

Experimental Herbicide Systems for Broadleaf Weed Control in Winter Peas

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In the fall of 2018, two separate winter pea herbicide studies were installed side-by-side. Study 1 was established to evaluate Spartan (sulfentrazone) applied alone and in combination with other preemergence (PRE) and postemergence (POST) herbicides for weed efficacy and crop tolerance in winter peas. Study 2 was established to evaluate winter pea tolerance and weed efficacy of Spartan (sulfentrazone) applied at three different timings; PRE, delayed PRE (dormant peas), and POST. Unfortunately, during the POST application timing the two studies were mistakenly mistreated, creating 37 different treatments (herbicides and application timing; n = 1 to 23 replicates per treatment), instead of 13 for each individual study (26 total; n = 4 replicates each) as intended.

The study was established at the Palouse Conservation Field Station near Pullman, WA. Treatments were applied PRE (at seeding), delayed PRE (early spring to dormant winter peas), and POST (late spring prior to bloom); detailed in Table 1 and Table 2. Treatments were applied with a CO₂ powered backpack sprayer and a 5 ft boom with 4 Teejet 11002VS nozzles, calibrated to deliver 15 gallons per acre (GPA). The study was conducted in a randomized complete block design with 4 replications. Plots were 8 ft by 25 ft long.

Crop stunting was visually assessed 27 weeks after treatment of application A (2 WATB), 33 WATA (8 WATB; 2WATC), and 38 WATA (13 WATB; 7 WATC). Crop bleaching was also rated 33 WATA (8 WATB; 2 WATC). Crop cover was visually estimated 38 WATA (13 WATB; 7 WATC). Broadleaf and grass weed control was observed by visual estimation 27 WATA, 33 WATA, and 38 WATA. Plants heights were recorded on June 11, 2019 (33 WATA; 8 WATB; 2 WATC). Plots were not harvested due to heavy weed pressure and incomplete replicates due to the POST treatment error. Data was averaged and standard deviations were calculated (if possible) for each treatment combination presented in Table 2 below.

Table 1. Treatment application details

| Study Application | A | B | C |
|--------------------------------|------------------|----------------|--------------|
| Date | October 22, 2018 | April 15, 2019 | May 29, 2019 |
| Application volume (GPA) | 15 | 15 | 15 |
| Timing | PRE | Delayed PRE | POST |
| Crop Stage | Seeded | 3" height | 10" height |
| Air temperature (°F) | 81 | 63 | 67 |
| Soil temperature (°F) | 63 | 50 | 57 |
| Wind velocity (mph, direction) | 3.7, N | 1, SW | 2.3, NW |
| Cloud Cover | 30 | 70 | 0 |
| Next rain occurred on | October 26, 2018 | April 19, 2019 | May 5, 2019 |
| Rain accumulation 2 WAT (IN) | 1.06 | 0.14 | 0.26 |

Results

Based on visual assessments and field assessments on July 18, 2019 (38, 13, & 7 WAT), five treatment combinations stood out as potentially effective treatments because of both crop safety ($\leq 10\%$ stunting; $\geq 80\%$ crop coverage) and effective weed control of broadleaves [$\geq 75\%$ control of mayweed chamomile; $\geq 85\%$ control of other broadleaves (common lambsquarters and prickly lettuce)]. These five treatments included:

- Trt #7: Spartan + Karmex DF applied PRE
- Trt #19: Spartan PRE, Triflurex HFP + NIS delayed PRE, and Metribuzin + MCPA Amine + NIS POST
- Trt #25: Spartan + NIS delayed PRE, Metribuzin + NIS POST
- Trt #28: Spartan + Karmex DF + NIS applied delayed PRE with Tough + NIS applied POST

- Trt #31: Spartan + Triflurex HFP NIS applied delayed PRE with Metribuzin + NIS applied POST

Alternative treatments, which caused minimal crop injury ($\leq 15\%$ stunting; $\geq 70\%$ crop coverage) and provided some broadleaf weed control ($\geq 53\%$ mayweed control; $\geq 55\%$ other broadleaves control) were as follows:

- Trt #11: Spartan PRE with Command + NIS POST
- Trt #17: Spartan PRE with Karmex DF Delayed PRE
- Trt #20: Spartan + NIS applied delayed PRE
- Trt #21: Spartan + NIS applied delayed PRE with Ultra Blazer + Metribuzin + NIS POST
- Trt #30: Spartan + Triflurex HFP + NIS delayed PRE with Ultra Blazer + Metribuzin + NIS POST
- Trt #34: Spartan + Karmex DF PRE with Spartan + NIS delayed PRE

There were also four treatments which had good weed control ($\geq 90\%$ mayweed control; $\geq 90\%$ other broadleaves control) but resulted in stand reduces of 40 to 50% (50-60% coverage) and some crop stunting (10 to 25%). Treatments included:

- Trt #15: Spartan PRE with Metribuzin + MCPA Amine + NIS POST
- Trt #22: Spartan + NIS delayed PRE with Metribuzin + MCPA Amine + NIS POST
- Trt #27: Spartan + Karmex DF + NIS delayed PRE with Ultra Blazer + NIS POST
- Trt #35: Spartan + Karmex DF PRE with Spartan + NIS delayed PRE and Metribuzin + MCPA Amine + NIS POST

The remaining treatments were classified one of three ways:

1) Safe on winter peas with little to no crop injury ($\leq 10\%$ stunting; $\geq 68\%$ coverage), but had little to no broadleaf weed control ($\leq 40\%$ mayweed control; $\leq 30\%$ other broadleaves control):

- Trt #2: Spartan PRE
- Trt #6: Raptor + COC POST
- Trt #8: Dual Magnum + Prowl H2O + Metribuzin PRE
- Trt #9: Valor PRE with Raptor + COC POST
- Trt #14: Spartan PRE with Metribuzin + NIS POST
- Trt #18: Spartan PRE with Triflurex HFP + NIS delayed PRE
- Trt #29: Spartan + Triflurex HFP + NIS delayed PRE

2) Injurious to winter peas ($\geq 15\%$ stunting; $\leq 40\%$ coverage) with some broadleaf weed control ($\geq 40\%$ mayweed control; $\geq 55\%$ other broadleaves control):

- Trt #4: Spartan + Valor PRE
- Trt #10: Spartan + Valor PRE with Raptor + COC POST
- Trt #12: Spartan + Karmex DF PRE with Command + NIS POST
- Trt #23: Spartan + NIS delayed PRE with Ultra Blazer + NIS POST
- Trt #24: Spartan + NIS delayed PRE with Tough + NIS POST
- Trt #26: Spartan + Karmex DF + NIS delayed PRE with Metribuzin + MCPA Amine + NIS POST
- Trt #36: Spartan + Karmex DF PRE with Spartan + NIS delayed PRE and Tough + NIS POST

3) Additional non-standard treatments which were either injurious to the winter peas, lacked broadleaf weed control, or both:

- Trt #3: Valor PRE
- Trt #13: Spartan PRE + Tough + NIS POST
- Trt #33: Spartan PRE with Spartan + NIS delayed PRE and Metribuzin + MCPA Amine + NIS POST
- Trt #37: Ultra Blazer + Metribuzin + NIS POST

Table 2. Percent crop injury (stunting and bleaching) and crop cover, as well as heights for winter peas after PRE (A), Delayed-PRE (B), and POST (C) sulfentrazone herbicide applications. Pullman, WA, 2019. WAT = weeks after treatment. Means followed by the same letter are not significantly different ($\alpha=0.05$).

| Winter Pea Injury, Heights, and Stand Coverage [mean (standard deviation)] | | | | | | | | | | |
|--|---------------|--------------|------------|----------------------------------|---------------|--------------------------------|---------------|----------|---------------------------------|--|
| Trt # (n=#) | Treatment | Appl Code | Rate | April 29, 2019 (27, 2, & -4 WAT) | | June 11, 2019 (33, 8, & 2 WAT) | | | July 18, 2019 (38, 13, & 7 WAT) | |
| | | | | Stunting | Stunting | Bleaching | Heights | Stunting | Cover | |
| | | | Field Rate | % | ----- % ----- | cm | ----- % ----- | | | |
| 1 (12) | Nontreated | | - | - | - | 64 (4) | - | 85 (11) | | |
| 2 (23) | Spartan | A | 8 fl oz/A | 3 (5) | 6 (7) | 0 (0) | 61 (4) | 3 (4) | 77 (24) | |
| 3 (3) | Valor | A | 2 oz/A | 8 (6) | 22 (3) | 0 (0) | 59 (5) | 8 (11) | 60 (57) | |
| 4 (3) | Spartan | A | 8 fl oz/A | 20 (0) | 25 (0) | 0 (0) | 54 (5) | 15 (7) | 40 (14) | |
| | Valor | A | 2 oz/A | | | | | | | |
| 5 (3) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Raptor | C | 4 fl oz/A | 3 (3) | 2 (3) | 0 (0) | 61 (5) | 2 (3) | 85 (15) | |
| | COC | C | 1% v/v | | | | | | | |
| 6 (3) | Raptor | C | 4 fl oz/A | 0 (0) | 0 (0) | 0 (0) | 64 (5) | 5 (NA) | 90 (NA) | |
| | COC | C | 1% v/v | | | | | | | |
| 7 (2) | Spartan | A | 8 fl oz/A | 0 (0) | 5 (0) | 0 (0) | 66 (1) | 0 (0) | 80 (28) | |
| | Karmex DF | A | 1.87 lb/A | | | | | | | |
| 8 (4) | Dual Magnum | A | 1.33 pt/A | | | | | | | |
| | Prowl H2O | A | 2.4 pt/A | 13 (6) | 21 (6) | 0 (0) | 57 (2) | 2 (3) | 83 (4) | |
| | Metribuzin | A | 5 oz/A | | | | | | | |
| 9 (1) | Valor | A | 2 oz/A | | | | | | | |
| | Raptor | C | 4 fl oz/A | 20 (NA) | 25 (NA) | 0 (NA) | 58 (NA) | 0 (NA) | 90 (NA) | |
| | COC | C | 1% v/v | | | | | | | |
| 10 (1) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Valor | A | 2 oz/A | 20 (NA) | 30 (NA) | 0 (NA) | 55 (NA) | 20 (NA) | 40 (NA) | |
| | Raptor | C | 4 fl oz/A | | | | | | | |
| | COC | C | 1% v/v | | | | | | | |
| 11 (2) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Command | C | 1.3 pt/A | 0 (0) | 5 (7) | 40 (57) | 60 (6) | 5 (7) | 80 (28) | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 12 (2) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Karmex DF | A | 1.87 lb/A | 5 (7) | 15 (7) | 75 (7) | 52 (6) | 15 (0) | 30 (NA) | |
| | Command | C | 1.3 pt/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 13 (1) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Tough | C | 0.5 pt/A | 0 (NA) | 5 (NA) | 0 (NA) | 51 (NA) | 0 (NA) | 40 (NA) | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 14 (2) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Metribuzin | C | 5 oz/A | 0 (0) | 13 (4) | 3 (4) | 58 (6) | 10 (NA) | 70 (NA) | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 15 (1) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Metribuzin | C | 5 oz/A | 0 (NA) | 40 (NA) | 0 (NA) | 54 (NA) | 15 (NA) | 60 (NA) | |
| | MCPA Amine | C | 16 fl oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 16 (4) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Command | B | 1.3 pt/A | 0 (0) | 6 (5) | 0 (0) | 61 (11) | 0 (0) | 90 (7) | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 17 (4) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Karmex DF | B | 1.5 lb/A | 6 (9) | 14 (14) | 0 (0) | 58 (2) | 5 (10) | 78 (3) | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 18 (3) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Triflurex HFP | B | 1.5 pt/A | 3 (6) | 3 (6) | 0 (0) | 60 (6) | 0 (0) | 68 (11) | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 19 (1) | Spartan | A | 8 fl oz/A | | | | | | | |
| | Triflurex HFP | B | 1.5 pt/A | 0 (NA) | 30 (NA) | 0 (NA) | 47 (NA) | 5 (NA) | 85 (NA) | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | MCPA Amine | C | 16 fl oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 20 (4) | Spartan | A | 8 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | 0 (0) | 1 (3) | 0 (0) | 61 (6) | 3 (6) | 95 (7) | |
| 21 (1) | Spartan | B | 8 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Ultra Blazer | C | 12 fl oz/A | 0 (NA) | 15 (NA) | 0 (NA) | 54 (NA) | 10 (NA) | 85 (NA) | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 22 (2) | Spartan | B | 8 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | 10 (14) | 35 (7) | 0 (0) | 47 (5) | 18 (11) | 60 (42) | |
| | MCPA Amine | C | 16 fl oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |

Table 2. Continued

| Continued Winter Pea Injury, Heights, and Stand Coverage [mean (standard deviation)] | | | | | | | | | | |
|--|---------------|--------------|-----------------------------|------------|----------|--------------------------------|---------|----------|---------------------------------|---|
| Trt # (n=#) | Treatment | Appl Code | April 29, 2019 (27 & 2 WAT) | | | June 11, 2019 (33, 8, & 2 WAT) | | | July 18, 2019 (38, 13, & 7 WAT) | |
| | | | Rate | Stunting | Stunting | Bleaching | Heights | Stunting | Cover | |
| | | | | Field Rate | | | | % | | % |
| 23 (3) | Spartan | B | 8 fl oz/A | 7 (6) | 28 (8) | 0 (0) | 56 (3) | 23 (4) | 20 (14) | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Ultra Blazer | C | 12 fl oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 24 (1) | Spartan | B | 8 fl oz/A | 0 (NA) | 15 (NA) | 0 (NA) | 47 (NA) | 20 (NA) | 40 (NA) | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Tough | C | 0.5 pt/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 25 (1) | Spartan | B | 8 fl oz/A | 0 (NA) | 0 (NA) | 0 (NA) | 52 (NA) | 0 (NA) | 98 (NA) | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 26 (2) | Spartan | B | 8 fl oz/A | 0 (0) | 40 (0) | 0 (0) | 50 (10) | 28 (18) | 20 (NA) | |
| | Karmex DF | B | 1.5 lb/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 16 fl oz/A | | | | | | | |
| | MCPA amine | C | 5 oz/A | | | | | | | |
| NIS | C | 0.25% v/v | | | | | | | | |
| 27 (1) | Spartan | B | 8 fl oz/A | 10 (NA) | 40 (NA) | 0 (NA) | 44 (NA) | 10 (NA) | 60 (NA) | |
| | Karmex DF | B | 1.5 lb/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Ultra Blazer | C | 12 fl oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 28 (1) | Spartan | B | 8 fl oz/A | 0 (NA) | 20 (NA) | 0 (NA) | 59 (NA) | 10 (NA) | 80 (NA) | |
| | Karmex DF | B | 1.5 lb/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Tough | C | 0.5 pt/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 29 (1) | Spartan | B | 8 fl oz/A | 0 (NA) | 10 (NA) | 0 (NA) | 54 (NA) | 0 (NA) | 85 (NA) | |
| | Triflurex HFP | B | 1.5 pt/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 30 (2) | Spartan | B | 8 fl oz/A | 10 (14) | 20 (14) | 0 (0) | 54 (8) | 10 (NA) | 95 (NA) | |
| | Triflurex HFP | B | 1.5 pt/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Ultra Blazer | C | 12 fl oz/A | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| NIS | C | 0.25% v/v | | | | | | | | |
| 31 (1) | Spartan | B | 8 fl oz/A | 0 (NA) | 10 (NA) | 0 (NA) | 64 (NA) | 10 (NA) | 80 (NA) | |
| | Triflurex HFP | B | 1.5 pt/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 32 (3) | Spartan | A | 4 fl oz/A | 8 (10) | 20 (9) | 0 (0) | 58 (4) | 3 (3) | 65 (33) | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 33 (1) | Spartan | A | 4 fl oz/A | 0 (NA) | 35 (NA) | 0 (NA) | 57 (NA) | NA (NA) | NA (NA) | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | MCPA Amine | C | 16 fl oz/A | | | | | | | |
| NIS | C | 0.25% v/v | | | | | | | | |
| 34 (2) | Spartan | A | 4 fl oz/A | 10 (14) | 10 (7) | 0 (0) | 56 (7) | 15 (7) | 70 (42) | |
| | Karmex DF | A | 1.5 lb/A | | | | | | | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 35 (1) | Spartan | A | 4 fl oz/A | 5 (NA) | 40 (NA) | 0 (NA) | 32 (NA) | 25 (NA) | 50 (NA) | |
| | Karmex DF | A | 1.5 lb/A | | | | | | | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | MCPA amine | C | 16 fl oz/A | | | | | | | |
| NIS | C | 0.25% v/v | | | | | | | | |
| 36 (1) | Spartan | A | 4 fl oz/A | 20 (NA) | 30 (NA) | 0 (NA) | 67 (NA) | 0 (NA) | NA (NA) | |
| | Karmex DF | A | 1.5 lb/A | | | | | | | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Tough | C | 0.5 pt/A | | | | | | | |
| NIS | C | 0.25% v/v | | | | | | | | |
| 37 (1) | Ultra Blazer | C | 12 fl oz/A | 0 (NA) | 10 (NA) | 0 (NA) | 55 (NA) | NA (NA) | NA (NA) | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |

Table 3. Percent weed control [means (standard deviation)] Italian ryegrass, mayweed chamomile, and broadleaves in winter peas following PRE (A), Delayed-PRE (B), and POST (C) sulfentrazone herbicide applications. Pullman, WA, 2019. WAT = weeks after treatment. Means followed by the same letter are not significantly different ($\alpha=0.05$).

| Italian Ryegrass and Broadleaf Weed Control [mean (standard deviation)] | | | | | | | | | | |
|---|----------------------|--------------|-------------------------|----------------------------------|-------------|--------------------------------|-------------|---------------------------------|---------|----------------------|
| Trt # (n=#) | Treatment | Appl Code | Rate | April 29, 2019 (27, 2, & -4 WAT) | | June 11, 2019 (33, 8, & 2 WAT) | | July 18, 2019 (38, 13, & 7 WAT) | | |
| | | | | Italian ryegrass | Broadleaves | Italian ryegrass | Broadleaves | Italian ryegrass | Mayweed | Other Broadleaves |
| | | | | Field Rate | % | % | % | % | % | % |
| 1 (12) | Nontreated | | - | - | - | - | - | - | - | - |
| 2 (23) | Spartan | A | 8 fl oz/A | 48 (37) | 69 (40) | 35 (38) | 47 (35) | 16 (24) | 27 (32) | 11 (24) |
| 3 (3) | Valor | A | 2 oz/A | 70 (10) | 93 (3) | 40 (20) | 57 (35) | 0 (0) | 17 (29) | 13 (23) |
| 4 (3) | Spartan | A | 8 fl oz/A | 77 (6) | 95 (0) | 60 (20) | 85 (13) | 0 (0) | 66 (57) | 55 (49) |
| | Valor | A | 2 oz/A | | | | | | | |
| 5 (3) | Spartan | A | 8 fl oz/A | 40 (36) | 95 (0) | 0 (0) | 57 (12) | 0 (0) | 50 (36) | 17 (21) |
| | Raptor COC | C C | 4 fl oz/A 1% v/v | | | | | | | |
| 6 (3) | Raptor COC | C C | 4 fl oz/A 1% v/v | 33 (35) | 53 (47) | 25 (43) | 13 (23) | 0 (0) | 0 (0) | 0 (0) |
| 7 (2) | Spartan | A | 8 fl oz/A | 45 (49) | 63 (46) | 75 (7) | 63 (46) | 0 (NA) | 99 (0) | 85 (7) |
| | Karmex DF | A | 1.87 lb/A | | | | | | | |
| 8 (4) | Dual Magnum | A | 1.33 pt/A | 79 (17) | 95 (0) | 79 (26) | 38 (45) | 10 (20) | 5 (10) | 0 (0) |
| | Prowl H2O | A | 2.4 pt/A | | | | | | | |
| | Metribuzin | A | 5 oz/A | | | | | | | |
| 9 (1) | Valor | A | 2 oz/A | 70 (NA) | 95 (NA) | 80 (NA) | 80 (NA) | 0 (NA) | 20 (NA) | 0 (NA) |
| | Raptor COC | C C | 4 fl oz/A 1% v/v | | | | | | | |
| 10 (1) | Spartan | A | 8 fl oz/A | 40 (NA) | 95 (NA) | 0 (NA) | 95 (NA) | 0 (NA) | 70 (NA) | 70 (NA) |
| | Valor | A | 2 oz/A | | | | | | | |
| | Raptor | C | 4 fl oz/A | | | | | | | |
| | COC | C | 1% v/v | | | | | | | |
| 11 (2) | Spartan | A | 8 fl oz/A | 28 (39) | 95 (0) | 0 (0) | 65 (35) | 0 (NA) | 65 (35) | 75 (7) |
| | Command | C | 1.3 pt/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 12 (2) | Spartan | A | 8 fl oz/A | 15 (21) | 48 (67) | 20 (28) | 55 (49) | 0 (0) | 75 (7) | 70 (14) |
| | Karmex DF | A | 1.87 lb/A | | | | | | | |
| | Command | C | 1.3 pt/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 13 (1) | Spartan | A | 8 fl oz/A | 50 (NA) | 95 (NA) | 0 (NA) | 60 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| | Tough NIS | C C | 0.5 pt/A 0.25% v/v | | | | | | | |
| 14 (2) | Spartan | A | 8 fl oz/A | 40 (57) | 48 (67) | 20 (28) | 70 (14) | 0 (0) | 30 (42) | 30 (42) |
| | Metribuzin NIS | C C | 5 oz/A 0.25% v/v | | | | | | | |
| 15 (1) | Spartan | A | 8 fl oz/A | 0 (NA) | 30 (NA) | 0 (NA) | 90 (NA) | 0 (NA) | 90 (NA) | 99 (NA) |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | MCPA Amine | C | 16 fl oz/A | | | | | | | |
| | NIS | C | 0.25% v/v | | | | | | | |
| 16 (4) | Spartan | A | 8 fl oz/A | 95 (0) | 91 (8) | 0 (0) | 65 (44) | 0 (0) | 43 (49) | 67 (46) |
| | Command NIS | B B | 1.3 pt/A 0.25% v/v | | | | | | | |
| 17 (4) | Spartan | A | 8 fl oz/A | 77 (17) | 96 (1) | 48 (36) | 93 (3) | 10 (20) | 69 (33) | 59 (40) |
| | Karmex DF NIS | B B | 1.5 lb/A 0.25% v/v | | | | | | | |
| 18 (3) | Spartan | A | 8 fl oz/A | 23 (15) | 95 (10) | 0 (0) | 50 (44) | 0 (0) | 0 (0) | 0 (0) |
| | Triflurex HFP NIS | B B | 1.5 pt/A 0.25% v/v | | | | | | | |
| 19 (1) | Spartan | A | 8 fl oz/A | 75 (NA) | 75 (NA) | 70 (NA) | 80 (NA) | 50 (NA) | 75 (NA) | 95 (NA) |
| | Triflurex HFP NIS | B B | 1.5 pt/A 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | MCPA Amine NIS | C C | 16 fl oz/A 0.25% v/v | | | | | | | |
| 20 (4) | Spartan | B | 8 fl oz/A | 53 (41) | 95 (0) | 18 (35) | 74 (36) | 15 (30) | 59 (28) | 55 (38) |
| | NIS | B | 0.25% v/v | | | | | | | |
| 21 (1) | Spartan | B | 8 fl oz/A | 80 (NA) | 80 (NA) | 70 (NA) | 95 (NA) | 60 (NA) | 70 (NA) | 70 (NA) |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Ultra Blazer | C | 12 fl oz/A | | | | | | | |
| | Metribuzin NIS | C C | 5 oz/A 0.25% v/v | | | | | | | |
| 22 (2) | Spartan | B | 8 fl oz/A | 50 (0) | 95 (0) | 0 (0) | 93 (4) | 0 (0) | 97 (3) | 97 (3) |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| | MCPA Amine NIS | C C | 16 fl oz/A 0.25% v/v | | | | | | | |

Table 3. Continued

| Continued Italian Ryegrass and Broadleaf Weed Control [mean (standard deviation)] | | | | | | | | | | |
|---|---------------|--------------|------------|----------------------------------|-------------|--------------------------------|-------------|---------------------------------|---------|----------------------|
| Trt # (n=#) | Treatment | Appl Code | Rate | April 29, 2019 (27, 2, & -4 WAT) | | June 11, 2019 (33, 8, & 2 WAT) | | July 18, 2019 (38, 13, & 7 WAT) | | |
| | | | | Italian ryegrass | Broadleaves | Italian ryegrass | Broadleaves | Italian ryegrass | Mayweed | Other Broadleaves |
| | | | | ----- % ----- | | ----- % ----- | | ----- % ----- | | |
| | | | Field Rate | | | | | | | |
| 23 (3) | Spartan | B | 8 fl oz/A | 33 (29) | 77 (23) | 3 (6) | 90 (0) | 0 (0) | 53 (50) | 91 (10) |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Ultra Blazer | C | 12 fl oz/A | | | | | | | |
| 24 (1) | Spartan | B | 8 fl oz/A | 75 (NA) | 70 (NA) | 60 (NA) | 95 (NA) | 0 (NA) | 90 (NA) | 95 (NA) |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Tough | C | 0.5 pt/A | | | | | | | |
| 25 (1) | Spartan | B | 8 fl oz/A | 80 (NA) | 95 (NA) | 70 (NA) | 95 (NAS) | 60 (NA) | 90 (NA) | 90 (NA) |
| | NIS | B | 0.25% v/v | | | | | | | |
| | Metribuzin | C | 5 oz/A | | | | | | | |
| 26 (2) | Spartan | B | 8 fl oz/A | 50 (14) | 78 (25) | 10 (14) | 93 (4) | 0 (0) | 75 (7) | 78 (25) |
| | Karmex DF | B | 1.5 lb/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 27 (1) | Spartan | B | 8 fl oz/A | 60 (NA) | 95 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 99 (NA) | 90 (NA) |
| | Karmex DF | B | 1.5 lb/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 28 (1) | Spartan | B | 8 fl oz/A | 80 (NA) | 95 (NA) | 60 (NA) | 90 (NA) | 40 (NA) | 99 (NA) | 99 (NA) |
| | Karmex DF | B | 1.5 lb/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 29 (1) | Spartan | B | 8 fl oz/A | 85 (NA) | 80 (NA) | 80 (NA) | 60 (NA) | 60 (NA) | 40 (NA) | 0 (NA) |
| | Triflurex HFP | B | 1.5 pt/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 30 (2) | Spartan | B | 8 fl oz/A | 40 (57) | 95 (0) | 25 (35) | 75 (21) | 0 (0) | 53 (32) | 83 (18) |
| | Triflurex HFP | B | 1.5 pt/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 31 (1) | Spartan | B | 8 fl oz/A | 40 (NA) | 95 (NA) | 0 (NA) | 60 (NA) | 0 (NA) | 95 (NA) | 99 (NA) |
| | Triflurex HFP | B | 1.5 pt/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 32 (3) | Spartan | A | 4 fl oz/A | 60 (36) | 93 (3) | 40 (40) | 83 (6) | 25 (43) | 50 (46) | 53 (46) |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 33 (1) | Spartan | A | 4 fl oz/A | 80 (NA) | 95 (NA) | 0 (NA) | 90 (NA) | 0 (NA) | 10 (NA) | 60 (NA) |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| | NIS | B | 0.25% v/v | | | | | | | |
| 34 (2) | Spartan | A | 4 fl oz/A | 80 (0) | 90 (7) | 45 (7) | 85 (7) | 35 (49) | 93 (4) | 83 (4) |
| | Karmex DF | A | 1.5 lb/A | | | | | | | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| 35 (1) | Spartan | A | 4 fl oz/A | 90 (NA) | 95 (NA) | 80 (NA) | 95 (NA) | 40 (NA) | 95 (NA) | 99 (NA) |
| | Karmex DF | A | 1.5 lb/A | | | | | | | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| 36 (1) | Spartan | A | 4 fl oz/A | 90 (NA) | 95 (NA) | 60 (NA) | 90 (NA) | 0 (NA) | 40 (NA) | 95 (NA) |
| | Karmex DF | A | 1.5 lb/A | | | | | | | |
| | Spartan | B | 4 fl oz/A | | | | | | | |
| 37 (1) | Spartan | B | 0.25% v/v | 20 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 10 (NA) | 0 (NA) |
| | NIS | C | 5 oz/A | | | | | | | |
| | Ultra Blazer | C | 12 fl oz/A | | | | | | | |

Disclaimer

Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to \$7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.