

# EVALUATION OF DUAL MAGNUM<sup>®</sup> AND OUTLOOK<sup>®</sup> USED PREEMERGENCE ON DIRECT-SEEDED DRY BULB ONIONS WITH ACTIVATED CHARCOAL

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## Introduction

Weeds are a major concern for onion growers in the Treasure Valley of eastern Oregon and southwestern Idaho. The sparse foliage and slow growth makes onions poor competitors with weeds. Large weeds can also reduce air circulation around plants, increasing the risk of foliar diseases. Yellow nutsedge particularly is a threat to direct-seeded onions throughout the Treasure Valley. Preliminary studies indicated the effectiveness of activated charcoal to neutralize Dual Magnum<sup>®</sup> (*S*-metolachlor) and Outlook<sup>®</sup> (dimethenamid-p) in the onion row when applied preemergence on direct-seeded onions (Felix and Ishida 2009, Felix et al. 2010). Currently, Dual Magnum and Outlook are registered for application to onion only when plants have attained the two-leaf stage. However, the best weed control results are realized when each herbicide is applied prior to weed emergence. The objective of this study was to evaluate the potential use of activated charcoal to neutralize Dual Magnum and Outlook immediately within the onion row when applied prior to onion emergence. Also, half of the treatments received 0.5 inch of overhead irrigation to evaluate the response of onion seedlings to herbicides applied prior to onion emergence with and without charcoal. **Dual Magnum and Outlook herbicides are not currently registered for pre-emergence application on direct-seeded dry bulb onions. Always read herbicide labels to ensure that the product is registered for the intended use.**

## Materials and Methods

A field study was conducted in 2011 at the Malheur Experiment Station, Ontario, Oregon to evaluate the potential use of activated charcoal to neutralize Dual Magnum and Outlook within the onion row and protect the emerging plants from the herbicide effects. A similar study was conducted in 2010 and the results are presented in Table 2. The study also evaluated the effect of simulated rain (0.5 inches) shortly after herbicide application and before onion emergence.

The field was plowed and beds formed during fall 2010. Enough fertilizer to provide 44, 210, 210, 5, 8, and 5 lb/acre of nitrogen, phosphate, sulfur, zinc, and manganese was applied during fall 2010. The beds were harrowed during spring 2011 and onion variety ‘Vaquero’ was planted on April 13, 2011. The study followed a split-plot design with simulated rain (with and without) forming the main blocks into which herbicide rates were randomly assigned as subplots. The study had three replications and the plot size was 7.33 ft wide (4 22-inch beds) by 25 ft long. The entire trial was sprayed with Roundup<sup>®</sup> at 22 fl oz/acre (0.77 lb ae/acre) on April 22 to control

volunteer wheat prior to onion emergence. Lorsban® 15G (chlorpyrifos at 0.125 lb ai/acre) was banded at 3.7 oz/1,000 ft of row over the entire field 5 days after planting as a preventive measure against onion maggots. Activated charcoal was applied in the onion row at the time of planting and herbicide treatments were applied on April 22, 2011.

The activated charcoal used was GRO-SAFE® (Norit Americas Inc., Atlanta, GA). Activated charcoal was applied using a modified planter fitted with a 25-gal Rear's NIFTY Tank Series (Rear's Manufacturing Co., Eugene, OR) and set to apply a 1-inch band of activated charcoal slurry directly over the onion row. Activated charcoal was applied at a rate of 25 lb/acre in 50 gal of water on the ground directly behind the onion planter's press wheel. After planting and charcoal application, Dual Magnum was applied preemergence at the rates of 1 pt/acre or 1.33 pt/acre (*S-metolachlor* at 0.95 lb ai/acre or 1.27 lb ai/acre) and Outlook at 10.5 fl oz/acre preemergence followed by 10.5 fl oz/acre when onions were at the two-leaf stage (dimethenamid-p at 0.49 lb ai/acre) or preemergence at 21 fl oz/acre (dimethenamid-p at 0.98 lb ai/acre). The study also included a grower standard, Prowl® H2O at 2 pt/acre (pendimethalin at 1 lb ai/acre) before onion emergence followed by Buctril® and Goal® 2XL herbicides that were applied when onions were at the two-leaf stage. The Dual Magnum and Outlook treatments were also treated with Goal 2XL and Buctril herbicides at 0.5pt/acre (oxyfluorfen and bromoxynil at 0.25 and 0.125 lb ai/acre, respectively) on June 9. An untreated control was also included.

Half of the main plots received sprinkler irrigation on April 27, 2011, simulating 0.5 inches of rainfall in 1 hour. The study area was furrow irrigated on May 7 and received regular irrigations to maintain adequate moisture in the top 12 inches of the soil profile.

Plant stand evaluations were accomplished by counting plants in the center two rows of the plot on May 20. The entire study area was sprayed with Poast at 1.5 pt/acre (sethoxydim at 0.28 lb ai/acre) tank-mixed with crop oil at 2 pts/acre on May 24. Plants were fertilized on June 22 using urea to supply 225 lb nitrogen/acre.

The insecticide Movento® was applied on June 13 at a rate of 5 fl oz/acre (spirotetramat at 0.078 lb ai/acre) plus Pierce methylated seed oil (MSO) at a rate of 1.5 pt/acre for onion thrips control. Onions were sprayed for thrips control again on June 22 and July 5 using a tank mixture of Radiant® at 10 fl oz/acre (spinetoram at 0.078 lb ai/acre) plus crop oil at 1 qt/100 gal of water. The final spray for thrips control was on June 24 with Lannate® at 3 pt/acre (methomyl at 0.9 lb ai/acre).

Plant tops were flailed on September 8 and the bulbs were lifted on September 13 and left on the ground to cure. Bulbs were handpicked from 15 ft of the 2 center rows of each plot on September 20. The onion bulbs were graded for yield and quality on September 23 following USDA standards. During grading, bulbs were separated according to quality: bulbs without blemishes (U.S. No. 1), split bulbs (No. 2), neck rot (bulbs infected with the fungus *Botrytis allii* in the neck or side), plate rot (bulbs infected with the fungus *Fusarium oxysporum*), and black mold (bulbs infected with the fungus *Aspergillus niger*). The U.S. No. 1 bulbs were graded according to diameter: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and super colossal (>4¼ inches). The data collected were subjected to analysis of variance and means compared using LSD at  $P = 0.05$ .

## Results and Discussion

There was a three-way interaction (irrigation by herbicide by charcoal) for onion plant stand on May 22 for some treatments (Table 1). The best onion plant stand (104,445 plants/acre) was obtained from plots that were banded with charcoal, treated with Dual Magnum at 1.33 pt/acre, and irrigated prior to onion emergence. It is unclear why the plant stand was reduced when Dual Magnum at 1 pt/acre was applied in plots treated with and without charcoal but not irrigated. A similar response was observed when Outlook at 10.5 and 21 fl oz/acre were separately applied without charcoal and irrigation. The plant stand was not reduced in plots that received the grower standard treatment with and without charcoal and irrigation.

Evaluations of May 22 indicated significantly improved yellow nutsedge control when Dual Magnum and Outlook were applied prior to onion emergence. Yellow nutsedge was controlled 88 to 97 percent when Dual Magnum was applied at 1 pt/acre and 78 to 98 percent when it was applied at 1.33 pt/acre. Outlook at 10.5 fl oz/acre controlled yellow nutsedge 64 to 95 percent, whereas 21 fl oz/acre provided 89 to 99 percent control. Application of Outlook at 10.5 fl oz with charcoal but without irrigation provided the lowest yellow nutsedge control at 64 percent. The grower standard application of Prowl H20 at 2 pt/acre followed by GoalTender<sup>®</sup> and Buc-tril provided 55 to 79 percent yellow nutsedge control. Nutsedge control assessed on September 9 indicated reduced yellow nutsedge control across herbicide treatments (Table 1). However, yellow nutsedge control was relatively better for the plots that received charcoal and were irrigated at the beginning of the study.

The marketable onion yield was variable across treatments with a general trend of higher yields for treatments that were treated with charcoal (Table 1). The analysis indicated significant difference among treatments for the marketable onion yield (Table 3). The highest marketable onion yield was obtained when Dual Magnum and Outlook were applied at 1 pt/acre and 21 fl oz/acre, respectively. These results may have been influenced by the weather in 2011. The cool weather early in the season may have ameliorated the herbicide effects on treatments that did not receive charcoal.

It should be noted that windy conditions at or around the time of planting delayed the intended application date of herbicides and sprinkler irrigation. Preemergence herbicides were not applied until 9 days after planting and the sprinkler irrigation was applied 5 days after herbicide application. These factors coupled with the heavy silt loam soil may have masked the negative herbicide effects on treatments that did not receive charcoal. It is unclear how these treatments would perform under lighter sandy soil conditions. The study will be repeated in 2012.

## References

- Felix, J., and J. Ishida. 2009. Use of activated charcoal to detoxify Dual Magnum<sup>®</sup> and Outlook<sup>®</sup> applied pre-emergence on direct-seeded onions. Oregon State University Malheur Agricultural Station Annual Report, Ext/CrS131:115-118.
- Felix, J., K. V. Osborne, and J. Ishida. 2010. Evaluation of Dual Magnum<sup>®</sup> and Outlook<sup>®</sup> used pre-emergence on direct-seeded dry bulb onions with activated charcoal. Oregon State University Malheur Agricultural Station Annual Report Ext/CrS132:120-125.

Table 1. Onion plant population (plants/acre) and yellow nutsedge control in response to preemergence application of Dual Magnum and Outlook herbicides with and without activated charcoal (25 lb/acre) and irrigation (0.5 inch) at the Malheur Experiment Station, Ontario, OR, 2011.

Treatment <sup>a</sup>	Rate	Charcoal	Irrigation	Plant stand	YNS Control <sup>b</sup>		Onion yield	
				May 22	May 22	Sep 9	U.S. No. 1	
		25 lb/acre	0.5 in	Plants/acre		%	cwt/acre	
Prowl H2O	2	pt/a	No					
GoalTender	0.25	pt/a	Yes	No	74,085	55	3	228
Prowl H2O	2	pt/a	Yes	Yes	88,605	79	18	383
Prowl H2O	2	pt/a	No	No	85,140	70	0	257
Prowl H2O	2	pt/a	No	Yes	84,480	43	0	238
Dual Magnum	1	pt/a	Yes	No	70,950	88	67	371
Dual Magnum	1	pt/a	Yes	Yes	102,960	94	85	551
Dual Magnum	1	pt/a	No	No	69,795	93	82	554
Dual Magnum	1	pt/a	No	Yes	96,360	97	88	461
Dual Magnum	1.3	pt/a	Yes	No	88,440	78	38	353
Dual Magnum	1.3	pt/a	Yes	Yes	104,445	92	70	504
Dual Magnum	1.3	pt/a	No	No	81,510	88	65	421
Dual Magnum	1.3	pt/a	No	Yes	97,020	98	80	469
Outlook	10.5	fl. oz/a	Yes	No	72,435	64	18	297
Outlook	10.5	fl. oz/a	Yes	Yes	93,390	90	40	405
Outlook	10.5	fl. oz/a	No	No	74,250	85	20	339
Outlook	10.5	fl. oz/a	No	Yes	100,815	95	47	470
Outlook	21	fl. oz/a	Yes	No	93,720	89	52	458
Outlook	21	fl. oz/a	Yes	Yes	92,565	95	67	479
Outlook	21	fl. oz/a	No	No	68,805	93	57	480
Outlook	21	fl. oz/a	No	Yes	100,815	99	76	564
Untreated			Yes	No	77,385	0	0	190
Untreated			Yes	Yes	99,495	0	0	425
Untreated			No	No	80,355	0	0	313
Untreated			No	Yes	86,460	0	0	280
LSD ( $P < 0.05$ )					16,295	18	33	215

<sup>a</sup> Prowl H2O was applied prior to onion emergence. All treatments (except the untreated control) were also sprayed with GoalTender at 0.5 pt/acre (0.25 lb ai/acre) and Buctril at 0.5 pt/acre (0.125 lb ai/acre) when onions were at the two-leaf stage.

<sup>b</sup> Visual evaluation of the percentage of control of yellow nutsedge (YNS).

Table 2. Onion plant population (plants/acre) and yellow nutsedge control in response to preemergence application of Dual Magnum and Outlook herbicides with and without activated charcoal and irrigation at the Malheur Experiment Station, Ontario, OR, 2010.

Treatment <sup>a</sup>	Rate	Charcoal	Irrigation	Plant stand	YNS Control <sup>b</sup>	Onion yield
				May 4	June 9, 2010	U.S. No. 1
		25 lb/acre	0.5 in	Plants/acre	%	cwt/acre
Prowl H2O <sup>c</sup>	2 pt/a	No	No	103,148	74	464
Dual Magnum	1 pt/a	Yes	No	101,164	92	557
Dual Magnum	1 pt/a	Yes	Yes	82,915	87	410
Dual Magnum	1 pt/a	No	No	82,518	87	491
Dual Magnum	1 pt/a	No	Yes	64,666	90	292
Dual Magnum	1.3 pt/a	Yes	No	80,138	89	387
Dual Magnum	1.3 pt/a	Yes	Yes	92,436	92	379
Dual Magnum	1.3 pt/a	No	No	91,643	96	511
Dual Magnum	1.3 pt/a	No	Yes	68,236	92	260
Outlook	10.5 fl. oz/a	Yes	No	82,518	70	460
Outlook	10.5 fl. oz/a	Yes	Yes	84,898	81	380
Outlook	10.5 fl. oz/a	No	No	90,056	79	427
Outlook	10.5 fl. oz/a	No	Yes	55,144	83	242
Outlook	21 fl. oz/a	Yes	No	87,279	80	424
Outlook	21 fl. oz/a	Yes	Yes	71,410	88	256
Outlook	21 fl. oz/a	No	No	93,626	86	415
Outlook	21 fl. oz/a	No	Yes	38,085	82	142
Untreated		Yes	No	76,071	0	199
LSD ( $P < 0.05$ )				28,158	21	158

<sup>a</sup> Prowl H2O was applied prior to onion emergence followed by GoalTender at 0.5 pt/acre (0.25 lb ai/acre) and Buctril at 0.5 pt/acre (0.125 lb ai/acre) when onions were at the two-leaf stage. Dual Magnum and Outlook treatments were also sprayed with GoalTender at 0.5 pt/acre (0.25 lb ai/acre) and Buctril at 0.5 pt/acre (0.125 lb ai/acre) when onions were at the two-leaf stage.

<sup>b</sup> Visual evaluation of the percentage of control of yellow nutsedge.

<sup>c</sup> Prowl H2O followed by GoalTender and Buctril plots in 2010 were in an area with very low yellow nutsedge density and were excluded from analysis.

Table 3. Onion yield in response to preemergence application of Dual Magnum and Outlook herbicides averaged over activated charcoal and irrigation treatments at the Malheur Experiment Station, Ontario, OR, 2011.

Treatment <sup>a</sup>	Rate	Onion yield					
		Small	Medium	Jumbo	Colossal	Super colossal	Marketable yield
		----- cwt/acre -----					
Prowl H2O	2 pt/a						
GoalTender	0.25 pt/a	35.2	102.1	171.2	3.2	0.0	276.6
Dual Magnum	1 pt/a	11.8	73.4	357.5	48.1	5.4	484.4
Dual Magnum	1.33 pt/a	17.5	99.5	314.9	19.3	3.1	436.8
Outlook	10.5 fl oz/a	19.1	102.8	247.4	22.6	5.1	377.8
Outlook	21 fl oz/a	12.3	88.0	354.5	47.8	5.1	495.4
Untreated		37.7	83.7	196.6	20.5	1.0	301.8
LSD $P < 0.05$		12.2	NS	84.7	32.4	NS	91.0

<sup>a</sup> Prowl followed by GoalTender was applied when onions were at the two-leaf stage. All treatment (except the untreated control) were also sprayed with GoalTender at 0.5 pt/acre (0.25 lb ai/acre) and Buctril at 0.5 pt/acre (0.125 lb ai/acre) when onions were at the two-leaf stage.