0.9 | MPH |
| 79. | Jul-18-2023 | 0    | IN | 62.7 | 79.7 | 70.75 | F | 5  | 0   | MPH |

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Trial ID: 23-MGS-Corn-04  
 Protocol ID: 23-MGS-Corn-04 Location: MEIGS Trial Year: 2023  
 Study Director: Dr. Bill Johnson Sponsor Contact: Dennis Long

Investigator: Dr. Bill Johnson

#### Application Description

|  | A           | B            |
|--|-------------|--------------|
| <b>Date</b>                            | May-5-2023  | Jun-5-2023   |
| <b>Start Time</b>                      | 7:25 PM     | 11:36 AM     |
| <b>Stop Time</b>                       | 7:36 PM     | 11:49 AM     |
| <b>Method</b>                          | SPRAY       | SPRAY        |
| <b>Timing</b>                          | PRE         | 3-5" WEEDS   |
| <b>Placement</b>                       | BROSOI      | BROFOL       |
| <b>Applied By</b>                      | M. ZIMMER   | L. MAIA      |
| <b>Entry Date</b>                      | May-24-2023 | Jun-15-2023  |
| <b>Air Temperature Start, Stop</b>     | 75, 75 F    | 70, 70 F     |
| <b>% Relative Humidity Start, Stop</b> | 39, 39      | 31, 31       |
| <b>Wind Velocity+Dir. Start</b>        | 1.8 MPH, SE | 1.6 MPH, NNE |
| <b>Wind Velocity+Dir. Stop</b>         | 2 MPH, SE   | 1.8 MPH, NNE |
| <b>Wind Velocity+Dir. Max</b>          | 3 MPH, SE   | 3 MPH, NNE   |
| <b>Wet Leaves (Y/N)</b>                | N, no       | N, no        |
| <b>Soil Temperature</b>                | 72 F        | 84 F         |
| <b>Soil Moisture</b>                   | NORMAL      | NORMAL       |
| <b>% Cloud Cover</b>                   | 20          | 90           |

#### Crop Stage At Each Application

|                                | A           | B           |
|--------------------------------|-------------|-------------|
| <b>Crop 1 Code, BBCH Scale</b> | ZEAMX, BCOR | ZEAMX, BCOR |
| <b>Days after Emergence</b>    | -7          | 24          |
| <b>Stage Majority, Percent</b> | 0, -        | V5, -       |
| <b>Stage Minimum, Percent</b>  | 0, -        | V5, -       |
| <b>Stage Maximum, Percent</b>  | 0, -        | V6, -       |
| <b>Height Average</b>          | 0 IN        | 16 IN       |
| <b>Height Minimum, Maximum</b> | 0, 0        | 13, 18      |

#### Pest Stage At Each Application

|                                 | A              | B              |
|---------------------------------|----------------|----------------|
| <b>Pest 1 Code, Type, Scale</b> | AMATU, W, BBCH | AMATU, W, BBCH |
| <b>Height Average</b>           | 0 IN           | 3 IN           |
| <b>Height Minimum, Maximum</b>  | 0, 0           | 0.5, 3         |
| <b>Density Average</b>          | 0 FT2          | 4 FT2          |
| <b>Density Minimum, Maximum</b> | 0, 0           | 0, 15          |
| <b>Pest 2 Code, Type, Scale</b> | SETFA, W, BBCH | SETFA, W, BBCH |
| <b>Height Average</b>           | 0 IN           | 3 IN           |
| <b>Height Minimum, Maximum</b>  | 0, 0           | 2, 4           |
| <b>Density Average</b>          | 0 FT2          | 2 FT2          |
| <b>Density Minimum, Maximum</b> | 0, 0           | 0, 8           |

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### Application Equipment

|                               | A            | B            |
|-------------------------------|--------------|--------------|
| <b>Equipment Name</b>         | CO2 BACKPACK | CO2 BACKPACK |
| <b>Equipment Type</b>         | BACSPR       | BACSPR       |
| <b>Operation Pressure</b>     | 34 PSI       | 34 PSI       |
| <b>Nozzle Model</b>           | XR           | XR           |
| <b>Nozzle Type</b>            | FLAFXR       | FLAFXR       |
| <b>Nozzle TradeName</b>       | TEEJET       | TEEJET       |
| <b>Nozzle Tip Size, Color</b> | 8002, YELLOW | 8002, YELLOW |
| <b>Nozzle Spacing</b>         | 20 IN        | 20 IN        |
| <b>Boom Length</b>            | 6.67 FT      | 6.67 FT      |
| <b>Ground Speed</b>           | 3 MPH        | 3 MPH        |
| <b>Carrier</b>                | WATER        | WATER        |
| <b>Application Amount</b>     | 20 GAL/AC    | 20 GAL/AC    |
| <b>Mix Overage</b>            | 75.0 mL      | 75.0 mL      |
| <b>Mix Size</b>               | 1467.0 mL    | 1467.0 mL    |
| <b>Propellant</b>             | COMCO2       | COMCO2       |

### Notes

| Context | Date        | By               | Notes  |
|---------|-------------|------------------|--|
| STATUS  | Mar-25-2023 | Dr. Bill Johnson | Automatically added by ARM: Trial Status updated to 'S' during trial creation. |
| STATUS  | May-24-2023 | Dr. Bryan Young  | Automatically added by ARM: Status changed to: : changed by (EINYOB).          |
| STATUS  | May-24-2023 | Dr. Bryan Young  | Automatically added by ARM: Status changed to: E: changed by (EINYOB).         |

### Instructions:

1. Belchim 23-208
2. Evaluations: ci at 7 and 14 DA-B; wc at 7, 14, 28 and 42 DA-B.

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Investigator: Dr. Bill Johnson

| Assessed By         |                    |                   |           |             | Marcelo Zimmer | Marcelo Zimmer | Marcelo Zimmer | Marcelo Zimmer |
|---------------------|--------------------|-------------------|-----------|-------------|----------------|----------------|----------------|----------------|
| Rating Date         |                    |                   |           |             | Jun-12-2023    | Jun-19-2023    | Jun-12-2023    | Jun-19-2023    |
| Part Rated          |                    |                   |           |             | PLOT, C        | PLOT, C        | PLOT, P        | PLOT, P        |
| Rating Type         |                    |                   |           |             | PHYGEN         | PHYGEN         | CONTRO         | CONTRO         |
| Rating Unit/Min/Max |                    |                   |           |             | %, 0, 100      | %, 0, 100      | %, 0, 100      | %, 0, 100      |
| Crop Type, Code     |                    |                   |           |             | C, ZEAMX       | C, ZEAMX       | C, ZEAMX       | C, ZEAMX       |
| Crop Name           |                    |                   |           |             | Corn           | Corn           | Corn           | Corn           |
| Pest Code           |                    |                   |           |             |                |                | AMATU          | AMATU          |
| Pest Name           |                    |                   |           |             |                |                | tall waterhemp | tall waterhemp |
| Rating Timing       |                    |                   |           |             | 7 DA-B         | 14 DA-B        | 7 DA-B         | 14 DA-B        |
| ARM Action Codes    |                    |                   |           |             | EC             | EC             | EC             | EC             |
| Trt No.             | Treatment Name     | Rate              | Appl Code | Appl Timing | 1*             | 4*             | 2*             | 5*             |
|                     |                    | Rate Unit         |           |             |                |                |                |                |
| 1                   | NONTREATED         |                   |           |             | 0.0            | 0.0            | 0.0            | 0.0            |
| 2                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 0.0 a          | 0.0 a          | 76.3 c         | 72.5 c         |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 3                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 0.0 a          | 0.0 a          | 82.5 b         | 87.0 b         |
|                     | MOTIF              | 3 fl oz/a         | B         | 3-5"W       |                |                |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 4                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 0.0 a          | 0.0 a          | 95.8 a         | 96.5 a         |
|                     | TOUGH              | 8 fl oz/a         | B         | 3-5"W       |                |                |                |                |
|                     | MOTIF              | 3 fl oz/a         | B         | 3-5"W       |                |                |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 5                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 0.0 a          | 0.0 a          | 94.5 a         | 94.8 a         |
|                     | TOUGH R            | 16 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 6                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 0.0 a          | 0.0 a          | 95.3 a         | 96.5 a         |
|                     | TOUGH R            | 16 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | AATREX             | 16 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
|                     | LSD P=.05          |                   |           |             | .              | .              | 4.92           | 5.53           |
|                     | Standard Deviation |                   |           |             | 0.00           | 0.00           | 3.20           | 3.59           |
|                     | CV                 |                   |           |             | 0.0            | 0.0            | 3.6            | 4.02           |
|                     | Levene's Prob(F)   |                   |           |             | .              | .              | 0.777          | 0.593          |
|                     | P(Shapiro-Wilk)^   |                   |           |             | .              | .              | 0.649          | 0.9921         |
|                     | P(Skewness)^       |                   |           |             | .              | .              | 0.7768         | 0.9042         |
|                     | P(Kurtosis)^       |                   |           |             | .              | .              | 0.5702         | 0.6674         |
|                     | Replicate F        |                   |           |             | 0.000          | 0.000          | 0.122          | 0.800          |
|                     | Replicate Prob(F)  |                   |           |             | 1.0000         | 1.0000         | 0.9451         | 0.5175         |
|                     | Treatment F        |                   |           |             | 0.000          | 0.000          | 31.305         | 32.620         |
|                     | Treatment Prob(F)  |                   |           |             | 1.0000         | 1.0000         | 0.0001         | 0.0001         |

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).  
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.  
 \* Adjusted means  
 Could not calculate LSD (% mean diff) for columns 1,4 because error mean square = 0.  
 ^Calculated from residual.

# Purdue Weed Science

## Belchim Evaluation of Tough R and Tough R plus Atrazine for Waterhemp Control in Corn

Trial ID: 23-MGS-Corn-04  
 Protocol ID: 23-MGS-Corn-04 Location: MEIGS Trial Year: 2023  
 Study Director: Dr. Bill Johnson Sponsor Contact: Dennis Long

Investigator: Dr. Bill Johnson

|                    |                    |                   |           |             | Marcelo Zimmer | Marcelo Zimmer | Marcelo Zimmer | Marcelo Zimmer |
|--------------------|--------------------|-------------------|-----------|-------------|----------------|----------------|----------------|----------------|
|                    |                    |                   |           |             | Jul-3-2023     | Jul-18-2023    | Jun-12-2023    | Jun-19-2023    |
|                    |                    |                   |           |             | PLOT, P        | PLOT, P        | PLOT, P        | PLOT, P        |
|                    |                    |                   |           |             | CONTRO         | CONTRO         | CONTRO         | CONTRO         |
|                    |                    |                   |           |             | %, 0, 100      | %, 0, 100      | %, 0, 100      | %, 0, 100      |
|                    |                    |                   |           |             | C, ZEAMX       | C, ZEAMX       | C, ZEAMX       | C, ZEAMX       |
|                    |                    |                   |           |             | Corn           | Corn           | Corn           | Corn           |
|                    |                    |                   |           |             | AMATU          | AMATU          | SETFA          | SETFA          |
|                    |                    |                   |           |             | tall waterhemp | tall waterhemp | Giant foxtail  | Giant foxtail  |
|                    |                    |                   |           |             | 28 DA-B        | 42 DA-B        | 7 DA-B         | 14 DA-B        |
|                    |                    |                   |           |             | EC             | EC             | EC             | EC             |
| Trt No.            | Treatment Name     | Rate              | Appl Code | Appl Timing | 7*             | 9*             | 3*             | 6*             |
|                    |                    | Rate Unit         |           |             |                |                |                |                |
| 1                  | NONTREATED         |                   |           |             | 0.0            | 0.0            | 0.0            | 0.0            |
| 2                  | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 70.0 c         | 67.5 c         | 99.5 a         | 98.5 a         |
|                    | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 3                  | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 85.5 b         | 85.5 b         | 99.5 a         | 98.8 a         |
|                    | MOTIF              | 3 fl oz/a         | B         | 3-5"W       |                |                |                |                |
|                    | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 4                  | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 95.5 a         | 95.5 a         | 100.0 a        | 98.8 a         |
|                    | TOUGH              | 8 fl oz/a         | B         | 3-5"W       |                |                |                |                |
|                    | MOTIF              | 3 fl oz/a         | B         | 3-5"W       |                |                |                |                |
|                    | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 5                  | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 95.5 a         | 95.8 a         | 99.0 a         | 98.5 a         |
|                    | TOUGH R            | 16 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| 6                  | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 96.0 a         | 96.0 a         | 98.3 a         | 98.3 a         |
|                    | TOUGH R            | 16 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | AATREX             | 16 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |                |                |
|                    | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |                |                |
| LSD P=.05          |                    |                   |           |             | 7.07           | 7.84           | 2.46           | 1.47           |
| Standard Deviation |                    |                   |           |             | 4.59           | 5.09           | 1.60           | 0.95           |
| CV                 |                    |                   |           |             | 5.19           | 5.78           | 1.61           | 0.97           |
| Levene's Prob(F)   |                    |                   |           |             | 0.626          | 0.876          | 0.654          | 0.81           |
| P(Shapiro-Wilk)^   |                    |                   |           |             | 0.4731         | 0.9403         | 0.0447*        | 0.0273*        |
| P(Skewness)^       |                    |                   |           |             | 0.9625         | 0.7667         | 0.0659         | 0.0275*        |
| P(Kurtosis)^       |                    |                   |           |             | 0.1008         | 0.706          | 0.5575         | 0.0941         |
| Replicate F        |                    |                   |           |             | 1.301          | 1.332          | 0.542          | 0.495          |
| Replicate Prob(F)  |                    |                   |           |             | 0.3193         | 0.3100         | 0.6624         | 0.6922         |
| Treatment F        |                    |                   |           |             | 23.995         | 23.459         | 0.686          | 0.193          |
| Treatment Prob(F)  |                    |                   |           |             | 0.0001         | 0.0001         | 0.6151         | 0.9376         |

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 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.  
 \* Adjusted means  
 Could not calculate LSD (% mean diff) for columns 1,4 because error mean square = 0.  
 ^Calculated from residual.

# Purdue Weed Science

## Belchim Evaluation of Tough R and Tough R plus Atrazine for Waterhemp Control in Corn

Trial ID: 23-MGS-Corn-04  
 Protocol ID: 23-MGS-Corn-04 Location: MEIGS Trial Year: 2023  
 Study Director: Dr. Bill Johnson Sponsor Contact: Dennis Long

Investigator: Dr. Bill Johnson

| Assessed By         |                    |                   |           |             | Marcelo Zimmer | Marcelo Zimmer |
|---------------------|--------------------|-------------------|-----------|-------------|----------------|----------------|
| Rating Date         |                    |                   |           |             | Jul-3-2023     | Jul-18-2023    |
| Part Rated          |                    |                   |           |             | PLOT, P        | PLOT, P        |
| Rating Type         |                    |                   |           |             | CONTRO         | CONTRO         |
| Rating Unit/Min/Max |                    |                   |           |             | %, 0, 100      | %, 0, 100      |
| Crop Type, Code     |                    |                   |           |             | C, ZEAMX       | C, ZEAMX       |
| Crop Name           |                    |                   |           |             | Corn           | Corn           |
| Pest Code           |                    |                   |           |             | SETFA          | SETFA          |
| Pest Name           |                    |                   |           |             | Giant foxtail  | Giant foxtail  |
| Rating Timing       |                    |                   |           |             | 28 DA-B        | 42 DA-B        |
| ARM Action Codes    |                    |                   |           |             | EC             | EC             |
| Trt No.             | Treatment Name     | Rate Rate Unit    | Appl Code | Appl Timing | 8*             | 10*            |
| 1                   | NONTREATED         |                   |           |             | 0.0            | 0.0            |
| 2                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 89.5 a         | 89.5 a         |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |
| 3                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 89.5 a         | 89.3 a         |
|                     | MOTIF              | 3 fl oz/a         | B         | 3-5"W       |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |
| 4                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 87.8 a         | 87.0 a         |
|                     | TOUGH              | 8 fl oz/a         | B         | 3-5"W       |                |                |
|                     | MOTIF              | 3 fl oz/a         | B         | 3-5"W       |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |
| 5                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 87.8 a         | 87.5 a         |
|                     | TOUGH R            | 16 fl oz/a        | B         | 3-5"W       |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |
| 6                   | MOCCASIN II PLUS   | 1 pt/a            | A         | PRE         | 92.3 a         | 92.3 a         |
|                     | TOUGH R            | 16 fl oz/a        | B         | 3-5"W       |                |                |
|                     | AATREX             | 16 fl oz/a        | B         | 3-5"W       |                |                |
|                     | ROUNDUP POWERMAX 3 | 20 fl oz/a        | B         | 3-5"W       |                |                |
|                     | AMSOL              | 8.5 lb ai/100 gal | B         | 3-5"W       |                |                |
| LSD P=.05           |                    |                   |           |             | 11.28          | 10.73          |
| Standard Deviation  |                    |                   |           |             | 7.32           | 6.96           |
| CV                  |                    |                   |           |             | 8.19           | 7.82           |
| Levene's Prob(F)    |                    |                   |           |             | 0.848          | 0.813          |
| P(Shapiro-Wilk)^    |                    |                   |           |             | 0.4767         | 0.5656         |
| P(Skewness)^        |                    |                   |           |             | 0.5202         | 0.499          |
| P(Kurtosis)^        |                    |                   |           |             | 0.5365         | 0.555          |
| Replicate F         |                    |                   |           |             | 0.369          | 0.408          |
| Replicate Prob(F)   |                    |                   |           |             | 0.7766         | 0.7500         |
| Treatment F         |                    |                   |           |             | 0.253          | 0.352          |
| Treatment Prob(F)   |                    |                   |           |             | 0.9021         | 0.8377         |

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 \* Adjusted means  
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## Purdue Weed Science

### Belchim Evaluation of Tough R and Tough R plus Atrazine for Waterhemp Control in Corn

Trial ID: 23-MGS-Corn-04  
Protocol ID: 23-MGS-Corn-04 Location: MEIGS Trial Year: 2023  
Study Director: Dr. Bill Johnson Sponsor Contact: Dennis Long

Investigator: Dr. Bill Johnson

#### Assessed By

Marcelo Zimmer = MZ

#### Part Rated

PLOT = plot

C = Crop is Part Rated

P = Pest is Part Rated

#### Rating Type

PHYGEN = phytotoxicity - general / injury

CONTRO = control / burndown or knockdown

#### Rating Unit/Min/Max

%, 0, 100 = percent

#### Crop Type, Code

C = EPPPO species (Bayer) codes

ZEAMX, BCOR, Zea mays, Corn = US

#### Pest Code

AMATU, Amaranthus tuberculatus, tall waterhemp = US

SETFA, Setaria faberi, Giant foxtail = US

#### ARM Action Codes

EC = Do not analyze untreated check, while still reporting treatment mean on AOV Means Table