**Herbicide Evaluation in Direct Seeded Mustard Greens and Radish**

Trials 2020.03

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Direct seeded mustard greens and radish were treated with *S*-metolachlor (Dual Magnum) at 0.33, 0.5 and 0.65 lbs. ai/A, PRE and POST 1 week after emergence; and pyridate (Tough) was applied POST at 0.47 and 0.62 lbs. ai/A + NIS at 0.25% v/v before crop and weeds reached 3”. The standard was Dacthal PRE at 7.5 lbs. ai/A. A non-treated control was included. The trial was conducted at Salinas, CA during October to December 2020 (Table 1). Treatments were replicated 4 times and arranged in a randomized complete block design. Data collected were crop injury estimates, stand and yield, as well as weed control. Data were subjected to analysis of variance using Agricultural Research Manager and mean separation was performed using LSD’s.

**Results**

Crop Injury:

Mustard greens - Dacthal, Dual Magnum PRE and Dual Magnum POST caused minor (<2.0 rating) to no injury on mustard greens. Pyridate caused moderate (5.9 rating) to severe (7.0 to 9.3 ratings) injury, resulting in dried/yellow older leaves and stunted/dead growth by 14DAT; continuing for the duration of the trial (Table 2).

Radish – Dacthal and Dual Magnum PRE caused minor (<1.3 rating) to no injury on radish, resulting in slightly stunted growth on injured plants by 14DAT. Dual Magnum at 1-week POST caused no injury. Pyridate at 0.47 lbs. ai/A caused moderate (5.4 rating) injury, resulting in dried older leaves and stunted growth by 14DAT. Pyridate at 0.62 lbs. ai/A caused severe (6.9 rating) injury, resulting in dried/dead older leaves and stunted growth by 14DAT. Pyridate injury remained for the duration of the trial (Table 3).

Crop Stand:

Mustard greens – Neither Dacthal, Dual Magnum PRE or POST nor Pyridate at 0.47 lbs. ai/A reduced stands of mustard greens within 1 – 4 weeks after application. Pyridate at 0.62 lbs. ai/A significantly reduced mustard green stand by 10-DAT (Table 4).

Radish – None of the treatments reduced stands of radish within 10 days after application (Table 4).

Crop Yield:

Mustard greens – Neither Dacthal nor Dual Magnum PRE or POST reduced mustard green numbers, fresh weight or size, compared to the non-treated check. Pyridate caused significant reductions in crop stand, weight and size, compared to the non-treated check (Table 5).

Radish – Neither Dacthal nor Dual Magnum POST reduced radish numbers, fresh weight or size, compared to the non-treated check. Dual Magnum PRE at 0.65 lbs. ai/A significantly reduced fresh weight and size. Pyridate at 0.62 lbs. ai/A caused significant reduction in crop numbers. Pyridate at 0.47 and 0.62 lbs. ai/A caused significant reduction in crop weight and size (Table 6).

Weed Control:

Major weeds present were annual bluegrass, burning nettle and shepherds-purse. All rates of Dual Magnum PRE were highly effective on the annual bluegrass, shepherds-purse and total weeds. Dual Magnum POST at 0.65 lbs. ai/A was highly effective on shepherds-purse. Pyridate + NIS was highly effective on burning nettle, shepherds-purse and moderately effective on total weeds, but provided no significant control of annual bluegrass. Dacthal was moderately effective on annual bluegrass and highly effective on shepherds-purse and total weeds, but provided no significant control of burning nettle (Table 7).

**Table 1**. Critical trial events and dates

|  |  |  |
| --- | --- | --- |
| **Critical Event** | **Date / Information** | |
| Crop: | Mustard Greens | Radish |
| Cultivar: | Southern Giant Curled | Roxanne |
| Seeding Date: | 10/14/20 | 10/14/20 |
| Emergence Date: | 10/21/20 | 10/20/20 |
| Application Intervals: | | |
| PostPlant/Pre-Emergence (PRE): | 10/16/20 | 10/16/20 |
| 1 Week Post-Emergence (POST): | 10/27/20 | 10/27/20 |
| POST @ <3” Weeds: | 10/30/20 | 10/30/20 |
| Evaluations: | | |
| Weed Counts: | 11/4/20 | 11/4/20 |
| Crop Injury:  PRE Treatments  POST Dual Magnum Treatments  POST Pyridate Treatments | 10/30/20 14-DAT  11/13/20 28-DAT  11/25/20 40-DAT  10/30/20 3-DAT  11/3/20 7-DAT  11/10/20 14-DAT  11/2/20 3-DAT  11/6/20 7-DAT  11/13/20 14-DAT | 10/23/20 7-DAT  10/30/20 14-DAT  11/6/20 21-DAT  10/30/20 3-DAT  11/3/20 7-DAT  11/10/20 14-DAT  11/2/20 3-DAT  11/6/20 7-DAT  11/13/20 14-DAT |
| Crop Stand:  PRE Treatments  POST Dual Magnum Treatments  POST Pyridate Treatments | 11/13/20 28-DAT  11/6/20 10-DAT  11/9/20 10-DAT | 10/26/20 10-DAT  11/6/20 10-DAT  11/9/20 10-DAT |
| Yield (Fresh Weight): | 12/2/20 | 11/20/20 |

DAT = Days After Treatment

**Table 2**. Mustard greens crop injury estimates**¹**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Rate**  **(lbs. ai/A)** | **Timing** | **OCT 30**  **14-DAT** | **NOV 13**  **28-DAT** | **NOV 25**  **40-DAT** | **OCT 30**  **3-DAT** | **NOV 3**  **7-DAT** | **NOV 10**  **14DAT** | **NOV 2**  **3-DAT** | **NOV 6**  **7-DAT** | **NOV 13**  **14-DAT** | **All Trts**  **14DAT** |
| **0 – 10 Scale** | | | | | | | | | |
| NonTreated | 0 | --- | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 b | 0.0 | 0.0 c | 0.0 b | 0.0 c | 0.0 c |
| Dacthal | 7.5 | PRE | 0.0 | 1.5 | 1.3 | --- | --- | --- | --- | --- | --- | 0.0 c |
| Dual Magnum | 0.33 | PRE | 0.0 | 1.5 | 1.0 | --- | --- | --- | --- | --- | --- | 0.0 c |
| Dual Magnum | 0.5 | PRE | 0.0 | 1.5 | 1.3 | --- | --- | --- | --- | --- | --- | 0.0 c |
| Dual Magnum | 0.65 | PRE | 0.0 | 2.0 | 1.8 | --- | --- | --- | --- | --- | --- | 0.0 c |
| Dual Magnum | 0.33 | 1-Wk POST | --- | --- | --- | 0.0 | 0.0 b | 0.1 | --- | --- | --- | 0.1 c |
| Dual Magnum | 0.5 | 1-Wk POST | --- | --- | --- | 0.0 | 0.1 b | 0.1 | --- | --- | --- | 0.1 c |
| Dual Magnum | 0.65 | 1-Wk POST | --- | --- | --- | 0.0 | 0.9 a | 0.5 | --- | --- | --- | 0.3 c |
| Pyridate +  X-77 NIS | 0.47 +  0.25% v/v | POST | --- | --- | --- | --- | --- | --- | 7.0 b | 5.9 a | 8.5 b | 8.5 b |
| Pyridate +  X-77 NIS | 0.62 +  0.25% v/v | POST | --- | --- | --- | --- | --- | --- | 8.0 a | 8.9 a | 9.3 a | 9.3 a |
| LSD (P = .05) | | | 0.00 | 1.63 | 1.43 | 0.00 | 0.48 | 0.55 | 0.41 | 3.79 | 0.50 | 0.37 |
| Treatment Prob (F) | | | 1.0000 | 0.1496 | 0.1664 | 1.0000 | 0.0054 | 0.2594 | 0.0001 | 0.0043 | 0.0001 | 0.0001 |

**¹** Rating scale: 0 = no injury, ≤2=safe, 10 = complete crop death.

**Table 3**. Radish crop injury estimates**¹**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Rate**  **(lbs. ai/A)** | **Timing** | **OCT 23**  **7-DAT** | | **OCT 30**  **14-DAT** | **NOV 6**  **21-DAT** | **OCT 30**  **3-DAT** | **NOV 3**  **7-DAT** | **NOV 10**  **14DAT** | **NOV 2**  **3-DAT** | **NOV 6**  **7-DAT** | **NOV 13**  **14-DAT** | **All Trts**  **14DAT** |
| **0 – 10 Scale** | | | | | | | | | | |
| NonTreated | 0 | --- | 0.0 | | 0.0 b | 0.0 c | 0.0 | 0.0 | 0.0 | 0.0 c | 0.0 c | 0.0 c | 0.0 d |
| Dacthal | 7.5 | PRE | 0.4 | | 0.0 b | 1.3 a | --- | --- | --- | --- | --- | --- | 0.0 d |
| Dual Magnum | 0.33 | PRE | 0.0 | | 0.0 b | 0.6 abc | --- | --- | --- | --- | --- | --- | 0.0 d |
| Dual Magnum | 0.5 | PRE | 0.3 | | 0.9 a | 0.4 bc | --- | --- | --- | --- | --- | --- | 0.9 c |
| Dual Magnum | 0.65 | PRE | 0.1 | | 1.1 a | 1.0 ab | --- | --- | --- | --- | --- | --- | 1.1 c |
| Dual Magnum | 0.33 | 1-Wk POST | --- | | --- | --- | 0.0 | 0.0 | 0.0 | --- | --- | --- | 0.0 d |
| Dual Magnum | 0.5 | 1-Wk POST | --- | | --- | --- | 0.0 | 0.0 | 0.0 | --- | --- | --- | 0.0 d |
| Dual Magnum | 0.65 | 1-Wk POST | --- | | --- | --- | 0.0 | 0.0 | 0.0 | --- | --- | --- | 0.0 d |
| Pyridate +  X-77 NIS | 0.47 +  0.25% v/v | POST | --- | | --- | --- | --- | --- | --- | 3.0 b | 3.0 b | 5.4 b | 5.4 b |
| pyridate +  X-77 NIS | 0.62 +  0.25% v/v | POST | --- | | --- | --- | --- | --- | --- | 4.0 a | 5.6 a | 6.9 a | 6.9 a |
| LSD (P = .05) | | | | 0.52 | 0.61 | 0.80 | 0.00 | 0.00 | 0.00 | 0.41 | 1.84 | 0.69 | 0.50 |
| Treatment Prob (F) | | | | 0.4802 | 0.0023 | 0.0378 | 1.0000 | 1.0000 | 1.0000 | 0.0001 | 0.0009 | 0.0001 | 0.0001 |

**¹** Rating scale: 0 = no injury, ≤2=safe, 10 = complete crop death.

**Table 4.** Mustard greens and radish crop stand

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Rate**  **(lbs. ai/A)** | **Timing** | **Mustard greens** | | | | **Radish** | | | |
| **NOV 13**  **28-DAT** | **NOV 6**  **10-DAT** | **NOV 9**  **10-DAT** | **All Trts** | **OCT 26**  **10-DAT** | **NOV 6**  **10-DAT** | **NOV 9**  **10-DAT** | **All Trts** |
| **no./10’ bed** | | | | | | | |
| NonTreated | 0 | --- | 47.0 | 44.8 | 42.8 a | 47.0 a | 40.8 | 37.3 | 38.8 | 38.8 |
| Dacthal | 7.5 | PRE | 46.3 | --- | --- | 46.3 a | 42.3 | --- | --- | 42.3 |
| Dual Magnum | 0.33 | PRE | 46.3 | --- | --- | 46.3 a | 41.3 | --- | --- | 41.3 |
| Dual Magnum | 0.5 | PRE | 46.8 | --- | --- | 46.8 a | 40.0 | --- | --- | 40.0 |
| Dual Magnum | 0.65 | PRE | 45.0 | --- | --- | 45.0 a | 36.0 | --- | --- | 36.0 |
| Dual Magnum | 0.33 | 1-Wk POST | --- | 43.5 | --- | 43.5 a | --- | 36.3 | --- | 36.3 |
| Dual Magnum | 0.5 | 1-Wk POST | --- | 41.5 | --- | 41.5 a | --- | 37.3 | --- | 37.3 |
| Dual Magnum | 0.65 | 1-Wk POST | --- | 42.8 | --- | 42.8 a | --- | 39.0 | --- | 39.0 |
| Pyridate +  X-77 NIS | 0.47 +  0.25% v/v | POST | --- | --- | 42.5 a | 42.5 a | --- | --- | 37.0 | 37.0 |
| Pyridate +  X-77 NIS | 0.62 +  0.25% v/v | POST | --- | --- | 32.8 b | 32.8 b | --- | --- | 39.3 | 39.3 |
| LSD (P = .05) | | | 7.62 | 10.31 | 6.70 | 6.54 | 30.52 | 34.92 | 31.25 | 6.63 |
| Treatment Prob (F) | | | 0.9814 | 0.9084 | 0.0169 | 0.0053 | 0.2157 | 0.6325 | 0.1766 | 0.5838 |

**Table 5**. Mustard greens crop yield (stand, fresh weight and size) at harvest (12/2/20)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatment** | **Rate**  **(lbs. ai/A)** | **Timing** | **Stand** | **Fresh Weight** | **Size** |
| **(1000s/Ac)** | **(Tons/Ac)** | **(gm/head)** |
| NonTreated | 0 | --- | 138.5 a | 4.53 a | 30.0 a |
| Dacthal | 7.5 | PRE | 134.1 a | 4.50 a | 30.4 a |
| Dual Magnum | 0.33 | PRE | 138.5 a | 4.60 a | 31.4 a |
| Dual Magnum | 0.5 | PRE | 130.7 a | 4.30 a | 29.9 a |
| Dual Magnum | 0.65 | PRE | 130.1 a | 3.80 a | 26.8 a |
| Dual Magnum | 0.33 | 1-Wk POST | 144.5 a | 4.40 a | 28.1 a |
| Dual Magnum | 0.5 | 1-Wk POST | 136.7 a | 4.33 a | 29.2 a |
| Dual Magnum | 0.65 | 1-Wk POST | 138.0 a | 4.85 a | 31.8 a |
| Pyridate +  X-77 NIS | 0.47 +  0.25% v/v | POST | 100.6 b | 1.08 b | 9.8 b |
| Pyridate +  X-77 NIS | 0.62 +  0.25% v/v | POST | 94.1 b | 0.78 b | 8.0 b |
| LSD (P = .05) | | | 22.94 | 1.39 | 8.57 |
| Treatment Prob (F) | | | 0.0009 | 0.0001 | 0.0001 |

**Table 6**. Radish crop yield (stand, fresh weight and size) at harvest (11/20/20)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatment** | **Rate**  **(lbs. ai/A)** | **Timing** | **Stand** | **Fresh Weight** | **Size** |
| **(1000s/Ac)** | **(Tons/Ac)** | **(gm/plant)** |
| NonTreated | 0 | --- | 137.2 ab | 4.08 abc | 26.9 bc |
| Dacthal | 7.5 | PRE | 138.0 ab | 3.48 bcd | 23.1 d |
| Dual Magnum | 0.33 | PRE | 144.5 a | 4.28 a | 26.9 bc |
| Dual Magnum | 0.5 | PRE | 134.6 ab | 4.15 ab | 28.1 ab |
| Dual Magnum | 0.65 | PRE | 119.7 ab | 3.20 d | 24.5 cd |
| Dual Magnum | 0.33 | 1-Wk POST | 122.3 ab | 3.43 cd | 25.6 bcd |
| Dual Magnum | 0.5 | 1-Wk POST | 121.5 ab | 3.45 bcd | 26.2 bc |
| Dual Magnum | 0.65 | 1-Wk POST | 122.8 ab | 4.05 abc | 30.1 a |
| Pyridate +  X-77 NIS | 0.47 +  0.25% v/v | POST | 115.0 b | 1.50 e | 12.0 e |
| Pyridate +  X-77 NIS | 0.62 +  0.25% v/v | POST | 79.2 c | 0.88 e | 10.0 e |
| LSD (P = .05) | | | 26.71 | 0.74 | 2.64 |
| Treatment Prob (F) | | | 0.0026 | 0.0001 | 0.3331 |

**Table 7**. Weed control (density)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Rate**  **(lbs. ai/A)** | **Timing** | **Annual Bluegrass** | **Burning Nettle** | **Shepherds-Purse** | **Total Weeds** |
| **Weed Density (No./2.8ft²)** | | | |
| NonTreated | 0 | --- | 75.5 a | 16.5 | 11.0 a | 120.3 a |
| Dacthal | 7.5 | PRE | 25.5 bc | 10.5 | 2.1 bc | 49.9 bcd |
| Dual Magnum | 0.33 | PRE | 0.5 c | 11.9 | 2.6 bc | 26.4 cd |
| Dual Magnum | 0.5 | PRE | 0.3 c | 9.9 | 1.1 bc | 22.1 d |
| Dual Magnum | 0.65 | PRE | 1.3 c | 12.6 | 0.4 c | 21.3 d |
| Dual Magnum | 0.33 | 1-Wk POST | 55.3 ab | 14.1 | 8.9 a | 87.9 ab |
| Dual Magnum | 0.5 | 1-Wk POST | 50.3 ab | 15.0 | 6.4 ab | 81.3 ab |
| Dual Magnum | 0.65 | 1-Wk POST | 64.6 a | 10.9 | 2.8 bc | 88.1 ab |
| Pyridate +  X-77 NIS | 0.47 +  0.25% v/v | POST | 58.1 ab | 1.9 | 0.9 bc | 66.8 bc |
| Pyridate +  X-77 NIS | 0.62 +  0.25% v/v | POST | 69.1 a | 1.1 | 2.3 bc | 77.4 b |
| LSD (P = .05) | | | 34.1 | 13.5 | 5.9 | 40.8 |
| Treatment Prob (F) | | | 0.0001 | 0.2968 | 0.0089 | 0.0002 |