

EVALUATION OF ZIDUA[®] AND WARRANT[®] HERBICIDES FOR WEED CONTROL IN DIRECT-SEEDED ONION

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Introduction

Few registered herbicides for weed control in direct-seeded onion necessitate continued efforts to identify potential products with weed efficacy and crop tolerance. Identification of herbicides for weed control in onion is essential in order to minimize yield losses from weed competition and realize acceptable bulb size. Onions are vulnerable to weed competition because of the slow early development and lack of a complete canopy cover to shade weeds. The weed control research program at Malheur Experiment Station endeavors to evaluate new herbicides that come on the market and determine their usefulness for weed control in direct-seeded onions grown under local production practices. The objectives of this study were to evaluate Zidua[®] and Warrant[®] herbicides for weed efficacy and to evaluate the tolerance of direct-seeded onion to these herbicides under furrow-irrigation conditions.

Material and Methods

A field study was established at Malheur Experiment Station, Ontario, Oregon in 2013 in a field previously planted to wheat. The wheat stubble was flailed and the field was plowed during fall 2012. The soil was Owyhee silt loam with a pH of 7.2 and 1.83% organic matter. Based on a soil test, 150 lb phosphate/acre and 100 lb sulfur/acre were broadcast in the fall of 2012 and the field was plowed and groundhogged. After fall fertilization the field was fumigated with Vapam[®] (metam sodium) at 16 gal/acre and simultaneously bedded on a 22-inch row spacing. On March 19, 2013, the beds were harrowed and flattened and supplemental common lambsquarters, pigweed, hairy nightshade, and kochia weed seeds were uniformly distributed across the study area using a hand spreader.

Onion variety 'Vaquero' was planted on March 19 in double rows spaced 3 inches apart with 4-inch seed spacing within each row on 22-inch beds. Lorsban[®] 15G at 3.7 oz/1,000 ft of row (chlorpyrifos 0.101 lb ai/acre) was banded over the top of onion rows on March 26 and the soil surface was rolled.

Preemergence Zidua and Warrant herbicide treatments were applied on April 1 and postemergence treatments on May 8 and June 3, 2013 when onions were at the 2-leaf stage. The complete list of herbicide treatments and rates is contained in Tables 1 and 2. The grower standard of Prowl H₂O[®] followed by Buctril[®] and GoalTender[®] were included.

The study was a randomized complete block design with four replications. Individual plots measured 7.33 ft (4 rows wide) and 27 ft long. Herbicide treatments were applied using a CO₂-

pressurized backpack sprayer fitted with a boom equipped with four EVS8002 flat-fan nozzles to deliver a spray volume of 20 gal/acre. All plots (except the untreated control) were sprayed with GoalTender and Buctril at the rates of 0.5 pt/acre, each equivalent to oxyfluorfen at 2 oz ai/acre and bromoxynil at 2 oz ai/acre, respectively, on May 8 and June 3, 2013. Plants were also sprayed (except the untreated control) with Select Max[®] (clethodim) at 1.46 oz ai/acre plus NIS (non-ionic surfactant) at 0.25% v/v on April 24 to control grassy weeds.

The first furrow irrigation was on March 28 and lasted 24 hours to supply about 4 inches of water (including runoff). All subsequent irrigations (19 times from April 16 to August 27, 2013) lasted the same duration and delivered the same amount of water.

Plants were sidedressed with urea on May 30 to supply nitrogen at 150 lb/acre. Onions were sprayed with Movento[®] (spirotetramat) at 0.078 lb ai/acre tank-mixed with Prime Oil[®] (crop oil concentrate) at 1.57 lb ai/acre on June 4 to control thrips. The onions were aerially sprayed for thrips control on June 13 using Radiant[®] at 10 oz/acre (spinetoram at 1.25 oz ai/acre) tank-mixed with Aza-Direct[®] at 16 oz/acre (azadirachtin at 0.197 lb ai/acre) plus a crop oil concentrate at 1 qt/100 gal of water. Subsequent aerial sprays for thrips control were on July 26 and July 14 using Radiant at 1.25 oz ai/acre and July 21 and 31 using Lannate[®] at 0.9 lb ai/acre each. Onions were visually evaluated for crop injury on April 26 and May 12, 2013. Weed control was evaluated subjectively on May 12 and June 24. Evaluations were based on 0 to 100%; where 0% = no weed control or crop injury and 100% = complete weed control or complete crop kill.

Plant tops were flailed and onion bulbs were lifted on September 10, 2013. Bulbs were hand-harvested from the two center rows on September 13 and graded on September 17, 2013. Bulbs were graded for quality and yield based on USDA standards. Data were subjected to analysis of variance and the treatment means were compared using LSD at 0.05% level of confidence.

Results and Discussion

Onion emergence was observed on April 12, 2013. Evaluations conducted on April 26 and May 12 indicated no apparent onion injury from herbicides applied prior to onion emergence (data not shown). Subsequent evaluation on June 24 did not show onion injury, suggesting onion tolerance to the herbicides (Table 1). Onion plant stand on May 20 was similar and ranged from 130,680 to 138,160 plants/acre across all treatments (Table 1).

Common lambsquarters control on June 24 ranged from 91 to 100% across herbicide treatments. Application of Zidua and Warrant preemergence followed by Buctril and GoalTender was similar to the grower standard of ProwlH₂O followed by Buctril and GoalTender. Pigweed control ranged from 94 to 96% across herbicide treatments. Control for kochia ranged from 49 to 96% across herbicide treatments.

Small-size onion yield varied among treatments and ranged from 2.2 to 10.3 cwt/acre compared to 10.9 cwt/acre for the untreated control (Table 2). Marketable onion yield for treatments that received Zidua prior to onion emergence ranged from 1,101 to 1,259 cwt/acre.

These results indicate possible tolerance of onion to preemergence application of Zidua and Warrant under the local conditions. However, droughty conditions during the preceding winter and spring may have masked the herbicide effects. The study will be evaluated further in 2014.

Table 1. Onion injury and weed control in direct-seeded onion with various herbicides on June 24, 2013 at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2013.

| Treatment | Rate/acre | Application timing ^a | Injury | Plant stand No./acre | Weed control | | |
|--|------------|---------------------------------|--------|-------------------------|-------------------------|-------------------------|--------|
| | | | | | common lambsquarters | pigweed species % | kochia |
| Untreated check | | | 0 | 138,160 | 0 | 0 | 0 |
| Zidua | 1.5 oz | PREPRE | 0 | 133,980 | 98 | 95 | 49 |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Zidua | 2.0 oz | PREPRE | 0 | 130,680 | 94 | 93 | 81 |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Zidua | 2.5 oz | PRE | 0 | 133,430 | 97 | 93 | 89 |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Zidua | 5.0 oz | POST | 0 | 129,580 | 91 | 96 | 91 |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Warrant | 1.5 pt | PRE | 0 | 133,760 | 95 | 95 | 68 |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Warrant | 3.0 pt | PRE | 0 | 131,230 | 92 | 95 | 66 |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Prowl H ₂ O | 2.0 pt | PRE | 0 | 135,190 | 98 | 94 | 93 |
| Nortron | 16.0 fl oz | PRE | | | | | |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Prowl H ₂ O | 2.0 pt | PRE | 0 | 129,800 | 99 | 96 | 96 |
| Nortron | 32.0 fl oz | PRE | | | | | |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Prowl H ₂ O (Grower std) | 2.0 pt | PRE | 0 | 131,670 | 97 | 96 | 89 |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Prowl H ₂ O | 2.0 pt | PRE | 0 | 136,290 | 100 | 96 | 90 |
| Sustain | 1.0 pt | PRE | | | | | |
| GoalTender | 0.25 pt | POST | | | | | |
| Buctril | 0.5 pt | POST | | | | | |
| Handweeded | | | 0 | 130,680 | 100 | 100 | 100 |
| LSD ($P = 0.05$) | | | NS | 7,303 | 5 | 4 | 20 |

^aPREPRE = preemergence to weed and onion; PRE = preemergence to weeds; POST = postemergence to weeds and onion.

Table 2. Onion yield in response to weed control with various herbicides at Malheur Experiment Station, Oregon State University, Ontario, OR, 2013.

| Treatment | Rate/acre | Application timing ^a | Marketable yield by grade | | | | | total 2¼->4 inch |
|--|------------|---------------------------------|---------------------------|---------------------|-------------------|-----------------------|--------------------------------|------------------------|
| | | | small <2¼ inch | medium 2¼-3 inch | jumbo 3-4 inch | colossal 4-4¼ inch | super- colossal >4¼ inch | |
| | | | ----- cwt/acre ----- | | | | | |
| Untreated check | | | 10.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Zidua | 1.5 oz | PREPRE | 10.3 | 58.0 | 686.8 | 296.9 | 59.8 | 1,101.4 |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Zidua | 2.0 oz | PREPRE | 5.8 | 34.6 | 690.2 | 449.5 | 84.1 | 1,258.5 |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Zidua | 2.5 oz | PRE | 6.6 | 46.5 | 712.1 | 409.0 | 78.9 | 1,246.6 |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Zidua | 5.0 oz | POST | 9.7 | 40.2 | 630.4 | 464.1 | 84.5 | 1,219.1 |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Warrant | 1.5 pt | PRE | 7.6 | 54.2 | 660.4 | 391.4 | 102.6 | 1,208.6 |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Warrant | 3.0 pt | PRE | 7.0 | 43.9 | 735.5 | 343.9 | 64.3 | 1,187.7 |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Prowl H ₂ O | 2.0 pt | PRE | 2.7 | 21.3 | 702.5 | 535.4 | 99.9 | 1,359.1 |
| Nortron | 16.0 fl oz | PRE | | | | | | |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Prowl H ₂ O | 2.0 pt | PRE | 6.3 | 47.8 | 649.6 | 440.0 | 153.2 | 1,290.6 |
| Nortron | 32.0 fl oz | PRE | | | | | | |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Prowl H ₂ O (Grower std) | 2.0 pt | PRE | 2.2 | 25.3 | 607.1 | 541.0 | 175.3 | 1,348.7 |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Prowl H ₂ O | 2.0 pt | PRE | 5.4 | 41.7 | 727.6 | 403.9 | 93.8 | 1,267.0 |
| Sustain | 1.0 pt | PRE | | | | | | |
| GoalTender | 0.25 pt | POST | | | | | | |
| Buctril | 0.5 pt | POST | | | | | | |
| Handweeded | | | 8.5 | 65.3 | 710.4 | 188.7 | 21.3 | 985.7 |
| LSD (<i>P</i> = 0.05) | | | 7.7 | 33.4 | 119.9 | 204.9 | 90.5 | 196.2 |

^aPREPRE = preemergence to weed and onion; PRE = preemergence to weeds; POST = postemergence to weeds and onion.