Tan Section: Adjuvant and Application Technology

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Adjuvants for Flucarbazone 2.0 control of Yellow Foxtail. Dr. Howatt, Mettler, and Harrington. ‘Glenn’ hard red spring wheat was seeded near Fargo on May 6. Treatments were applied to 4 to 5 leaf wheat and 2 to 3 leaf yellow foxtail on June 16 with 88°F, 46% relative humidity, 10% cloud cover, 3 mph wind velocity at 225°, and dry soil at 79°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/30 yeft</th>
<th>7/15 yeft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flcz2.0</td>
<td>0.32 oz ai/A</td>
<td>60 %</td>
<td>68 %</td>
</tr>
<tr>
<td>Flcz2.0+Preference</td>
<td>0.32+0.25%</td>
<td>63 %</td>
<td>77 %</td>
</tr>
<tr>
<td>Flcz2.0+Preference+AG02013</td>
<td>0.32+0.25%+4</td>
<td>68 %</td>
<td>87 %</td>
</tr>
<tr>
<td>Flcz2.0+AG13064</td>
<td>0.32+3</td>
<td>68 %</td>
<td>80 %</td>
</tr>
<tr>
<td>Flcz2.0+AG8050</td>
<td>0.32+6.4</td>
<td>63 %</td>
<td>78 %</td>
</tr>
<tr>
<td>Flcz2.0+AG14039</td>
<td>0.32+8</td>
<td>67 %</td>
<td>82 %</td>
</tr>
<tr>
<td>Flcz2.0+AG14039</td>
<td>0.32+12</td>
<td>62 %</td>
<td>87 %</td>
</tr>
<tr>
<td>CV</td>
<td></td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>LSD P=.05</td>
<td></td>
<td>5</td>
<td>9</td>
</tr>
</tbody>
</table>

Wheat did not exhibit response to any treatment. Control on June 30 with flucarbazone alone was 60%. Control was enhanced with addition of Preference+AG02013, AG13064, or AG14039. On July 15, each of the adjuvant treatments improved control of foxtail with flucarbazone, 68%. Preference+AG02013 or AG14039 with flucarbazone resulted in the highest control, 87%, while AG13064 only improved control with flucarbazone to 80%.
Adjuvants for Thiencarbazone control of Wild Oat. Dr. Howatt, Mettler, and Harrington. 'Glenn' hard red spring wheat was seeded near Fargo on May 6. Treatments were applied to 3 leaf wheat and 1 to 4 leaf wild oat on June 5 with 87°F, 35% relative humidity, 10% cloud cover, 6 mph wind velocity at 90°, and dry soil at 77°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/19</th>
<th>7/03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiencarbazone</td>
<td>oz ai/A</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Thcz+Preference</td>
<td>0.06</td>
<td>75</td>
<td>72</td>
</tr>
<tr>
<td>Thcz+Preference+AG02013</td>
<td>0.06+0.25%</td>
<td>75</td>
<td>88</td>
</tr>
<tr>
<td>Thcz+AG13064</td>
<td>0.06+3</td>
<td>75</td>
<td>88</td>
</tr>
<tr>
<td>Thcz+AG8050</td>
<td>0.06+6.4</td>
<td>75</td>
<td>89</td>
</tr>
<tr>
<td>Thcz+AG14039</td>
<td>0.06+8</td>
<td>75</td>
<td>91</td>
</tr>
<tr>
<td>Thcz+AG14039</td>
<td>0.06+12</td>
<td>75</td>
<td>91</td>
</tr>
<tr>
<td>CV</td>
<td></td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>LSD P=.05</td>
<td></td>
<td>.</td>
<td>5</td>
</tr>
</tbody>
</table>

Wheat did not show visible response to treatments. Wild oat symptoms did not differ across treatments on June 19. On July 3, thiencarbazone gave 72% control of wild oat. All adjuvant treatments increased control with thiencarbazone to an average of 89%. Adjuvant treatments could not be separated.
Adjuvants for Pyroxsulam control of Wild Oat. Dr. Howatt, Mettler, and Harrington. ‘Glenn’ hard red spring wheat was seeded near Fargo on May 6. Treatments were applied to 3 leaf wheat and 1 to 4 leaf wild oat on June 5 with 87°F, 35% relative humidity, 10% cloud cover, 6 mph wind velocity at 90°, and dry soil at 77°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/19 wicoa</th>
<th>7/03 wicoa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pxlm</td>
<td>0.18 oz ai/A</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Pxlm+Preference</td>
<td>0.18+0.25%</td>
<td>75</td>
<td>63</td>
</tr>
<tr>
<td>Pxlm+Preference+AG02013</td>
<td>0.18+0.25%+4</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Pxlm+AG13064</td>
<td>0.18+3</td>
<td>75</td>
<td>88</td>
</tr>
<tr>
<td>Pxlm+AG8050</td>
<td>0.18+6.4</td>
<td>75</td>
<td>87</td>
</tr>
<tr>
<td>Pxlm+AG14039</td>
<td>0.18+8</td>
<td>75</td>
<td>91</td>
</tr>
<tr>
<td>Pxlm+AG14039</td>
<td>0.18+12</td>
<td>75</td>
<td>94</td>
</tr>
<tr>
<td>CV</td>
<td></td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>LSD P=.05</td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Wheat did not show visible response to treatments. Wild oat symptoms did not differ across treatments on June 19. On July 3, pyroxsulam gave 63% control of wild oat. All adjuvant treatments increased control with pyroxsulam. AG14039 improved control of wild oat with pyroxsulam to as much as 94% at the high rate. Preference+AG02013 gave similar flucarbazone improvement to 90%, but Preference only increased control with pyroxsulam to 83%.
Adjuvants for Kochia control with Bromoxynil\&2,4-D\&fluroxypyr. Dr. Howatt, Mettler, and Harrington. ‘Tradition’ barley was seeded near Rogers, North Dakota on May 6. Treatments were applied to 3 to 4 leaf barley and 1 to 6 inch kochia on June 8 with 72°F, 43% relative humidity, less than 5% cloud cover, 4.4 mph wind velocity at 90°, and dry soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/20</th>
<th>7/4</th>
<th>7/17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>oz</td>
<td>koch</td>
<td>koch</td>
<td>koch</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox</td>
<td>8</td>
<td>77</td>
<td>93</td>
<td>92</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+AG13064</td>
<td>8+3</td>
<td>82</td>
<td>91</td>
<td>92</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+Preference+AG02013</td>
<td>8+0.25%+4</td>
<td>82</td>
<td>95</td>
<td>97</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+AG8050</td>
<td>8+6.4</td>
<td>88</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+AG14039</td>
<td>8+8</td>
<td>72</td>
<td>89</td>
<td>97</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox</td>
<td>12</td>
<td>96</td>
<td>94</td>
<td>95</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+AG13064</td>
<td>12+3</td>
<td>77</td>
<td>70</td>
<td>82</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+Preference+AG02013</td>
<td>12+0.25%+4</td>
<td>80</td>
<td>83</td>
<td>80</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+AG8050</td>
<td>12+6.4</td>
<td>92</td>
<td>92</td>
<td>95</td>
</tr>
<tr>
<td>Brox&amp;2,4-D&amp;Flox+AG14039</td>
<td>12+8</td>
<td>90</td>
<td>95</td>
<td>96</td>
</tr>
</tbody>
</table>

CV                       | 5     | 4     | 4     |
LSD P=.05                | 8     | 7     | 6     |

Treatments did not cause injury to barley. Initial herbicide control of kochia at the low rate was improved with AG8050 but this did not last to the next evaluation. Initial control with the high rate of herbicide was 96%. Control was only 77% with AG13064 or Preference and AG02013. This level of reduced control persisted through the season.
Adjuvant protection of triallate. Howatt, Mettler, Davidson. Incorporated triallate was applied and immediately incorporated with two passes of a field cultivator before remaining treatments (except those containing Extend because of delivery delay) were applied May 6 with 72°F, 19% relative humidity, 5% cloud cover, 5 mph wind at 45° and damp to dry soil at 60°F. 'Glenn' hard red spring wheat was seeded near Fargo on May 6. The Extend treatment was applied to pre-spike to 1 leaf wild oat May 19 with 57°F, 35% relative humidity, 100% cloud cover, 7 mph wind velocity at 80° and damp to dry soil at 50°F. Treatments were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/19 wioa</th>
<th>6/30 wioa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triallate (PRE)</td>
<td>16</td>
<td>63</td>
<td>48</td>
</tr>
<tr>
<td>Triallate (PPI)</td>
<td>16</td>
<td>94</td>
<td>90</td>
</tr>
<tr>
<td>Triallate+Extend</td>
<td>16+0.5%</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>Triallate+Grounded</td>
<td>16+32</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>Triallate+Infuse</td>
<td>16+32</td>
<td>70</td>
<td>48</td>
</tr>
<tr>
<td>Triallate+Ad-Here</td>
<td>16+16</td>
<td>68</td>
<td>33</td>
</tr>
<tr>
<td>Triallate+Ad-Here</td>
<td>16+32</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>Untreated Check</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

CV 13 18
LSD P=.05 10 10

Wheat did not show visible injury of herbicide symptoms. Triallate that was incorporated provided 90% control of wild oat. Control was nearly half that when incorporation was not performed. Only Ad-Here at 32 fl oz/A started to overcome the deficit in control without incorporation, but control was only 60%. A higher rate could possibly provide more benefit, but the cost of product could become prohibitive. Treatments that included Extend were applied late in germination and wild oat likely were not sufficiently exposed before seedling establishment to see triallate effect.
Adjuvant protection for Triallate and Pyroxasulfone. Dr. Howatt, Mettler, and Harrington. Triallate (PPI) was applied and immediately incorporated with two passes of a field cultivator before remaining treatments (except those containing Extend because of delayed delivery) were applied on May 6 with 72°F, 19% relative humidity, 5% cloud cover, 5 mph wind at 45°, and damp to dry soil at 60°F. ‘Glenn’ hard red spring wheat was seeded near Fargo on May 6. Treatments containing Extend were applied to near spike stage grasses May 19 with 57°F, 35% relative humidity, 100% cloud cover, 7 mph wind velocity at 80°, and damp to dry soil at 50°F. All treatments were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/19</th>
<th>6/30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>oz ai/A</td>
<td>wioa</td>
<td>wioa</td>
</tr>
<tr>
<td>Triallate (PPI)</td>
<td>16</td>
<td>89</td>
<td>88</td>
</tr>
<tr>
<td>Pysf</td>
<td>0.85</td>
<td>53</td>
<td>25</td>
</tr>
<tr>
<td>Triallate+Pysf</td>
<td>16+0.85</td>
<td>89</td>
<td>86</td>
</tr>
<tr>
<td>Triallate+Extend</td>
<td>16+0.5%</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>Triallate+Grounded</td>
<td>16+32</td>
<td>59</td>
<td>38</td>
</tr>
<tr>
<td>Triallate+Pysf+Extend</td>
<td>16+0.85+0.5%</td>
<td>38</td>
<td>5</td>
</tr>
<tr>
<td>Triallate+Pysf+Grounded</td>
<td>16+0.85+32</td>
<td>76</td>
<td>40</td>
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<td>Untreated Check</td>
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<tr>
<td>CV</td>
<td></td>
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<td>25</td>
</tr>
<tr>
<td>LSD P=.05</td>
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<td>12</td>
<td>13</td>
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</table>

Wheat did not express symptoms of herbicide damage. Incorporated triallate provided 88% control of wild oat. Non-incorporated triallate+pyroxasulfone provided similar control to this even though triallate would not have been stabilized with cultivation and pyroxasulfone alone only gave 25% control. Additives to enhance and prolong activity of soil applied herbicides were not a sufficient substitute for lack of triallate incorporation. Treatments that included Extend were applied late in germination and wild oat likely were not sufficiently exposed before seedling establishment to see triallate effect.
Adjuvant for soil herbicides. Dr. Howatt, Mettler, and Harrington. The experiment was established on a non-cropped plot with bare ground near Fargo. Treatments were applied to soil on June 1 with 82°F, 12% relative humidity, 5% cloud cover, and 8 mph wind velocity at 225° and dry soil at 68°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>Jun-29-2017 weeds</th>
<th>Jul-6-2017 weeds</th>
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<td>Trifluralin</td>
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<td>23</td>
<td>15</td>
</tr>
<tr>
<td>Trif+Grounded</td>
<td>12+32</td>
<td>38</td>
<td>20</td>
</tr>
<tr>
<td>Trif+Extend</td>
<td>12+32</td>
<td>40</td>
<td>23</td>
</tr>
<tr>
<td>Trif+Ad-Here</td>
<td>12+32</td>
<td>40</td>
<td>33</td>
</tr>
<tr>
<td>Pendimethalin</td>
<td>16</td>
<td>48</td>
<td>40</td>
</tr>
<tr>
<td>Pend+Grounded</td>
<td>16+32</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>Pend+Extend</td>
<td>16+32</td>
<td>48</td>
<td>40</td>
</tr>
<tr>
<td>Pend+Ad-Here</td>
<td>16+32</td>
<td>53</td>
<td>43</td>
</tr>
<tr>
<td>Acetochlor</td>
<td>18</td>
<td>58</td>
<td>46</td>
</tr>
<tr>
<td>Aceto+Grounded</td>
<td>18+32</td>
<td>45</td>
<td>28</td>
</tr>
<tr>
<td>Aceto+Extend</td>
<td>18+32</td>
<td>53</td>
<td>38</td>
</tr>
<tr>
<td>Aceto+Ad-Here</td>
<td>18+32</td>
<td>48</td>
<td>30</td>
</tr>
<tr>
<td>Pyroxasulfone</td>
<td>1.7</td>
<td>73</td>
<td>51</td>
</tr>
<tr>
<td>Pxsf+Grounded</td>
<td>1.7+32</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td>Pxsf+Extend</td>
<td>1.7+32</td>
<td>74</td>
<td>63</td>
</tr>
<tr>
<td>Pxsf+Ad-Here</td>
<td>1.7+32</td>
<td>51</td>
<td>51</td>
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<tr>
<td>Dimethenamid-P</td>
<td>12</td>
<td>73</td>
<td>55</td>
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<tr>
<td>Dime-P+Grounded</td>
<td>12+32</td>
<td>71</td>
<td>58</td>
</tr>
<tr>
<td>Dime-P+Extend</td>
<td>12+32</td>
<td>69</td>
<td>66</td>
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<tr>
<td>Dime-P+Ad-Here</td>
<td>12+32</td>
<td>78</td>
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<tr>
<td>Sulfentrazone</td>
<td>4.5</td>
<td>97</td>
<td>98</td>
</tr>
<tr>
<td>Suen+Grounded</td>
<td>4.5+32</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>Suen+Extend</td>
<td>4.5+32</td>
<td>95</td>
<td>97</td>
</tr>
<tr>
<td>Suen+Ad-Here</td>
<td>4.5+32</td>
<td>98</td>
<td>99</td>
</tr>
</tbody>
</table>

CV  
LSD P=.05  
15          
13          

Weed emergence was almost exclusively redroot pigweed, waterhemp, and common lambsquarters. The poor level of weed control with several herbicides resulted in large LSD, and means could not be separated within herbicide group. Sulfentrazone provided 98% control of weeds without additive but additive did not antagonize control. Control with acetochlor tended to decrease with all additives. Control with pendimethalin and pyroxasulfone tended to increase with additives. And control with trifluralin tended to increase with additive, possibly because the additives prevented some of the trifluralin loss due to volatility or photodegradation as treatments were not incorporated.

An experiment was conducted near Mayville, ND to evaluate weed control from PPI herbicides incorporated immediately after application at a 4 inch depth and POST herbicides. PPI treatments were applied on May 22, 2017 at 11:35 PM with 53.2°F air, 18°F soil at a four inch depth, 25% RH, 75% cloud cover, 8-10 mph NNW wind, and adequate soil moisture. POST treatments were applied on June 20, 2017 at 2:00 PM with 72°F air, 80°F soil, 43% RH, 30% cloud cover, 2-3 mph NNE wind, and adequate soil moisture. Weeds present were: corn 2-4" at 2-4/ft², yefg 4-6" at 6-8/ft², colq 2-4" at 1-2/ft², wibw 1-2" at 1-2/ft². Soil characteristics were: 23.1% sand, 52% silt, 24.9% clay, Silt Loam, 4.5% OM, and 7.7 pH. Treatments were applied to the center 7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa through 11002 TTI nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Eptam is extremely volatile while Sonalan is affected by photodegradation. Both herbicides were tank-mixed with multiple ijuants designed to protect pre-emergent herbicides from degradation and volatilization on the soil surface. Herbicide treatments were incorporated immediately after application. As the rate of Eptam AdHere increased, so did weed control. There was no or little added weed control with any POST applications except for Flexstar+MSO.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (Product/A)</th>
<th>14 DA PPI</th>
<th>28 DA PPI</th>
<th>56 DA PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rrpw colq corw</td>
<td>rrpw colq corw</td>
<td>rrpw colq corw</td>
<td></td>
</tr>
<tr>
<td>Eptam+Sonalan</td>
<td>1pt+2pt</td>
<td>99 99 70</td>
<td>80 80 60</td>
<td>70 70 37</td>
</tr>
<tr>
<td>Eptam+Sonalan+AdHere</td>
<td>1pt+2pt+1pt</td>
<td>99 99 70</td>
<td>72 72 52</td>
<td>72 72 45</td>
</tr>
<tr>
<td>Eptam+Sonalan</td>
<td>2pt+2pt</td>
<td>99 99 70</td>
<td>80 80 50</td>
<td>80 80 50</td>
</tr>
<tr>
<td>Eptam+Sonalan+AdHere</td>
<td>2pt+2pt+1pt</td>
<td>99 99 70</td>
<td>93 93 75</td>
<td>87 87 63</td>
</tr>
<tr>
<td>Eptam+Sonalan</td>
<td>3pt+2pt</td>
<td>99 99 70</td>
<td>90 90 72</td>
<td>90 90 73</td>
</tr>
<tr>
<td>Eptam+Sonalan+AdHere</td>
<td>3pt+2pt+1pt</td>
<td>99 99 70</td>
<td>93 93 77</td>
<td>93 93 78</td>
</tr>
<tr>
<td>Eptam+Sonalan+AdHere</td>
<td>1pt+2pt+1pt</td>
<td>99 99 70</td>
<td>90 90 50</td>
<td>95 95 88</td>
</tr>
<tr>
<td>DSS Agar+MSO</td>
<td>2pt+1pt</td>
<td>0 0 0</td>
<td>0 0 0</td>
<td>0 0 0</td>
</tr>
<tr>
<td>Eptam+Sonalan+AdHere</td>
<td>1pt+2pt+1pt</td>
<td>0.67oz</td>
<td>99 99 70</td>
<td>90 90 60</td>
</tr>
<tr>
<td>Permit+MSO</td>
<td>0.67oz+1pt</td>
<td>0 0 0</td>
<td>0 0 0</td>
<td>0 0 0</td>
</tr>
<tr>
<td>Eptam+Sonalan</td>
<td>1pt+2pt+1pt</td>
<td>99 99 70</td>
<td>90 90 60</td>
<td>90 90 93</td>
</tr>
<tr>
<td>Flexstar+MSO</td>
<td>0.75pt+1pt</td>
<td>0 0 0</td>
<td>0 0 0</td>
<td>99 60 75</td>
</tr>
<tr>
<td>Flexstar+MSO</td>
<td>0.75pt+1pt</td>
<td>0 0 0</td>
<td>9 9 7</td>
<td>5 5 6</td>
</tr>
</tbody>
</table>
Eptam with Extender/Protector Adjuvants. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted at Mayville, ND to evaluate weed control from PPI herbicides incorporated into the soil 1 hour after application at a 4 inch depth. PPI treatments were applied on May 22, 2017 at 11:50 AM with 53.2 F air, 49.8 F soil at a four inch depth, 25% RH, 75% cloud cover, 8-10 mph NNW wind, and adequate soil moisture. Soil characteristics were: 23.1% sand, 52% silt, 24.9% clay, Silt, 4.5% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type power sprayer delivering 17 gpa through 11002 TTI nozzles at 40 psi. The experiment had a randomized complete block design with six replicates per treatment.

Eptam is an extremely volatile herbicide that was tank mixed with multiple adjuvants designed to protect pre-emergent herbicides from degradation and volatilization on the soil surface. Treatments were incorporated 1 hour after application to slow environmental effects to act on the Eptam. Weed control decreased from 14 to 56 days after application (DAA). The addition of AdHere and Infuse provided the best weed control from 14 to 56 DAA.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>14 DAA</th>
<th>28 DAA</th>
<th>56 DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>tam</td>
<td>3pt</td>
<td>99 99 90</td>
<td>83 83 83</td>
<td>77 77 77</td>
</tr>
<tr>
<td>tam+Grounded</td>
<td>3pt+4floz</td>
<td>99 99 93</td>
<td>86 86 85</td>
<td>85 85 83</td>
</tr>
<tr>
<td>tam+Grounded</td>
<td>3pt+1pt</td>
<td>99 99 88</td>
<td>90 90 88</td>
<td>58 58 58</td>
</tr>
<tr>
<td>tam+AdHere</td>
<td>3pt+1pt</td>
<td>99 99 95</td>
<td>97 96 95</td>
<td>90 90 90</td>
</tr>
<tr>
<td>tam+MCS 100</td>
<td>3pt+8floz</td>
<td>99 99 93</td>
<td>94 90 87</td>
<td>65 65 65</td>
</tr>
<tr>
<td>tam+MCS 101</td>
<td>3pt+8floz</td>
<td>99 99 93</td>
<td>99 99 93</td>
<td>77 77 77</td>
</tr>
<tr>
<td>tam+MCH 101</td>
<td>3pt+8floz</td>
<td>99 99 95</td>
<td>98 96 95</td>
<td>67 67 67</td>
</tr>
<tr>
<td>tam+MCG 100</td>
<td>3pt+8floz</td>
<td>99 99 95</td>
<td>88 90 88</td>
<td>82 82 80</td>
</tr>
<tr>
<td>tam+Infuse</td>
<td>3pt+2pt</td>
<td>99 99 95</td>
<td>93 93 92</td>
<td>91 91 90</td>
</tr>
<tr>
<td>tam+Sorbyx</td>
<td>3pt+1pt</td>
<td>99 99 95</td>
<td>99 99 95</td>
<td>80 80 80</td>
</tr>
<tr>
<td>tam+Extend</td>
<td>3pt+0.5%v/v</td>
<td>99 99 90</td>
<td>90 90 85</td>
<td>63 63 63</td>
</tr>
<tr>
<td>tam+InPlace</td>
<td>3pt+8floz</td>
<td>70 70 70</td>
<td>73 73 73</td>
<td>63 63 63</td>
</tr>
<tr>
<td>D</td>
<td>0 0 4</td>
<td>9 9 6</td>
<td>12 12 12</td>
<td></td>
</tr>
</tbody>
</table>
nalan with Extender/Protector Adjuvants. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Mayville, ND to evaluate weed control from PPI herbicides incorporated into the soil 2 days after application a 4 inch depth. PPI treatments were applied on May 22, 2017 at 12:25 PM with 53.2 F air, 49.8 F soil at a four inch depth, % RH, 75% cloud cover, 8-10 mph NNW wind, and adequate soil moisture. Soil characteristics were: 23.1% sand, 52% silt, .9% clay, Silt Loam, 4.5% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa through 11002 TTI nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

nalan was tankmixed with multiple adjuvants designed to protect pre-emergent herbicides from degradation and volatilization on the soil surface. Treatments were incorporated 2 days after application to allow environmental effects to act on the Sonalan. Weed control decreased from 14 to 56 days after application (DAA). The addition of AdHere provided the best weed control from 14 to 28 DAA, however weed control dramatically decreased after 56 DAA. The addition of Grounded at 4 oz, MCG 100, Infuse, and Sorbyx provided the most consistent weed control from 14 to 56 DAA.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (Product/A)</th>
<th>14 DAA</th>
<th>28 DAA</th>
<th>56 DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>nalan</td>
<td>2pt</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>nalan+Grounded</td>
<td>2pt+4floz</td>
<td>98</td>
<td>87</td>
<td>82</td>
</tr>
<tr>
<td>nalan+Grounded</td>
<td>2pt+1pt</td>
<td>99</td>
<td>83</td>
<td>70</td>
</tr>
<tr>
<td>nalan+AdHere</td>
<td>2pt+1pt</td>
<td>96</td>
<td>93</td>
<td>54</td>
</tr>
<tr>
<td>nalan+MCS 100</td>
<td>2pt+8floz</td>
<td>87</td>
<td>88</td>
<td>68</td>
</tr>
<tr>
<td>nalan+MCS 101</td>
<td>2pt+8floz</td>
<td>99</td>
<td>92</td>
<td>63</td>
</tr>
<tr>
<td>nalan+MCH 101</td>
<td>2pt+8floz</td>
<td>80</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>nalan+MCG 100</td>
<td>2pt+8floz</td>
<td>92</td>
<td>88</td>
<td>85</td>
</tr>
<tr>
<td>nalan+Infuse</td>
<td>2pt+2pt</td>
<td>93</td>
<td>88</td>
<td>83</td>
</tr>
<tr>
<td>nalan+Sorbyx</td>
<td>2pt+1pt</td>
<td>90</td>
<td>87</td>
<td>65</td>
</tr>
<tr>
<td>nalan+Extend</td>
<td>2pt+0.5%v/v</td>
<td>92</td>
<td>87</td>
<td>65</td>
</tr>
<tr>
<td>nalan+InPlace</td>
<td>2pt+8floz</td>
<td>92</td>
<td>87</td>
<td>65</td>
</tr>
</tbody>
</table>
Tam Plus Sonalan with Extender/Protector Adjuvants. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment is conducted near Mayville, ND to evaluate weed control from PRE herbicides. PRE treatments were applied on May 22, 201 12:05 PM with 53.2°F air, 49.8°F soil at a four inch depth, 25% RH, 75% cloud cover, 8-10 mph NNW wind, and adequate soil moisture. Soil characteristics were: 23.1% sand, 52% silt, 24.9% clay, Silt Loam, 4.5% OM, and 7.7 pH. Treatments were applied the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa through 11002 TTI nozzles 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Tam is extremely volatile while Sonalan is affected by photodegradation. Both herbicides were tankmixed with multiple adjuvants designed to protect pre-emergent herbicides from degradation and volatilization on the soil surface. PRE treatments are not incorporated after application to allow environmental effects to act on each herbicide. Weed control stayed relatively consistent from 14 to 56 days after application (DAA). The addition of most adjuvants only slightly increased weed control.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (Product/A)</th>
<th>14 DAA</th>
<th>28 DAA</th>
<th>56 DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>rwp</td>
<td>colq</td>
<td>corw</td>
</tr>
<tr>
<td>Tam + Sonalan</td>
<td>3pt+2pt</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>Tam + Sonalan + Grounded</td>
<td>3pt+2pt+4floo</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Tam + Sonalan + Grounded</td>
<td>3pt+2pt+1pt</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Tam + Sonalan + AdHere</td>
<td>3pt+2pt+1pt</td>
<td>53</td>
<td>53</td>
<td>53</td>
</tr>
<tr>
<td>Tam + Sonalan + MCS 100</td>
<td>3pt+2pt+8floo</td>
<td>43</td>
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<td>43</td>
</tr>
<tr>
<td>Tam + Sonalan + MCS 101</td>
<td>3pt+2pt+8floo</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Tam + Sonalan + MCH 101</td>
<td>3pt+2pt+8floo</td>
<td>43</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>Tam + Sonalan + MCG 100</td>
<td>3pt+2pt+8floo</td>
<td>43</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>Tam + Sonalan + Infuse</td>
<td>3pt+2pt+2pt</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Tam + Sonalan + Sorbyx</td>
<td>3pt+2pt+1pt</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Tam + Sonalan + Extend</td>
<td>3pt+2pt+0.5%v/v</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Tam + Sonalan + InPlace</td>
<td>3pt+2pt+8floo</td>
<td>30</td>
<td>30</td>
<td>30</td>
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</table>

7 7 7 4 4 5 4 5 5
Weed control using Roundup with and without surfactant. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Mayville, ND to evaluate whether or not there is a need for additional surfactants with a fully added glyphosate formulation. POST treatments were applied on June 20, 2017 at 2:25 PM with 72 F air, 80 F soil at a four inch depth, 43% RH, 30% cloud cover, 2-3 mph NNE wind, and adequate soil moisture. Weeds present at the time of POST applications were: corw 6-8" at 6-8/ft², and colq 6-8" at 6-8/ft², wibw 4-6" at 1-2/ft², rrpw 4-6" at 1-2/ft², and yeft 8-10" at 10/ft². Soil characteristics were: 23.1% sand, 52% silt, 24.9% clay, Silt Loam, 4.5% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa through 11001 TT nozzles at 30 psi. The experiment had a randomized complete block design with three replicates per treatment.

Roundup Powermax controlled all other weeds except wild buckwheat. Roundup Powermax at 22 floz was only enhanced by Rainier EA at either rates. Roundup Powermax at 32 floz was enhanced with the addition of both Activator 90 and Rainier EA at other rates. Not all surfactants enhance glyphosate.

Table. Weed control using Roundup with and without surfactant (Zollinger, Wirth, Adams)

<table>
<thead>
<tr>
<th>Treatment()</th>
<th>Rate (\text{Product/A})</th>
<th>14 DAA % control</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUPM</td>
<td>22 floz</td>
<td>62</td>
</tr>
<tr>
<td>RUPM+LI-700</td>
<td>22floz+0.25%v/v</td>
<td>50</td>
</tr>
<tr>
<td>RUPM+Activator 90</td>
<td>22floz+0.25%v/v</td>
<td>45</td>
</tr>
<tr>
<td>RUPM+Rainier EA</td>
<td>22floz+0.25%v/v</td>
<td>76</td>
</tr>
<tr>
<td>RUPM+LI-700</td>
<td>22floz+0.5%v/v</td>
<td>47</td>
</tr>
<tr>
<td>RUPM+Activator 90</td>
<td>22floz+0.5%v/v</td>
<td>58</td>
</tr>
<tr>
<td>RUPM+Rainier EA</td>
<td>22floz+0.5%v/v</td>
<td>86</td>
</tr>
<tr>
<td>RUPM</td>
<td>32floz</td>
<td>59</td>
</tr>
<tr>
<td>RUPM+LI-700</td>
<td>32floz+0.25%v/v</td>
<td>60</td>
</tr>
<tr>
<td>RUPM+Activator 90</td>
<td>32floz+0.25%v/v</td>
<td>69</td>
</tr>
<tr>
<td>RUPM+Rainier EA</td>
<td>32floz+0.25%v/v</td>
<td>83</td>
</tr>
<tr>
<td>RUPM+LI-700</td>
<td>32floz+0.5%v/v</td>
<td>62</td>
</tr>
<tr>
<td>RUPM+Activator 90</td>
<td>32floz+0.5%v/v</td>
<td>68</td>
</tr>
<tr>
<td>RUPM+Rainier EA</td>
<td>32floz+0.5%v/v</td>
<td>95</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

1 \(RUPM = \text{Roundup Powermax}\)

An experiment was conducted near Hillsboro, ND to evaluate Roundup Powermax enhancement with approved adjuvants. Flax, amaranth, sunflowers, and conventional corn were planted on June 1, 2017. POST treatments were applied on July 5, 2017 from 10-2 with 88 F air, 75 F soil at a four inch depth, 45% RH, 0% cloud cover, 0-1 mph NW wind, and adequate soil moisture. Weeds present at the time of POST applications were: flax 10-12" at 10/ft2, amaranth 13-16" at 20/ft2, sunflowers 20-24" at 5/ft2, and conventional corn 16-18" at 5/ft2. Soil characteristics were: 15.3% sand, 53.9% silt, 30.8% clay, silty clay loam, 6.2% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 12 gpa through 110015 TTI nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Species control was similar from 14 to 28 days after application. The addition of AMS provided the most species control. Class Act Ridlon was the best non-AMS water-conditioner over all species.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>14 DAA</th>
<th>28 DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DW) RUPM</td>
<td>22floz</td>
<td>Flax 90</td>
<td>Amaranth 72</td>
</tr>
<tr>
<td>(HW) RUPM</td>
<td>22floz</td>
<td>60</td>
<td>62</td>
</tr>
<tr>
<td>(DW) RUPM+AMS</td>
<td>22floz+8.5lb/100gal</td>
<td>96</td>
<td>86</td>
</tr>
<tr>
<td>(HW) RUPM+AMS</td>
<td>22floz+8.5lb/100gal</td>
<td>96</td>
<td>75</td>
</tr>
<tr>
<td>(HW) RUPM+Choice Trio</td>
<td>22floz+0.5%v/v</td>
<td>93</td>
<td>82</td>
</tr>
<tr>
<td>(HW) RUPM+Corndbelt Vaporgard</td>
<td>22floz+0.5%v/v</td>
<td>96</td>
<td>71</td>
</tr>
<tr>
<td>(HW) RUPM+FS Attero</td>
<td>22floz+0.5%v/v</td>
<td>96</td>
<td>62</td>
</tr>
<tr>
<td>(HW) RUPM+FS Certin</td>
<td>22floz+0.5%v/v</td>
<td>96</td>
<td>75</td>
</tr>
<tr>
<td>(HW) RUPM+Leeway II</td>
<td>22floz+0.5%v/v</td>
<td>97</td>
<td>73</td>
</tr>
<tr>
<td>(HW) RUPM+Traverse D</td>
<td>22floz+0.5%v/v</td>
<td>97</td>
<td>63</td>
</tr>
<tr>
<td>(HW) RUPM+Ensure Max</td>
<td>22floz+0.5%v/v</td>
<td>96</td>
<td>65</td>
</tr>
<tr>
<td>(HW) RUPM+Seerinity</td>
<td>22floz+0.5%v/v</td>
<td>96</td>
<td>65</td>
</tr>
<tr>
<td>(HW) RUPM+Zaar</td>
<td>22floz+1%v/v</td>
<td>96</td>
<td>57</td>
</tr>
</tbody>
</table>

LSD 3 5 5 6 2 4 4 4

1 DW = Distilled Water, HW = 1,000 ppm Hard Water, RUPM = Roundup Powermax
**Engenia with Approved Adjuvants.** Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate Engenia enhancement with approved adjuvants. Amaranth, quinoa, tame buckwheat, and sunflowers were planted on June 1, 2017. POST treatments were applied on July 5, 2017 from 10-2 with 88 F air, 75 F soil at a four inch depth, 45% RH, 0% cloud cover, 0-1 mph NW wind, and adequate soil moisture. Weeds present at the time of POST applications were: amaranth 13-16" at 20/ft², quinoa 8-14" at 20/ft², tame buckwheat 16-18" at 20/ft², and sunflowers 20-24" at 5/ft². Soil characteristics were: 15.3% sand, 53.9% silt, 30.8% clay, silty clay loam, 6.2% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 12 gpa through 110015 TTI nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The addition of Class Act Ridion, a non-AMS water-conditioner, provided the best overall species control in hard water across all species.

Table. Engenia with Approved Adjuvants (Zollinger, Wirth, Adams).

<table>
<thead>
<tr>
<th>Treatment¹</th>
<th>Product/Acre</th>
<th>14 DAA</th>
<th></th>
<th>28 DAA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amar Quin</td>
<td>Tabw Snfl</td>
<td>% control</td>
<td>Amar Quin</td>
<td>Tabw Snfl</td>
</tr>
<tr>
<td>(DW) Engenia</td>
<td>12.8floz</td>
<td>42</td>
<td>42</td>
<td>62</td>
<td>63</td>
</tr>
<tr>
<td>(HW) Engenia</td>
<td>12.8floz</td>
<td>25</td>
<td>32</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>(DW) Engenia+AMS</td>
<td>12.8floz+8.5lb/100gal</td>
<td>52</td>
<td>67</td>
<td>67</td>
<td>63</td>
</tr>
<tr>
<td>(HW) Engenia+AMS</td>
<td>12.8floz+8.5lb/100gal</td>
<td>63</td>
<td>65</td>
<td>69</td>
<td>58</td>
</tr>
<tr>
<td>(HW) Engenia+Class Act Ridion</td>
<td>12.8floz+0.5%v/v</td>
<td>68</td>
<td>75</td>
<td>77</td>
<td>69</td>
</tr>
<tr>
<td>(HW) Engenia+Choice Trio</td>
<td>12.8floz+0.5%v/v</td>
<td>63</td>
<td>79</td>
<td>79</td>
<td>72</td>
</tr>
<tr>
<td>(HW) Engenia+Corntop Vaporgard</td>
<td>12.8floz+0.5%v/v</td>
<td>47</td>
<td>65</td>
<td>65</td>
<td>68</td>
</tr>
<tr>
<td>(HW) Engenia+FS Attero</td>
<td>12.8floz+0.5%v/v</td>
<td>56</td>
<td>57</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>(HW) Engenia+FS Certin</td>
<td>12.8floz+0.5%v/v</td>
<td>40</td>
<td>40</td>
<td>53</td>
<td>63</td>
</tr>
<tr>
<td>(HW) Engenia+Leeway II</td>
<td>12.8floz+0.5%v/v</td>
<td>60</td>
<td>72</td>
<td>70</td>
<td>63</td>
</tr>
<tr>
<td>(HW) Engenia+Traverse D</td>
<td>12.8floz+0.5%v/v</td>
<td>53</td>
<td>72</td>
<td>74</td>
<td>73</td>
</tr>
<tr>
<td>(HW) Engenia+Ensure Max</td>
<td>12.8floz+0.5%v/v</td>
<td>48</td>
<td>63</td>
<td>58</td>
<td>47</td>
</tr>
<tr>
<td>(HW) Engenia+Serenity</td>
<td>12.8floz+0.5%v/v</td>
<td>50</td>
<td>62</td>
<td>62</td>
<td>60</td>
</tr>
<tr>
<td>(HW) Engenia+Zaar</td>
<td>12.8floz+1%v/v</td>
<td>68</td>
<td>75</td>
<td>72</td>
<td>70</td>
</tr>
</tbody>
</table>

LSD

6 5 5 5 4 5 4 4

¹DW = Distilled Water, HW = 1,000 ppm Hard Water
Limiting Dicamba Movement with Adjuvants. Dr. Howatt, Mettler, and Harrington. ‘ND12-24081’ soybean was seeded near Fargo on May 15. Treatments were applied to 2 to 3 trifoliolate soybean on June 29 with 70°F, 67% humidity, 99% cloud cover, and 3 mph wind velocity at 0° and moist soil at 68°F. Treatments were applied with a backpack sprayer delivering 17 gpa at 40 psi through Alxr 11002 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. This was a non-replicated demonstration.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>7/6 injury distance</th>
<th>7/19 injury distance</th>
<th>8/10 injury distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS+NIS+Glyt-4.5+Dica-C</td>
<td>23+0.25%+12+8</td>
<td>20</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>Full Load Comp+Glyt-4.5+Dica-C</td>
<td>0.375%+12+8</td>
<td>10</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Cado Max+Full Load+Glyt-4.5+Dica-C</td>
<td>0.25%+0.375%+12+8</td>
<td>10</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Full Load+Drift Fiant+Glyt-4.5+Dica-C</td>
<td>0.375%+0.15%+12+8</td>
<td>7</td>
<td>35</td>
<td>40</td>
</tr>
</tbody>
</table>

# of reps | 1 | 1 | 1

Initial injury pattern, distance, diminishing intensity from source, and direction was consistent with presumed and observed droplet movement during the application. On subsequent dates, injury at the extremity of movement was consistent for a long distance and occurred in all directions from the initial injury area, even upwind of prevailing air movement. This seems to indicate volatilization had occurred several days after the initial movement. Size of the potential volatility ring seemed more related to the particle drift area than the treated area.
**Xtendimax with Adjuvants.** Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate Xtendimax enhancement with adjuvants. Flax, amaranth, quinoa, and tame buckwheat were planted on June 1, 2017. POST treatments were applied on June 26, 2017 from 11-3 with 72 F air, 68.5F soil at a four inch depth, 34.2% RH, 40% cloud cover, 5-8 mph NW wind, and adequate soil moisture. Weeds present at the time of POST applications were: flax 5-6" at 20/ft2, amaranth 6-7" at 20/ft2, quinoa 3-6" at 10/ft2, and tame buckwheat 3-6" at 20/ft2. Soil characteristics were: 15.3% sand, 53.9% silt, 30.8% clay, silty clay loam, 6.2% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The addition of MSO to Xtendimax in both distilled and hard water provided the best overall species control whether AMS was added or not.

**Table.** Xtendimax with Adjuvants (Zollinger, Wirth, Adams).

<table>
<thead>
<tr>
<th>Treatment¹</th>
<th>Product/Acre</th>
<th>14 DAA</th>
<th></th>
<th>28 DAA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Flax</td>
<td>Amer</td>
<td>Quin</td>
<td>Tabw</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% control</td>
<td>% control</td>
<td>% control</td>
<td>% control</td>
</tr>
<tr>
<td>(DW) Xtendimax+Rainier EA</td>
<td>17floz+0.5%/v</td>
<td>60</td>
<td>52</td>
<td>93</td>
<td>80</td>
</tr>
<tr>
<td>(DW) Xtendimax+Aqua-Veta</td>
<td>17floz+2floz</td>
<td>25</td>
<td>27</td>
<td>68</td>
<td>67</td>
</tr>
<tr>
<td>(DW) Xtendimax+Blue Diamond</td>
<td>17floz+0.5%/v</td>
<td>38</td>
<td>47</td>
<td>87</td>
<td>58</td>
</tr>
<tr>
<td>(DW) Xtendimax+MSO</td>
<td>17floz+1.5pt</td>
<td>75</td>
<td>63</td>
<td>93</td>
<td>82</td>
</tr>
<tr>
<td>(DW) Xtendimax+Rainier EA+AMS</td>
<td>17floz+0.5%/v+8.5lb/100gal</td>
<td>68</td>
<td>65</td>
<td>95</td>
<td>72</td>
</tr>
<tr>
<td>(DW) Xtendimax+Blue Diamond+AMS</td>
<td>17floz+0.5%/v+8.5lb/100gal</td>
<td>35</td>
<td>50</td>
<td>90</td>
<td>67</td>
</tr>
<tr>
<td>(DW) Xtendimax+MSO+AMS</td>
<td>17floz+1.5pt+8.5lb/100gal</td>
<td>72</td>
<td>63</td>
<td>98</td>
<td>87</td>
</tr>
<tr>
<td>(HW) Xtendimax+Rainier EA+AMS</td>
<td>17floz+0.5%/v+8.5lb/100gal</td>
<td>43</td>
<td>38</td>
<td>90</td>
<td>67</td>
</tr>
<tr>
<td>(HW) Xtendimax+Blue Diamond+AMS</td>
<td>17floz+0.5%/v+8.5lb/100gal</td>
<td>50</td>
<td>48</td>
<td>92</td>
<td>68</td>
</tr>
<tr>
<td>(HW) Xtendimax+MSO+AMS</td>
<td>17floz+1.5pt+8.5lb/100gal</td>
<td>72</td>
<td>63</td>
<td>98</td>
<td>86</td>
</tr>
<tr>
<td>LSD</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

¹DW = Distilled Water, HW = 1,000 ppm Hard Water
**Dicamba and Glyphosate with Adjuvants.** Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate dicamba and glyphosate enhancement with adjuvants. Amaranth, quinoa, tame buckwheat, and sunflowers were planted on June 1, 2017. POST treatments were applied on July 5, 2017 from 10-2 with 88 F air, 75 F soil at a four inch depth, 45% RH, 0% cloud cover, 0-1 mph NW wind, and adequate soil moisture. Weeds present at the time of POST applications were: amaranth 13-16” at 20/ft², quinoa 8-14” at 20/ft², tame buckwheat 16-18” at 20/ft², and sunflowers 20-24” at 5/ft². Soil characteristics were: 15.3% sand, 53.9% silt, 30.8% clay, silty clay loam, 6.2% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 12 gpa through 110015 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Species control was similar from 14 to 28 days after application. The addition of any adjuvant increased Engenia and Engenia + Buccaneer Plus. However, the addition of either Plexus or Capsule to Engenia increased species control more than the additions of either Astonish or Contrast. Once Buccaneer Plus was added to the tank-mix, there were very few differences in species control regardless of adjuvant added.

Table. Dicamba and Glyphosate with Adjuvants (Zollinger, Wirth, Adams).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>14 DAA</th>
<th>28 DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Amar Quin Tabw Snfl</td>
<td>Amar Quin Tabw Snfl</td>
</tr>
<tr>
<td>Engenia</td>
<td>10floz</td>
<td>40 42 42 58</td>
<td>37 42 45 58</td>
</tr>
<tr>
<td>Engenia+Astonish</td>
<td>10floz+54floz/100gal</td>
<td>42 58 55 58</td>
<td>43 57 58 60</td>
</tr>
<tr>
<td>Engenia+Contrast</td>
<td>10floz+2.5lb/100gal</td>
<td>33 48 45 55</td>
<td>33 45 45 58</td>
</tr>
<tr>
<td>Engenia+Plexus</td>
<td>10floz+12floz</td>
<td>33 72 63 60</td>
<td>33 65 60 60</td>
</tr>
<tr>
<td>Engenia+Capsule</td>
<td>10floz+0.5%v/v</td>
<td>52 60 58 65</td>
<td>48 60 57 65</td>
</tr>
<tr>
<td>Engenia+Buccaneer Plus</td>
<td>10floz+22floz</td>
<td>23 50 60 60</td>
<td>23 52 60 60</td>
</tr>
<tr>
<td>Engenia+Buccaneer Plus+Astonish</td>
<td>10floz+22floz+54floz/100gal</td>
<td>62 90 90 85</td>
<td>64 92 90 85</td>
</tr>
<tr>
<td>Engenia+Buccaneer Plus+Contrast</td>
<td>10floz+22floz+2.5lb/100gal</td>
<td>70 93 83 85</td>
<td>70 93 83 80</td>
</tr>
<tr>
<td>Engenia+Buccaneer Plus+Plexus</td>
<td>10floz+22floz+12floz</td>
<td>58 90 85 88</td>
<td>58 93 88 88</td>
</tr>
<tr>
<td>Engenia+Buccaneer Plus+Capsule</td>
<td>10floz+22floz+0.5%v/v</td>
<td>70 90 87 83</td>
<td>70 92 85 82</td>
</tr>
<tr>
<td>LSD</td>
<td>7 7 7 6</td>
<td>7 6 6 4</td>
<td></td>
</tr>
</tbody>
</table>
**Water conditioning for glufosinate.** Dr. Howatt, Mettler, and Harrington. '30208LL' (plot A) and 'ND12-24081' (not glufosinate-resistant, plot B) soybean, respectively, were planted in two different plots near Fargo on May 19. Paired treatments were designed to provide similar benefit of the adjuvant to glufosinate activity. All treatments were mixed by adding the AMS or ET-4000 first to the hard water carrier (7g CaCl2 and 2.3g MgCl2 per 3 gal of water) followed by the herbicides. Treatments were applied to 2 trifoliate soybean, 4 to 5 inch common lambsquarters, 4 inch waterhemp, and 5 to 6 inch yellow foxtail on June 20 with 57°F, 80% relative humidity, 10% cloud cover, 6 mph wind velocity at 360° and damp soil at 60°F, at site A. Site B treatments were applied to 3 trifoliate soybean, 2 to 3 inch common lambsquarters, 2 to 5 inch waterhemp, 2 to 5 inch redroot pigweed, and 1 to 2 inch Venice mallow on July 7 with 70°F 69% relative humidity, 0% cloud cover, 4 mph wind velocity at 270°, and moist soil at 69°F. Both sites were applied using a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to 7 foot wide areas the length of 10 by 30 foot plots. The experiments were randomized complete block designs with three replicates at site A and four replicates at site B.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>7/04</th>
<th>7/04</th>
<th>7/04</th>
<th>7/14</th>
<th>7/14</th>
<th>7/14</th>
<th>7/14</th>
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<tr>
<td></td>
<td></td>
<td>a wae</td>
<td>a colq</td>
<td>a yeft</td>
<td>b colq</td>
<td>b soya</td>
<td>b pgwd</td>
<td>b vema</td>
</tr>
<tr>
<td>Gluf-I+Meto-M+AMS-L</td>
<td>4.7+12+38</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Gluf-I+Meto-M+ET-4000</td>
<td>4.7+12+1%</td>
<td>82</td>
<td>47</td>
<td>78</td>
<td>48</td>
<td>81</td>
<td>88</td>
<td>55</td>
</tr>
<tr>
<td>Gluf-I+Meto-M+AMS-L</td>
<td>4.7+12+48</td>
<td>75</td>
<td>50</td>
<td>83</td>
<td>58</td>
<td>83</td>
<td>91</td>
<td>64</td>
</tr>
<tr>
<td>Gluf-I+Meto-M+ET-4000</td>
<td>4.7+12+1.25%</td>
<td>73</td>
<td>53</td>
<td>83</td>
<td>65</td>
<td>84</td>
<td>90</td>
<td>70</td>
</tr>
<tr>
<td>Gluf-I+Meto-M+AMS-L</td>
<td>4.7+12+58</td>
<td>78</td>
<td>57</td>
<td>82</td>
<td>64</td>
<td>81</td>
<td>90</td>
<td>55</td>
</tr>
<tr>
<td>Gluf-I+Meto-M+ET-4000</td>
<td>4.7+12+1.5%</td>
<td>80</td>
<td>57</td>
<td>83</td>
<td>64</td>
<td>85</td>
<td>91</td>
<td>69</td>
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<td>CV</td>
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<td>5</td>
<td>7</td>
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<table>
<thead>
<tr>
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<th>7/20</th>
<th>7/20</th>
<th>7/20</th>
<th>7/20</th>
<th>7/28</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>a all</td>
<td>b colq</td>
<td>b soya</td>
<td>b pgwd</td>
<td>b vema</td>
<td>b colq</td>
<td>b vema</td>
<td></td>
</tr>
<tr>
<td>Gluf-I+Meto-M+AMS-L</td>
<td>4.7+12+38</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Gluf-I+Meto-M+ET-4000</td>
<td>4.7+12+1%</td>
<td>0</td>
<td>28</td>
<td>91</td>
<td>90</td>
<td>28</td>
<td>38</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Gluf-I+Meto-M+AMS-L</td>
<td>4.7+12+48</td>
<td>0</td>
<td>35</td>
<td>93</td>
<td>91</td>
<td>30</td>
<td>40</td>
<td>23</td>
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</tr>
<tr>
<td>Gluf-I+Meto-M+ET-4000</td>
<td>4.7+12+1.25%</td>
<td>0</td>
<td>30</td>
<td>94</td>
<td>90</td>
<td>33</td>
<td>35</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Gluf-I+Meto-M+AMS-L</td>
<td>4.7+12+58</td>
<td>0</td>
<td>35</td>
<td>94</td>
<td>94</td>
<td>30</td>
<td>40</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Gluf-I+Meto-M+ET-4000</td>
<td>4.7+12+1.5%</td>
<td>0</td>
<td>38</td>
<td>94</td>
<td>95</td>
<td>38</td>
<td>35</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>CV</td>
<td>0</td>
<td>13</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>15</td>
<td>18</td>
<td></td>
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</tr>
<tr>
<td>LSD P=0.05</td>
<td>0</td>
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<td>4</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* a or b placed before the weed evaluations indicate site a or b.

Glufosinate did not perform as expected this year in several related studies, especially on common lambsquarters. At site A, control was not consistently related to adjuvant rate on July 4, and by July 19, treatments could not be differentiated from each other or the check strip between plots. Site B demonstrated generally better control of Venice mallow, common lambsquarters, and soybean with glufosinate plus ET-4000 than liquid AMS but only a slight effect of rate. Control of pigweeds, either redroot or waterhemp, was quite consistent across treatments. Pigweeds and soybean with live tissue were not found on July 28. Control of remaining species with glufosinate on this date still tended to be better with ET-4000 than liquid AMS, although by small numerical values.
ank-mix enhancement with Water Conditioning Adjuvants. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Mayville, ND to evaluate weed control and soybean injury from POST herbicide enhancement with water conditioning adjuvants. Soybeans were seeded on May 19, 2017. POST treatments were applied on June 20, 2017 at 00 PM with 72 F air, 80 F soil at a four inch depth, 43% RH, 30% cloud cover, 2-3 mph NNE wind, and adequate soil moisture. Seeds present at the time of POST applications were: corn 4-6" at 4-6/ft2, colq 4-6" at 6-8/ft2, wibw 2-4" at 1-2/yd2, and yef 6" at 8-10/ft2. Soil characteristics were: 23.1% sand, 52% silt, 24.9% clay, Silt Loam, 4.5% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The addition of ET-4000 provided more weed control than the addition of Bronc. With Sinister at 4.2 fl oz/A there was little weed control improvement as ET-4000 rate increased from 0.5% to 1.5% v/v. However, with Sinister at 6.6 fl oz/A common weed control increased as ET-4000 rate increased from 0.5% to 1.5% v/v. As the rate of Sinister increased, so did the weed control.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>pH</th>
<th>Soy</th>
<th>Yeft</th>
<th>Colq</th>
<th>Corw</th>
<th>% Inj</th>
<th>Soy</th>
<th>Yeft</th>
<th>Colq</th>
<th>Corw</th>
<th>% Inj</th>
</tr>
</thead>
<tbody>
<tr>
<td>W) Durango + Sinister + Mocassin</td>
<td>10.6 fl oz + 4.2 fl oz + 0.75 pt</td>
<td>4.9</td>
<td>22</td>
<td>73</td>
<td>65</td>
<td>65</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>65</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>+ R-11 + Bronc</td>
<td>+ 0.25% v/v + 3% v/v</td>
<td>3.2</td>
<td>22</td>
<td>80</td>
<td>75</td>
<td>72</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>70</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>W) Durango + Sinister + Mocassin</td>
<td>10.6 fl oz + 4.2 fl oz + 0.75 pt</td>
<td>2.6</td>
<td>22</td>
<td>75</td>
<td>70</td>
<td>70</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>68</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>+ R-11 + ET-4000</td>
<td>+ 0.25% v/v + 1% v/v</td>
<td>2.0</td>
<td>25</td>
<td>80</td>
<td>60</td>
<td>60</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>52</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>W) Durango + Sinister + Mocassin</td>
<td>10.6 fl oz + 6.6 fl oz + 0.75 pt</td>
<td>4.4</td>
<td>20</td>
<td>88</td>
<td>77</td>
<td>75</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>45</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>+ R-11 + Bronc</td>
<td>+ 0.25% v/v + 3% v/v</td>
<td>2.9</td>
<td>20</td>
<td>85</td>
<td>71</td>
<td>71</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>62</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>W) Durango + Sinister + Mocassin</td>
<td>10.6 fl oz + 6.6 fl oz + 0.75 pt</td>
<td>2.4</td>
<td>22</td>
<td>87</td>
<td>68</td>
<td>70</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>70</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>+ R-11 + ET-4000</td>
<td>+ 0.25% v/v + 1% v/v</td>
<td>2.1</td>
<td>18</td>
<td>89</td>
<td>72</td>
<td>73</td>
<td>0</td>
<td>99</td>
<td>99</td>
<td>77</td>
<td>0</td>
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<td>D</td>
<td>4</td>
<td>7</td>
<td>8</td>
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<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

W = 500 ppm Hard Water
**Home-made HSMOC.** Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to create an HSMOC using different mixtures of formulated MSO and NIS adjuvants. Flax, amaranth, quinoa, and RR soybeans were planted on June 1, 2017. POST treatments were applied on July 4, 2017 from 8-11 with 82 F air, 70.6 F soil at a four inch depth, 67% RH, 0% cloud cover, 5-10 mph SSE wind, and adequate soil moisture. Weeds present at the time of POST applications were: flax 10-12” at 10/ft2, amaranth 12-16” at 20/ft2, quinoa 12-16” at 10/ft2, and RR soybeans 9-11” at 10/ft2. Soil characteristics were: 15.3% sand, 53.9% silt, 30.8% clay, silty clay loam, 6.2% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The purpose of this trial was to test different combinations of MSO + NIS adjuvants to “create” or “mimic” an industry HSMOC adjuvants. Results varied depending on MSO type and NIS type; however, some combinations of MSO + NIS provided similar or better species control than formulated HSMOC adjuvants.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (Product/A)</th>
<th>14 DAA</th>
<th>28 DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDHT+Laudis+Upland+Rainier EA</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>62</td>
<td>50</td>
</tr>
<tr>
<td>TDHT+Laudis+Upland+Wet-Sol</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>43</td>
<td>25</td>
</tr>
<tr>
<td>TDHT+Laudis+Upland+Wet-Clt</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>42</td>
<td>35</td>
</tr>
<tr>
<td>TDHT+Laudis+Upland+Preference</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>43</td>
<td>30</td>
</tr>
<tr>
<td>TDHT+Laudis+Upland+Activator 90</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>TDHT+Laudis+Hasten EA+Rainier EA</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>77</td>
<td>50</td>
</tr>
<tr>
<td>TDHT+Laudis+Hasten EA+Wet-Sol</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>TDHT+Laudis+Hasten EA+Wet-Clt</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>TDHT+Laudis+Hasten EA+Preference</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>TDHT+Laudis+Hasten EA+Activator 90</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>TDHT+Laudis+MSO Leci-Tech+Rainier EA</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>62</td>
<td>42</td>
</tr>
<tr>
<td>TDHT+Laudis+MSO Leci-Tech+Wet-Sol</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>43</td>
<td>33</td>
</tr>
<tr>
<td>TDHT+Laudis+MSO Leci-Tech+Wet-Clt</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>35</td>
<td>33</td>
</tr>
<tr>
<td>TDHT+Laudis+MSO Leci-Tech+Preference</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>49</td>
<td>38</td>
</tr>
<tr>
<td>TDHT+Laudis+MSO Leci-Tech+Activator 90</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>32</td>
<td>30</td>
</tr>
<tr>
<td>TDHT+Laudis+MES-100+Rainier EA</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>TDHT+Laudis+MES-100+Wet-Sol</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>TDHT+Laudis+MES-100+Wet-Clt</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td>TDHT+Laudis+MES-100+Preference</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>TDHT+Laudis+MES-100+Activator 90</td>
<td>9.6fioz+1.5fioz+0.67pt+158mls</td>
<td>45</td>
<td>42</td>
</tr>
<tr>
<td>TDHT+Laudis+Destiny HC</td>
<td>9.6fioz+1.5fioz+1pt</td>
<td>52</td>
<td>50</td>
</tr>
<tr>
<td>TDHT+Laudis+Hybrid</td>
<td>9.6fioz+1.5fioz+1pt</td>
<td>93</td>
<td>60</td>
</tr>
<tr>
<td>TDHT+Laudis+Glacier EA</td>
<td>9.6fioz+1.5fioz+1pt</td>
<td>68</td>
<td>47</td>
</tr>
<tr>
<td>TDHT+Laudis+Hot-MES</td>
<td>9.6fioz+1.5fioz+1pt</td>
<td>33</td>
<td>38</td>
</tr>
</tbody>
</table>

LSD: 6 6 9 3 4 5 5 3

1 TDHT - Touchdown HiTech (Unloaded Glyphosate)
**Touchdown HiTech and Engenia with HSOC Adjuvants.** Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate Touchdown HiTech and Engenia enhancement with HSOC adjuvants. Amaranth, quinoa, LL canola, and RR soybeans were planted on June 1, 2017. POST treatments were applied on July 4, 2017 from 8-11 with 82 F air, 70.6 F soil at a four inch depth, 67% RH, 0% cloud cover, 5-10 mph SSE wind, and adequate soil moisture. Weeds present at the time of POST applications were: amaranth 12-16” at 20/ft2, quinoa 12-16” at 10/ft2, LL canola 12-14” at 20/ft2, and RR soybeans 9-11” at 10/ft2. Soil characteristics were: 15.3% sand, 53.9% silt, 30.8% clay, silty clay loam, 6.2% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The tank-mix of Touchdown Hi-Tech and Engenia was used to mimic a “Roundup Xtend” system. The addition of Hybrid to the tank-mix increased control the most, followed by Glacier EA and Duce.

**Table. Touchdown HiTech and Engenia with HSOC Adjuvants (Zollinger, Wirth, Adams).**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>Amar Quin</th>
<th>Cano Soyb</th>
<th>Amar Quin</th>
<th>Cano Soyb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touchdown HiTech+Engenia</td>
<td>9.6floz+6.5floz</td>
<td>58</td>
<td>43</td>
<td>33</td>
<td>73</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Rainier EA</td>
<td>9.6floz+6.5floz+0.5%v/v</td>
<td>47</td>
<td>72</td>
<td>67</td>
<td>74</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Noble MSO</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>52</td>
<td>68</td>
<td>47</td>
<td>75</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Destiny HC</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>42</td>
<td>75</td>
<td>40</td>
<td>65</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Hybrid</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>68</td>
<td>77</td>
<td>70</td>
<td>78</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Glacier EA</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>52</td>
<td>60</td>
<td>52</td>
<td>65</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Kixyt</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>45</td>
<td>55</td>
<td>50</td>
<td>65</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Duce</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>65</td>
<td>73</td>
<td>53</td>
<td>76</td>
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<tr>
<td>Touchdown HiTech+Engenia+Savvy</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>43</td>
<td>67</td>
<td>60</td>
<td>73</td>
</tr>
<tr>
<td>Touchdown HiTech+Engenia+Hot-MES</td>
<td>9.6floz+6.5floz+1.5pt</td>
<td>32</td>
<td>45</td>
<td>37</td>
<td>60</td>
</tr>
<tr>
<td>LSD</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>
Enlist Duo with HSOC Adjuvants. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate Enlist Duo enhancement HSOC adjuvants. Amaranth, quinoa, tame buckwheat, and RR soybeans were planted on June 1, 2017. POST treatments were applied on July 4, 2017 from 8-11 with 82 F air, 70.6 F soil at a four inch depth, 67% RH, 0% cloud cover, 5-10 mph SSE wind, and adequate soil moisture. Weeds present at the time of POST applications were: amaranth 12-16” at 20/ft2, quinoa 12-16” at 10/ft2, tame buckwheat 16-18” at 30/ft2, and RR soybeans 9-11” at 10/ft2. Soil characteristics were: 15.3% sand, 53.9% silt, 30.8% clay, silty clay loam, 6.2% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The addition of Hybrid increased species control the most.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>14 DAA Amar Quin</th>
<th>14 DAA Tabw Soyb</th>
<th>28 DAA Amar Quin</th>
<th>28 DAA Tabw Soyb</th>
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</thead>
<tbody>
<tr>
<td>Enlist Duo</td>
<td>1.75pt</td>
<td>58</td>
<td>72</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td>Enlist Duo+Rainier EA</td>
<td>1.75pt+0.5%v/v</td>
<td>52</td>
<td>65</td>
<td>55</td>
<td>53</td>
</tr>
<tr>
<td>Enlist Duo+Noble MSO</td>
<td>1.75pt+1.5pt</td>
<td>40</td>
<td>47</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>Enlist Duo+Destiny HC</td>
<td>1.75pt+1.5pt</td>
<td>63</td>
<td>70</td>
<td>45</td>
<td>65</td>
</tr>
<tr>
<td>Enlist Duo+Hybrid</td>
<td>1.75pt+1.5pt</td>
<td>87</td>
<td>88</td>
<td>79</td>
<td>85</td>
</tr>
<tr>
<td>Enlist Duo+Glacier-EA</td>
<td>1.75pt+1.5pt</td>
<td>70</td>
<td>83</td>
<td>71</td>
<td>83</td>
</tr>
<tr>
<td>Enlist Duo+Kixyt</td>
<td>1.75pt+1.5pt</td>
<td>70</td>
<td>75</td>
<td>62</td>
<td>75</td>
</tr>
<tr>
<td>Enlist Duo+Duce</td>
<td>1.75pt+1.5pt</td>
<td>47</td>
<td>67</td>
<td>57</td>
<td>63</td>
</tr>
<tr>
<td>Enlist Duo+Savvy</td>
<td>1.75pt+1.5pt</td>
<td>73</td>
<td>73</td>
<td>63</td>
<td>75</td>
</tr>
<tr>
<td>Enlist Duo+Hot-MES</td>
<td>1.75pt+1.5pt</td>
<td>53</td>
<td>62</td>
<td>62</td>
<td>60</td>
</tr>
<tr>
<td>LSD</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>14</td>
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23
Liberty or Clarity at Varying Spray Qualities. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Fargo, ND to evaluate lambsquarters efficacy with Liberty or Clarity at varying spray qualities. POST treatments were applied on June 29, 2017 from 1:00-2:00 with 68 F air, 65F soil at a four inch depth, 40% RH, 50% cloud cover, 4-6 mph NW wind, and adequate soil moisture. Weeds present at the time of POST applications were: 8-16" common lambsquarters at 20/ft2. Treatments were applied to the center 15 feet of the 20 by 40 foot plots with a pulse width modulation sprayer mounted to a Polaris Ranger. The experiment had a randomized complete block design with three replicates per treatment.

Lambsquarters was the only weed observed. Lambsquarters stand was very thick with differing heights throughout the study which increased variation. There were very few differences in lambsquarters control with the use of different nozzles.

Table. Mesotrione with Varying Wilger Spray Nozzles (Zollinger, Wirth, Adams).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>Wilger Spray Nozzle</th>
<th>14 DAA</th>
<th>28 DAA</th>
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<tr>
<td></td>
<td></td>
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<td>Colq</td>
<td>Colq</td>
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<tr>
<td>Untreated</td>
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<td></td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Mesotrione+Preference</td>
<td>3oz+0.25%/v/v</td>
<td>ER Nozzle</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Mesotrione+Preference</td>
<td>3oz+0.25%/v/v</td>
<td>SR Nozzle</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Mesotrione+Preference</td>
<td>3oz+0.25%/v/v</td>
<td>MR Nozzle</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>Mesotrione+Preference</td>
<td>3oz+0.25%/v/v</td>
<td>DR Nozzle</td>
<td>17</td>
<td>37</td>
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<tr>
<td>Mesotrione+PO</td>
<td>3oz+1pt</td>
<td>ER Nozzle</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>Mesotrione+PO</td>
<td>3oz+1pt</td>
<td>SR Nozzle</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td>Mesotrione+PO</td>
<td>3oz+1pt</td>
<td>MR Nozzle</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Mesotrione+PO</td>
<td>3oz+1pt</td>
<td>DR Nozzle</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
<td></td>
<td>7</td>
<td>23</td>
</tr>
</tbody>
</table>
Liberty or Clarity at Varying Spray Qualities. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Fargo, ND to evaluate lambsquarters efficacy with Liberty or Clarity at varying spray qualities. POST treatments were applied on June 6, 2017 from 9:00-2:00 with 76 F air, 67F soil at a four inch depth, 35% RH, 20% cloud cover, 7-9 mph S wind, and adequate soil moisture. Weeds present at the time of POST applications were: 8-16” common lambsquarters at 20/ft². Treatments were applied to the center 15 feet of the 20 by 40 foot plots with a pulse width modulation sprayer mounted to a Polaris Ranger. The experiment had a randomized complete block design with three replicates per treatment.

Lambsquarters was the only weed observed. Lambsquarters stand was very thick with differing heights throughout the study which increased variation. There were very few differences within treatments at all spray qualities.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>Spray Quality</th>
<th>14 DAA Colq</th>
<th>14 DAA Colq</th>
<th>28 DAA Colq</th>
<th>28 DAA Colq</th>
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</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>5 GPA, 150 Microns</td>
<td>3</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>5 GPA, 300 Microns</td>
<td>18</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>5 GPA, 450 Microns</td>
<td>20</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>5 GPA, 600 Microns</td>
<td>18</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>5 GPA, 750 Microns</td>
<td>20</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>5 GPA, 900 Microns</td>
<td>18</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>20 GPA, 150 Microns</td>
<td>18</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>20 GPA, 300 Microns</td>
<td>17</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>20 GPA, 450 Microns</td>
<td>17</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty</td>
<td>22floz</td>
<td>20 GPA, 600 Microns</td>
<td>17</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>20 GPA, 750 Microns</td>
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<tr>
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<tr>
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<td>5 GPA, 300 Microns</td>
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<td>72</td>
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<tr>
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<td>5 GPA, 450 Microns</td>
<td>40</td>
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<tr>
<td>Clarity</td>
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<td>5 GPA, 600 Microns</td>
<td>37</td>
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<tr>
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<td>5 GPA, 750 Microns</td>
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<tr>
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<td>5 GPA, 900 Microns</td>
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<tr>
<td>Clarity</td>
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<td>20 GPA, 150 Microns</td>
<td>37</td>
<td>55</td>
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</tr>
<tr>
<td>Clarity</td>
<td>8floz</td>
<td>20 GPA, 300 Microns</td>
<td>32</td>
<td>58</td>
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<tr>
<td>Clarity</td>
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<td>20 GPA, 450 Microns</td>
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<tr>
<td>Clarity</td>
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<tr>
<td>Clarity</td>
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<td>20 GPA, 750 Microns</td>
<td>32</td>
<td>47</td>
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<tr>
<td>Clarity</td>
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<td>20 GPA, 900 Microns</td>
<td>32</td>
<td>47</td>
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LSD

9
12
Roundup Weathermax with Clarity at Varying Spray Qualities. Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Fargo, ND to evaluate lambsquarters efficacy with Roundup Weathermax with Clarity at varying spray qualities. POST treatments were applied on June 6, 2017 from 9:00-2:00 with 76 F air, 67F soil at a four inch depth, 35% RH, 20% cloud cover, 7-9 mph S wind, and adequate soil moisture. Weeds present at the time of POST applications were: 8-16” common lambsquarters at 20/ft2. Treatments were applied to the center 15 feet of the 20 by 40 foot plots with a pulse width modulation sprayer mounted to a Polaris Ranger. The experiment had a randomized complete block design with three replicates per treatment.

Lambsquarters was the only weed observed. Lambsquarters stand was very thick with differing heights throughout the study which increased variation. Lambsquarters control increased as micron size increased.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>Spray Quality</th>
<th>14 DAA Colq</th>
<th>28 DAA Colq</th>
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<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
<td>-% control-</td>
<td>-% control-</td>
</tr>
<tr>
<td>Roundup Weathermax+Clarity</td>
<td>22floz+8floz</td>
<td>150 Microns</td>
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<td>3</td>
</tr>
<tr>
<td>Roundup Weathermax+Clarity</td>
<td>22floz+8floz</td>
<td>300 Microns</td>
<td>25</td>
<td>47</td>
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<tr>
<td>Roundup Weathermax+Clarity</td>
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<td>450 Microns</td>
<td>43</td>
<td>57</td>
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<tr>
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<td>22floz+8floz</td>
<td>600 Microns</td>
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<td>62</td>
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<tr>
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<td>22floz+8floz</td>
<td>750 Microns</td>
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<td>67</td>
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<tr>
<td>Roundup Weathermax+Clarity</td>
<td>22floz+8floz</td>
<td>900 Microns</td>
<td>48</td>
<td>63</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
<td></td>
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<td>12</td>
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**Enlist Duo at Varying Spray Qualities.** Richard K. Zollinger, Devin A. Wirth, Jason W. Adams. An experiment was conducted near Fargo, ND to evaluate lambsquarters efficacy with Enlist Duo at varying spray qualities. POST treatments were applied on June 6, 2017 from 9:00-2:00 with 76 F air, 67F soil at a four inch depth, 35% RH, 20% cloud cover, 7-9 mph S wind, and adequate soil moisture. Weeds present at the time of POST applications were: 8-16" common lambsquarters at 20/ft². Treatments were applied to the center 15 feet of the 20 by 40 foot plots with a pulse width modulation sprayer mounted to a Polaris Ranger. The experiment had a randomized complete block design with three replicates per treatment.

Lambsquarters was the only weed observed. Lambsquarters stand was very thick with differing heights throughout the study which increased variation. Lambsquarters control increased as micron size increased.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product/Acre</th>
<th>Spray Quality</th>
<th>14 DAA Colq</th>
<th>14 DAA Colq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
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<td></td>
<td>-% control-</td>
<td>-% control-</td>
</tr>
<tr>
<td>Enlist Duo</td>
<td>3.5pt</td>
<td>150 Microns</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Enlist Duo</td>
<td>3.5pt</td>
<td>300 Microns</td>
<td>42</td>
<td>52</td>
</tr>
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<tr>
<td>Enlist Duo</td>
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Genetic enhancer with glyphosate. Dr. Howatt, Mettler, and Harrington. RR2X soybean ‘ND12-24081’ were seeded near Fargo on May 19. Preemergence treatment of metolachlor&metribuzin at 2.4 lb per acre were applied on May 19 with 62°F, 28% relative humidity, and 60% cloud cover, 6 mph wind at 90° and dry soil at 58°F. POST treatments were applied to 2 to 3 trifoliate soybeans, 5 inch redroot pigweed and waterhemp, 6 inch common lambsquarters, and 4 inch common ragweed on June 26 with 68°F, 34% relative humidity, 0% cloud cover, and 2.5 mph wind velocity at 315° and dry soil at 64°F. A second application of each treatment was applied to 6 inch common lambsquarters, 2 to 6 inch waterhemp, and 2 to 3 inch redroot pigweed on July 21 with 82°F, 77% humidity, 75% cloud cover, 8 mph wind at 135°, and dry soil at 76°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/26 popul.</th>
<th>7/7 popul.</th>
<th>7/12 vigor</th>
<th>7/12 inj</th>
<th>7/12 wahe</th>
<th>7/12 colq</th>
<th>7/12 corw</th>
<th>7/24 cover</th>
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<tbody>
<tr>
<td></td>
<td>oz/A</td>
<td>pl/2 m</td>
<td>pl/2 m</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Glyphosate</td>
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<td>60</td>
<td>10</td>
<td>97</td>
<td>93</td>
<td>95</td>
<td>28</td>
</tr>
<tr>
<td>Glyphosate+ALB5000</td>
<td>12+16</td>
<td>24</td>
<td>23</td>
<td>70</td>
<td>0</td>
<td>94</td>
<td>91</td>
<td>93</td>
<td>28</td>
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<td>CV</td>
<td></td>
<td>23</td>
<td>30</td>
<td>9</td>
<td>0</td>
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<td>4</td>
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<tr>
<td>LSD P=.05</td>
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<td>10</td>
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<table>
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<th>7/25 inj</th>
<th>7/25 wahe</th>
<th>7/25 colq</th>
<th>7/25 corw</th>
<th>8/31 height</th>
<th>10/9 yield</th>
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<tr>
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<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>cm</td>
<td>bu/A</td>
</tr>
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<td>92</td>
<td>97</td>
<td>84</td>
<td>34</td>
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</tr>
<tr>
<td>Glyphosate+ALB5000</td>
<td>12+16</td>
<td>70</td>
<td>4</td>
<td>92</td>
<td>91</td>
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<td>10</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>8</td>
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\(a\) Glyphosate formulation was GlyStar Plus from Albaugh, LLC.

Redroot pigweed was completely controlled by both treatments. Weed control was similar between the treatments. Dry weather resulted in poor plant establishment and growth. ALB5000 resulted in slightly better soybean growth early in the season; however, no difference was detected July 25. Soybean injury was less with the addition of ALB5000. Injury manifested as puckered leaves and restricted leaf development with less intense green color on newer tissue. The cause of this could not be determined. The injury did not appear on border plants and intensity was much greater with glyphosate alone.

On August 31, distance between lowest and highest pod on the stem was 34 cm in plots where glyphosate was applied alone and 37 cm with the addition of ALB5000. Yield was affected by dry weather in the area as bulk field areas on the farm produced about 18 bu/A. This trial was later maturing and was targeted by jackrabbits for much of the season, especially once other food sources senesced. This further reduced yield and resulted in more variance within treatment.
Genetic enhancer with Dicamba. Dr. Howatt, Mettler, and Harrington. ‘AG09X6’ soybean was seeded near Fargo on May 19. Preemergence treatments of metolachlor & metribuzin at 2.4 pounds per A was applied May 19 with 61°F, 28% relative humidity, 60% cloud cover, 6 mph wind velocity at 90° and dry soil at 58°F. Post treatments were applied to 2 to 3 trifoliate soybean, 6 inch common lambsquarters, 4 inch common ragweed, and 5 inch redroot pigweed and waterhemp on June 26 with 68°F, 34% relative humidity, and 0% cloud cover, 2 to 4 mph wind velocity at 315° and dry soil at 64°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
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<th>7/7</th>
<th>7/12</th>
<th>7/12</th>
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<td>vigor</td>
<td>inj</td>
<td>wahe</td>
<td>colq</td>
<td>conw</td>
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<td>60</td>
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<td>85</td>
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<th>7/24</th>
<th>7/24</th>
<th>7/24</th>
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<td>wahe</td>
<td>colq</td>
<td>conw</td>
<td>height</td>
<td>yield</td>
</tr>
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<td>96</td>
<td>92</td>
<td>97</td>
<td>50</td>
<td>19</td>
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<td>89</td>
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<td>90</td>
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<td>5</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>6</td>
</tr>
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* Dicamba formulation was Xtendimax from Monsanto Company.

Redroot pigweed was completely controlled by all treatments. Weed control was similar among the treatments on July 12. But on July 24, weed control was less when ALB5000 was included compared with dicamba alone.

Dry weather resulted in poor plant establishment and growth. ALB5000 tended to promote slightly better soybean growth. Minor soybean injury was observed July 12 but not later in the season. This injury was not affected by addition of ALB5000. Injury manifested as slight paler green color. The cause of this could not be determined. The injury did not appear on border plants.

On August 31, distance between lowest and highest pod on the stem was 50 cm in plots where dicamba was applied alone, 56 cm with addition of 16 oz ALB5000, and 48 cm with 24 oz ALB5000. Yield was affected by dry weather in the area as bulk field areas on the farm produced about 18 bu/A. This trial also suffered jackrabbits feeding damage for much of the season, especially once other food sources senesced. This resulted in more variance within treatment.
Genetic enhancer effect on competition between soybean and weeds. Dr. Howatt, Metter, and Harrington. RR2X 'ND12-24081' soybean was seeded near Fargo on May 19. The first application of treatments was applied to 2 to 3 trifoliate soybeans, 4 inch common lambsquarters, 2 inch common ragweed, and 2 to 5 inch redroot pigweed and waterhemp on June 26 with 68°F, 34% relative humidity 0% cloud cover, 2 mph wind velocity at 315° and dry soil at 64°F. The second application was applied to 6 inch common lambsquarters, 2 to 6 inch waterhemp, and 2 to 3 inch redroot pigweed on July 21 with 82°F, 77% relative humidity, 75% cloud cover, 7 mph wind velocity at 135° and dry soil at 76°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>6/26 popl.</th>
<th>7/7 popl.</th>
<th>7/12 vigor</th>
<th>7/12 inj.</th>
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<th>7/12 colq</th>
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<tr>
<td></td>
<td>oz/A</td>
<td>pl/2 m</td>
<td>pl/2 m</td>
<td>%</td>
<td>%</td>
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<td>%</td>
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<td>70</td>
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<td>90</td>
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<tr>
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<td>3</td>
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<tr>
<td>LSD P=.05</td>
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<table>
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<th>7/24 vigor</th>
<th>7/24 inj.</th>
<th>7/24 wahe</th>
<th>7/24 colq</th>
<th>8/31 height</th>
<th>10/9 yield</th>
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<td>%</td>
<td>%</td>
<td>%</td>
<td>cm</td>
<td>bu/A</td>
</tr>
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<td>74</td>
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</table>

|                |       | 16         | 24         | 75         | 20        | 5         | 14           | 44          |
|                |       | 4          | 16         | 5          | 15        | 4         | 4            | 4           |

* Glyphosate formulation was GlyStar Plus from Albaugh, LLC.

Redroot pigweed was completely controlled by both treatments. Weed control on July 12 was slightly better with glyphosate alone than when ALB5000 was added. This was more evident with common lambsquarters on July 24 with a difference in control of 12 percentage points.

Dry weather resulted in poor plant establishment and growth. No difference in vigor was detected among hand weeded, glyphosate, and glyphosate plus ALB5000 treatments. Soybean injury was present in herbicide-treated plots. Injury was much less on July 24 with the addition of ALB5000. Injury manifested as puckered leaves and restricted leaf development with less intense green color on newer tissue. The cause of this could not be determined. The injury did not appear on plants in the hand weeded check.

On August 31, distance between lowest and highest pod on the stem was 30 cm in the hand weeded check, 30 cm in plots where glyphosate was applied alone, 30 cm with the addition of ALB5000, and 7 cm in the untreated check. Yield was affected by dry weather in the area as bulk field areas on the farm produced about 18 bu/A. This trial was later maturing and was targeted by jackrabbits for much of the season, especially once other food sources senesced. This further reduced yield and resulted in more variance within treatment.