

**Fierce EZ and Fierce MTZ comparisons in a glyphosate tolerant soybean cropping system at**

**Rosemount, MN - 2019.**

Gunsolus, Jeffrey L., Douglas W. Miller, Ryan Mentz, McKenzie Barth, and Lewis Sheaffer. The objective of this experiment was to evaluate residual weed control with Fierce EZ, Fierce MTZ, and other herbicides in a glyphosate tolerant soybean herbicide program. The experiment was conducted at Rosemount, MN on a Waukegon silt loam (9% sand, 49% silt, 42% clay) with pH 6.6 and 3.9% organic matter. Soil test P and K were 92 and 192 lbs/A, respectively. The area was weedy fallow in 2018 and was chisel plowed in the fall. In 2019, the area was field cultivated on April 26. On April 29, the area was fertilized with 120 lbs/A P and 120 lbs/A K. The area was field cultivated twice on May 30. On May 31, NorthStar NS 61903NXR2 soybeans were seeded in 30 inch rows at a rate of 150,000 seeds/A. The experimental design was a randomized complete block with four replications. Plot size was 15 by 30 feet. Treatments were applied to a 10 foot wide strip with a tractor mounted, compressed air sprayer with an eight nozzle boom and 15 inch nozzle spacing. Applications were made using 110015VS XR Teejet flat-fan at 35 psi pressure producing a spray volume of 15 gpa. Preemergence treatments were applied on May 31. Two postemergence applications were applied on June 26 and July 15, respectively. Weed control and soybean injury were visually rated. Two 0.25 m<sup>2</sup> grids were established in each plot for weed density counts. Yields were determined by harvesting the center two plot rows. Data are presented in the Tables. Some weed density data was transformed for analysis to correct for heterogeneity of variance. All data presented are the original un-transformed means. Application environmental conditions and weed data are presented below.

| <b>Treatment Date</b>       | <b>May 31</b> | <b>June 26</b>           | <b>July 15</b>                                   |
|-----------------------------|---------------|--------------------------|--|
| Application                 | Preemergence  | Postemergence Sequential | Late Postemergence                               |
| Target Weed Stage           | --            | 2" weeds                 | 2" weeds   |
| Soybean Stage               | --            | 2 trifoliolate / 5-7"    | 7-8 trifoliolate / 18-20"<br>20-22" canopy width |
| Air Temperature (°F)        | 77            | 73                       | 85   |
| Relative humidity (%)       | 54            | 65                       | 85   |
| Dewpoint (°F)               | 59            | 60                       | 72   |
| Soil Moisture               | moist at 1"   | moist at 0.5"            | moist at 0.25"                                   |
| Soil Temperature (°F)       | 80            | 68                       | 80   |
| Sky                         | 30% clouds    | 65% clouds               | 85% clouds                                       |
| Wind (mph)                  | W 5           | W 4                      | SW 8-10  |
| Rainfall before Application |               |                          |  |
| Week 1 (inch)               | 1.56          | 1.32                     | 0.64   |
| Rainfall after Application  |               |                          |  |
| Week 1 (inch)               | 1.14          | 3.08                     | 2.79   |
| Week 2 (inch)               | 0.20          | 1.05                     | 0.14   |
| <b>Weed Size (inches)*</b>  |               |                          |  |
| Common Lambsquarters (Colq) | --            | 0.5-2" (to 4")           | 0.5-1"   |
| Tall Waterhemp* (Tawh)      | --            | 0.5-2" (to 5")           | old=4-8"/new=0.25-0.75" **                       |
| Velvetleaf (Vele)           | --            | 1-2.5" (to 4")           | 1-2"   |
| Foxtail (giant and yellow)  | --            | 2-4" (to 7")             | --   |
| Woolly Cupgrass (Wocg)      | --            | 2-4" (to 5")             | 2-5"   |

\* Weed size in parenthesis on June 26 represent the larger range of weed species in the non-preemergence treated plots.

\*\* old = waterhemp that was not controlled by the June 26 postemergence application, new = newly emerged waterhemp.

**Results**

Heavy wind-driven rain occurred five days after the preemergence herbicide application. Later observation of weed control led to the conclusion that surface movement of herbicides occurred across the treated plot area into the adjacent untreated plot rows and potentially causing a dilution effect in parts of the treated 4-row plot.

The primary broadleaf weed species were tall waterhemp (546/m<sup>2</sup> on June 25), common lambsquarters (159/m<sup>2</sup>), and velvetleaf (8/m<sup>2</sup>). Foxtail (85-90% giant and 10-15% yellow) and woolly cupgrass were the grass species present. Grass density was light (16/m<sup>2</sup>) and populations were variable. Foxtails were the primary species present on the June 25 rating date. Following the June 26 postemergence application, little to no foxtail species emerged and the later grass species ratings were based primarily on later emerging woolly cupgrass. Weed species on the June 26 postemergence application date generally ranged larger in size in the treatments that did not receive a preemergence herbicide application. The preemergence treatments generally all showed a level of weed size suppression with some variation depending on specific treatment and/or weed species.

Initial and residual control of tall waterhemp was good to excellent for all preemergence herbicide treatments (Table 1). Zidua Pro provided the best control and Authority MTZ the lowest preemergence waterhemp control on the June 25 rating date. The postemergence sequential application on June 26 generally controlled most existing (old) waterhemp in the preemergence treatment group based on the July 15 ratings. Postemergence control of existing waterhemp (old) was lower in the three postemergence-only treatments compared to the preemergence treated plots on the July 15 rating date. This was generally due to larger waterhemp present in these post-only treatments on the June 26 application date. Roundup alone resulted in poor control of existing (old) waterhemp while the Roundup plus V-10440 or Anthem Maxx tank mixes resulted in increased control of the existing waterhemp compared to Roundup only. The addition of V-10440 or Anthem Maxx also resulted in good residual control of "new" waterhemp compared to Roundup alone at the July 15 date. Existing (old) waterhemp control in the postemergence-only treatments on July 25 were similar to the July 15 ratings in that the existing (old) waterhemp was still poorly controlled. Few "new" waterhemp emerged following the July 15 postemergence application based on observations of the Roundup only treatment. Final control ratings on October 8 for the postemergence-only treatments show that late season canopy competition improved waterhemp control but these treatments general resulted in lower waterhemp control compared to the preemergence treatments.

Authority First, Authority MTZ, and Zidua Pro provided excellent common lambsquarters control. The Fierce treatments all provided poor control. All common lambsquarters present at the June 26 postemergence application date were controlled by the postemergence treatments. All of the preemergence treatment plus the V-10440 and Anthem Maxx tank mixes in the postemergence-only treatments provided residual control of lambsquarters compared to the postemergence Roundup-only treatment. All lambsquarters was controlled by the July 15 postemergence sequential treatment and lambsquarters control was excellent for all treatments on the July 25 and October 8 rating dates.

Velvetleaf populations were more variable than the tall waterhemp or common lambsquarters populations. Authority First and Zidua Pro provided the best preemergence control of velvetleaf. Authority MTZ provided little velvetleaf control. All postemergence treatments controlled existing velvetleaf. Few velvetleaf emerged after the July 26 postemergence application and control was excellent for all treatments on the July 25 and October 8 rating dates.

Due to the high variability of grass species density, treatment differences were generally not significantly different. Overall control of foxtail species was better than woolly cupgrass control. Authority MTZ showed little to no foxtail control compared to the other preemergence treatments. All postemergence treatments controlled existing grass species. The preemergence Authority First treatment showed reduced residual control of woolly cupgrass compared to the other preemergence treatments. Postemergence treatments that included a residual tank mix component generally provided complete residual grass control.

Weed density counts (Table 2) generally matched the visual weed control data with deviations resulting from the small sample area and variation in weed species population density.

No soybean injury was observed with any treatment. Soybean yields averaged 60 Bu/A in herbicide treated plots. There were no significant yield differences between herbicide treatments (data not shown). The weedy check treatment was not harvested.

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**Table 1. (Weed Control)**

| Treatment <sup>4</sup>                               | Rate                   | Weed Control**   |       |                  |       |       |       |      |       |       |       |       |       |       |       |       |                            |       |       |       |  |
|--|------------------------|------------------|-------|------------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|----------------------------|-------|-------|-------|--|
|  |                        | Tawh             |       |                  |       |       |       |      | Colq  |       |       |       | Vele  |       |       |       | grass species <sup>1</sup> |       |       |       |  |
|  |                        | old <sup>2</sup> |       | new <sup>2</sup> |       | old   | new   |      | 6/25  |       | 7/15  |       | 7/25  |       | 10/8  |       | foxtail <sup>3</sup>       |       | Wocg  |       |  |
|  |                        | 6/25             | 7/15  | 7/15             | 7/25  | 7/25  | 10/8  | 6/25 | 7/15  | 7/25  | 10/8  | 6/25  | 7/15  | 7/25  | 10/8  | 6/25  | 6/25                       | 7/15  | 7/25  | 10/8  |  |
| (product/A)  |                        | ------(%)-----   |       |                  |       |       |       |      |       |       |       |       |       |       |       |       |                            |       |       |       |  |
| <b>Preemergence May 31 / Postemergence June 26</b>   |                        |                  |       |                  |       |       |       |      |       |       |       |       |       |       |       |       |                            |       |       |       |  |
| Fierce EZ <sup>5</sup> / Roundup <sup>6</sup>        | 6 oz / 32 oz           | 93 bc            | 99 a  | 97 a             | 98 a  | 99 a  | 99 ab | 48 b | 97 a  | 98 a  | 100 a | 64 c  | 100 a | 100 a | 100 a | 73 ab | 50 a                       | 99 a  | 98 a  | 99 a  |  |
| Fierce EZ / Roundup + V-10440 <sup>7</sup>           | 6 oz / 32 oz + 6 oz    | 95 ab            | 100 a | 100 a            | 100 a | 100 a | 100 a | 48 b | 100 a | 100 a | 100 a | 63 c  | 100 a | 100 a | 100 a | 55 b  | 28 a                       | 100 a | 100 a | 100 a |  |
| Fierce MTZ <sup>8</sup> / Roundup                    | 1 pt / 32 oz           | 96 ab            | 99 a  | 98 a             | 98 ab | 99 a  | 99 ab | 36 b | 99 a  | 99 a  | 100 a | 44 cd | 100 a | 99 a  | 100 a | 93 a  | 31 a                       | 99 a  | 99 a  | 99 a  |  |
| Fierce MTZ / Roundup + V-10440                       | 1 pt / 32 oz + 6 oz    | 95 ab            | 100 a | 100 a            | 100 a | 100 a | 100 a | 44 b | 99 a  | 99 a  | 100 a | 71 bc | 100 a | 100 a | 100 a | 73 ab | 18 a                       | 99 a  | 100 a | 100 a |  |
| Authority First <sup>9</sup> / Roundup               | 4.5 oz / 32 oz         | 97 ab            | 99 a  | 97 a             | 97 ab | 99 a  | 99 ab | 99 a | 99 a  | 99 a  | 100 a | 99 a  | 100 a | 100 a | 100 a | 96 a  | 11 a                       | 95 b  | 95 b  | 99 b  |  |
| Zidua Pro <sup>10</sup> / Roundup + V-10440          | 4.5 oz / 32 oz + 6 oz  | 99 a             | 99 a  | 99 a             | 99 a  | 97 a  | 99 a  | 99 a | 99 a  | 99 a  | 100 a | 97 ab | 100 a | 99 a  | 100 a | 90 a  | 30 a                       | 99 a  | 99 a  | 99 a  |  |
| Authority MTZ <sup>11</sup> / Roundup + Anthem Maxx  | 11 oz / 32 oz + 2.5 oz | 90 c             | 99 a  | 99 a             | 99 a  | 99 a  | 99 a  | 99 a | 100 a | 100 a | 100 a | 18 d  | 100 a | 100 a | 100 a | 14 c  | 9 a                        | 99 a  | 99 a  | 100 a |  |
| <b>Postemergence June 26 / Postemergence July 15</b> |                        |                  |       |                  |       |       |       |      |       |       |       |       |       |       |       |       |                            |       |       |       |  |
| Roundup / Roundup                                    | 32 oz / 32 oz          | --               | 64 c  | 35 b             | 69 d  | 98 a  | 92 c  | --   | 70 b  | 99 a  | 100 a | --    | 95 a  | 99 a  | 100 a | --    | --                         | 95 b  | 99 a  | 100 a |  |
| Roundup + V-10440 / Roundup                          | 32 oz + 6 oz / 32 oz   | --               | 90 ab | 96 a             | 90 bc | 99 a  | 95 c  | --   | 94 a  | 100 a | 100 a | --    | 96 a  | 100 a | 100 a | --    | --                         | 100 a | 100 a | 100 a |  |
| Roundup + Anthem Maxx <sup>12</sup> / Roundup        | 32 oz + 2.5 oz / 32 oz | --               | 85 b  | 97 a             | 85 c  | 99 a  | 97 bc | --   | 97 a  | 99 a  | 100 a | --    | 99 a  | 100 a | 100 a | --    | --                         | 100 a | 100 a | 100 a |  |

\*\* Means followed by same letter do not significantly differ (P=.05, LSD).

<sup>1</sup> primarily giant and yellow foxtail on June 18 and woolly cupgrass on July 11, July 25, and October 8.

<sup>2</sup> old = waterhemp that was not controlled by the postemergence application, new = newly emerged waterhemp.

<sup>3</sup> giant (85-90%) and yellow (10-15%) foxtail.

<sup>4</sup> All postemergence applications included 7 pts/A N-Pak ammonium sulfate solution (3.4 lbs/gal) and 4.8 ox/A Induce (nonionic surfactant).

<sup>5</sup> Fierce EZ 3.04SC = flumioxazin (1.34 lb ai/gal) & pyroxasulfone (1.7 lb ai/gal).

<sup>6</sup> Roundup PowerMax 4.5SL (glyphosate).

<sup>7</sup> V-10440 = experimental from Valent.

<sup>8</sup> Fierce MTZ 2.64 SC = flumioxazin (0.5 lb ai/gal) & pyroxasulfone (0.64 lb ai/gal) & metribuzin (1.5 lb ai/gal).

<sup>9</sup> Authority First 70DF = 63.1% sulfentrazone & 7.9% chloransulam-methyl.

<sup>10</sup> Zidua Pro 4.09L = 2.28 lbs ai/gal pyroxasulfone & 0.48 lbs ai/gal saflufenacil & 1.33 lbs ai/gal imazethapyr .

<sup>11</sup> Authority MTZ 45DF = 18% sulfentrazone & 27% metribuzin.

<sup>12</sup> Anthem Maxx 4.3SC = fluthiacet-methyl (0.126 lb ai/gal) & pyroxasulfone (4.174 lb ai/gal).

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**Table 2. (Weed Density)**

| Treatment <sup>4</sup>                               | Rate<br><br>(product/A) | Weed Density**   |       |                  |       |      |       |      |      |      |      |      |                             | grass species <sup>1</sup> |      |      |
|--|-------------------------|------------------|-------|------------------|-------|------|-------|------|------|------|------|------|-----------------------------|----------------------------|------|------|
|  |                         | Tawh             |       |                  |       |      | Colq  |      |      | Vele |      |      | foxtail <sup>3</sup> + Wocg |                            | Wocg |      |
|  |                         | old <sup>2</sup> |       | new <sup>2</sup> |       | old  | new   | 6/25 | 7/15 | 7/25 | 6/25 | 7/15 | 7/25                        | 6/25                       | 7/15 | 7/25 |
|  |                         | 6/25             | 7/15  | 7/15             | 7/25  |      |       |      |      |      |      |      |                             |                            |      |      |
| -----(#/m2)-----                                     |                         |                  |       |                  |       |      |       |      |      |      |      |      |                             |                            |      |      |
| <b>Preemergence May 31 / Postemergence June 26</b>   |                         |                  |       |                  |       |      |       |      |      |      |      |      |                             |                            |      |      |
| Fierce EZ <sup>5</sup> / Roundup <sup>6</sup>        | 6 oz / 32 oz            | 13 a             | 0 a   | 6 bc             | 0 a   | 4 a  | 19 b  | 2 a  | 0 a  | 2 ab | 0 a  | 0 a  | 16 a                        | 1 a                        | 1 a  |      |
| Fierce EZ / Roundup + V-10440 <sup>7</sup>           | 6 oz / 32 oz + 6 oz     | 18 a             | 0 a   | 0 a              | 0 a   | 0 a  | 26 b  | 0 a  | 0 a  | 2 ab | 0 a  | 0 a  | 23 a                        | 0 a                        | 0 a  |      |
| Fierce MTZ <sup>8</sup> / Roundup                    | 1 pt / 32 oz            | 10 a             | 0 a   | 2 ab             | 0 a   | 2 a  | 12 b  | 2 a  | 1 a  | 3 ab | 0 a  | 0 a  | 19 a                        | 1 a                        | 1 a  |      |
| Fierce MTZ / Roundup + V-10440                       | 1 pt / 32 oz + 6 oz     | 19 a             | 0 a   | 0 a              | 0 a   | 0 a  | 24 b  | 0 a  | 1 a  | 2 ab | 0 a  | 0 a  | 19 a                        | 1 a                        | 1 a  |      |
| Authority First <sup>9</sup> / Roundup               | 4.5 oz / 32 oz          | 25 a             | 0 a   | 15 c             | 0 a   | 2 a  | 1 a   | 0 a  | 1 a  | 1 a  | 0 a  | 0 a  | 18 a                        | 1 a                        | 2 a  |      |
| Zidua Pro <sup>10</sup> / Roundup + V-10440          | 4.5 oz / 32 oz + 6 oz   | 43 a             | 0 a   | 0 a              | 0 a   | 0 a  | 1 a   | 0 a  | 0 a  | 0 a  | 0 a  | 0 a  | 15 a                        | 0 a                        | 0 a  |      |
| Authority MTZ <sup>11</sup> / Roundup + Anthem Maxx  | 11 oz / 32 oz + 2.5 oz  | 43 a             | 0 a   | 0 a              | 0 a   | 0 a  | 1 a   | 0 a  | 0 a  | 8 cd | 0 a  | 0 a  | 15 a                        | 0 a                        | 0 a  |      |
| <b>Postemergence June 26 / Postemergence July 15</b> |                         |                  |       |                  |       |      |       |      |      |      |      |      |                             |                            |      |      |
| Roundup / Roundup                                    | 32 oz / 32 oz           | 546 b            | 32 b  | 315 d            | 36 c  | 15 a | 171 c | 17 c | 3 a  | 9 cd | 0 a  | 1 a  | 20 a                        | 5 b                        | 1 a  |      |
| Roundup + V-10440 / Roundup                          | 32 oz + 6 oz / 32 oz    | 571 b            | 15 ab | 19 c             | 17 b  | 2 a  | 126 c | 5 b  | 0 a  | 10 d | 0 a  | 0 a  | 13 a                        | 0 a                        | 0 a  |      |
| Roundup + Anthem Maxx <sup>12</sup> / Roundup        | 32 oz + 2.5 oz / 32 oz  | 491 b            | 9 a   | 16 bc            | 12 ab | 2 a  | 170 c | 6 b  | 1 a  | 6 bc | 0 a  | 0 a  | 16 a                        | 0 a                        | 0 a  |      |
| Weedy check  |                         | 575 b            | --    | --               | --    | --   | 168 c | --   | --   | 7 cd | --   | --   | 13 a                        | --                         | --   |      |
| Data transformation applied <sup>12</sup>            |                         | AS               | NT    | AL               | NT    | NT   | AL    | AS   | NT   | NT   | NT   | NT   | NT                          | NT                         | NT   |      |

\*\*Means followed by same letter do not significantly differ (P=.05, LSD).

<sup>1</sup> primarily giant and yellow foxtail on June 18 and woolly cupgrass on July 11, July 25, and October 8.

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<sup>11</sup> Authority MTZ 45DF = 18% sulfentrazone & 27% metribuzin.

<sup>12</sup> Anthem Maxx 4.3SC = fluthiacet-methyl (0.126 lb ai/gal) & pyroxasulfone (4.174 lb ai/gal).

<sup>12</sup> Data transformation - AL = Automatic log of X+1, AS = Automatic square root transformation of X+0.5, NT = Not transformed.