

## Nutsedge Control in Onions

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### INTRODUCTION

There were 49,000 acres of onions produced in California in 2007 which is 30% of US production (NASS, 2008). 2,255 of the California acres are located in Monterey and Ventura Counties. The coastal districts provide a specific niche for the onion market by supplying onions late summer to fall when other districts have finished harvest operations. Onions are particularly susceptible to weed pressure because they have slow seedling development and they do not form a competitive canopy later in the growth cycle. In conventional systems growers rely upon a preemergence herbicide to reduce weed pressure during the seedling stage and upon postemergence applications to kill escaped weeds and to apply a preemergence material to inhibit weed emergence later in the growth cycle. In 2007 and 2008 several new registrations of herbicides or modified labeled uses were granted:

- Goal Tender for use at the 1<sup>st</sup> true leaf stage (prior label use stated 2<sup>nd</sup> true leaf stage)
- Prowl H2O for use at the loop stage (prior label use stated 2<sup>nd</sup> to 9<sup>th</sup> true leaf stage)
- Nortron for preemergence and postemergence use (growth stage not specified)
- Outlook for use against yellow nutsedge at the 2<sup>nd</sup> true leaf stage
- Dual Magnum for use against yellow nutsedge at the 4<sup>th</sup> true leaf stage

These registrations have greatly improved weed control programs in onions by giving growers increased herbicide choices and increased flexibility regarding when during the crop cycle they can be used.

Outlook was registered in 2007 prior to the onion growing season and growers used this material during both the 2007 and 2008 growing seasons. Dual Magnum was registered at the end of the growing season in 2008 and growers have not yet been able to use it along the coast. Outlook is registered for use at the 2<sup>nd</sup> true leaf stage and Dual Magnum at the 4<sup>th</sup> true leaf stage. Yellow nutsedge (*Cyperus esculentus*) is a warm season weed that emerges when soil temperatures warm in the late spring. In 2006 the weather was wet and cool. In a trial conducted in 2006, both Outlook and Dual Magnum were applied at the 2<sup>nd</sup> true leaf stage (May 8) and there was little emergence of yellow nutsedge at that time. Both materials had reduced nutsedge emergence at the weed evaluation conducted 76 days after planting. A small number of nutsedge plants broke through at the 120 days after planting weed evaluation, but in general both materials provided excellent control of yellow nutsedge and good safety to the onions. However, in the 2007 trial

the spring weather was dry and warm and by the 2<sup>nd</sup> true leaf stage on April 11 there was significant emergence of well developed nutsedge plants. Outlook is not effective against established nutsedge plants. As a result, this research project was initiated to evaluate burning nutsedge back with an acid fertilizer (7-7-0-7) and then applying Outlook. This research report discusses the results of trials conducted in 2007 and 2008.

## **METHODS**

Two field trials were conducted in Monterey County: **Trial No. 1:** This trial was established with a cooperating grower south of King City. The soil at the site was Metz complex loamy sand. Each plot was one 40 inch bed wide by 25 feet long; the plots were arranged in a randomized complete block design with four replications. The field variety was ‘Tamara’ and was planted on March 4, 2007. Prior to the establishment of the trial, the field had been treated with Dacthal post plant preemergence and Goal Tender at the first true leaf stage; both of these materials had no impact on the nutsedge population. First true leaf applications were made on April 4 and second true leaf on April 11. The acid based fertilizer 7-7-0-7 and Outlook was applied at the first and second true leaf stages (see Tables for application rates and timing). Irrigation was applied on the first or second day following the Outlook applications to incorporate the material into the soil. Evaluations of the number of nutlets in the soil of each treatment were conducted by collecting roughly 8,000 – 10,000 cm<sup>3</sup> of soil on September 27. The soil was sieved to remove all nutlets in the soil which were then counted and weighed. The number of nutlets in each sample was converted to nutlets per 1,000 cm<sup>3</sup>. Yield evaluations were conducted on September 27 by harvesting all bulbs in an eight foot long strip in the middle of each plot and counting and weighing bulbs. **Trial No. 2:** This trial was conducted with a cooperating grower west of San Ardo. The soil type at the site was Pico fine sandy loam. Each plot was one 40-inch bed wide by 30 feet long and replicated four times in a randomized complete block design. The field variety was planted to a proprietary dehydration variety from ConAgra on March 10. Prior to the establishment of the trial, the field had been treated with Dacthal post plant preemergence and Goal Tender at the first true leaf stage; both of these materials had no impact on the nutsedge population. The first true leaf applications were made on April 10 and the second true leaf on April 21. The acid based fertilizer 7-7-0-7 and Outlook were applied at the first and second true leaf stages (see Tables for application rates and timing). Irrigation was applied on the first or second day following the Outlook applications to incorporate the material into the soil. Evaluations of the number of nutlets in the soil of each treatment were conducted by collecting roughly 8,000 – 10,000 cm<sup>3</sup> of soil on September 19. The soil was sieved to remove all nutlets in the soil which were then counted and weighed. The number of nutlets in each sample was converted to nutlets per 1,000 cm<sup>3</sup>. Yield evaluations were conducted on September 19 by harvesting all bulbs in an eight foot long strip in the middle of each plot and counting and weighing bulbs. **Trial No. 3.** In a herbicide trial at Oxnard, CA, May – September 2007, Outlook and Dual Magnum were evaluated for yellow nutsedge control in a sandy loam soil. Dual Magnum was applied at 4 leaf stage of onion at 0.63 lb a.i. /acre (May) and repeatedly at 0.95 lb a.i./acre at 5-6 leaf stage (June) and at bulb formation in July, while Outlook was applied at the same three timings but always at 0.33 lb a. i. /acre rate.

**Details for all trials:** All materials were applied with a CO<sub>2</sub> backpack sprayer with two passes of a one nozzle wand with an 8008E tip at 30 psi applying the equivalent of 72 gallons per acre.

## RESULTS

**Trial No. 1:** The trial site was heavily infested with yellow nutsedge. The nutsedge was emerged by the time the onions were at the first and second true leaf stage. Given that Outlook is a post emergence material, it was thought that if the nutsedge was burned back with an acid based fertilizer (e.g. 7-7-0-7) then Outlook could inhibit the emergence of new leaves of nutsedge. Weed pressure was so extreme in the trial that weed control ratings were used to evaluate treatments rather than weed counts. First true leaf applications of Outlook gave better weed control than second true leaf applications on the April 23 and May 4 evaluation dates, but by June 1 all Outlook treatments had similar weed control ratings (Table 1). All Outlook treatments had greatly improved weed control than the untreated control. However, on the August 9 evaluation date the nutsedge began to resprout and weed control began to breakdown. There was no significant phytotoxicity in any of the treatments. There were significantly fewer nutsedge and lower weight of nutsedge nutlets in the soil in the Outlook treated plots (Table 2). There is a trend that indicates that the 14 oz/A application had fewer nutsedge in the soil than the two sequential applications of 7.0 oz/A. Yields of all Outlook treatments were improved over the untreated (Table 2). However, yields were less than observed in an adjacent trial in a part of the field with little nutsedge pressure (data not shown), which may indicate that there was a yield reduction which may have been due to the following factors: 1) nutsedge pressure; 2) phytotoxicity from 7-7-0-7 applications; or 3) a combination of these factors.

**Trial No. 2:** This trial was conducted in a field with an extremely high nutsedge population. Nutsedge was emerged and well established by the first and second true leaf stages. Early applications of the acid fertilizer 7-7-0-7 in combination with 7.0 or 14.0 oz/A of Outlook provided the better nutsedge control for two months after application than applications made at the 2<sup>nd</sup> true leaf stage (Table 3). By July 29 the level of control provided by Outlook was breaking down and the nutsedge was resprouting and all treatments declined in efficacy. One treatment included Goal Tender at the first true leaf stage and this treatment also provided excellent weed control but was the most phytotoxic treatment on most evaluation dates (Table 3). The stand of onions in this trial was impacted by the high nutsedge population early in the growth cycle and the yield evaluations are a bit difficult to interpret due to variability in the data. In general it appears that the 1<sup>st</sup> true leaf applications of Outlook at 14.0 oz/A had lower yield than the 7.0 followed by 7.0 oz/A treatment. The untreated plots had no marketable yield. The variety used in this trial was less vigorous than varieties used for fresh market and the regrowth of nutsedge was higher in the part of the field with this variety than in an adjacent planting of a more vigorous fresh market type of onion.

**Trial No. 3.** Dual Magnum completely prevented nutsedge shoot emergence from 21 May to 26 June, while Outlook reduced it more than 70% during the same period compared to untreated control, in which 77 shoots per 45ft<sup>2</sup> plot emerged. In July nutsedge emergences continued at

accelerated rate due to warmer soil temperatures and changed from 77 shoots/plot to 278 shoots/plot from 11 July to 7 August. Repeated applications of increased rate of Dual Magnum were effective in preventing shoot germination and the nutsedge shoot density changed from 10 to 18 shoots/plot for the same time period, and was significantly lower than untreated. Nutsedge emergence in plots treated with Outlook changed from 20 to 61 shoots/plot but was not statistically different from untreated control, likely due to large variability in nutsedge density among all plots. No significant crop injury or associated yield reduction was observed following these in-season applications of Dual Magnum and Outlook.

## **CONCLUSIONS**

Yellow nutsedge is a serious weed in onion production. It cannot be effectively removed by hand or cultivation and has the potential to devastate the yield of onions. Both Outlook and Dual Magnum are registered for use on onions to control yellow nutsedge. Neither of these materials have postemergence activity on onions and in most years the nutsedge will be emerged prior to the allowed timing for use of these materials. These trials showed that burning nutsedge back with an acid based fertilizer such as 7-7-0-7 allowed the subsequent application of Outlook to effectively inhibit nutsedge regrowth for about two months. The control provided by Outlook and Dual Magnum helped to safeguard the yield of onions which otherwise was greatly reduced by competition by nutsedge. Outlook reduced the number and size of nutsedge tubers in treated plots and may help reduce nutsedge pressure in subsequent crops. Dual was safe in onions when applied in-season and provided good nutsedge control in southern California, where yellow nutsedge emerges continuously throughout late spring and summer.

## **LITERATURE CITED**

NASS. 2008. Vegetable 2007 Summary. Agricultural Statistics Board, NASS USDA. Washington, D.C. 86 pp.

Pereira, W., G. Crabtree and R.D. Williams. 1987. Herbicide action on purple and yellow nutsedge (*Cyperus rotundus* and *C. esculentus*). Weed Technology 1:92-98.

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Table 1. Trial No. 1. Weed ratings<sup>1</sup> and phytotoxicity ratings on April 23, May 4, June 1 and August 9, 2007

No.	Treatment	Material/A	a.i./A lbs	Application Timing	Nutsedge			Phytotoxicity			
					4/23	5/4	6/1	4/23	5/4	6/1	8/9
1	7-7-0-7	35 gallons		Post 1 t. leaf	5.8	7.8	8.3	0.2	0.0	0.0	0.0
	Fb Outlook 6.0	7.0 oz	0.33	Post 1 t. leaf							
	Fb Outlook 6.0	7.0 oz	0.33	14 days later							
2	7-7-0-7	35 gallons		Post 1 t. leaf	6.7	8.0	8.6	0.3	0.0	0.0	0.0
	Fb Outlook 6.0	14.0 oz	0.66	Post 1 t. leaf							
3	7-7-0-7	35 gallons		Post 2 t. leaf	2.3	4.2	8.1	0.0	0.0	0.0	0.0
	Fb Outlook 6.0	7.0 oz	0.33	Post 2 t. leaf							
	Fb Outlook 6.0	7.0 oz	0.33	14 days later							
4	7-7-0-7	35 gallons		Post 2 t. leaf	2.8	5.3	8.0	0.0	0.0	0.0	0.0
	Fb Outlook 6.0	14.0 oz	0.66	Post 2 t. leaf							
5	Untreated	----	----	----	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	LSD (0.05)	----	----	----	0.9	1.1	0.6	n.s.	n.s.	n.s.	n.s.

1 – Scale: 0 = no weed control to 10 complete weed control.

Table 2. Trial No. 1. Yellow nutsedge nutlet counts in soil and onion yield evaluations on September 27, 2007

No.	Treatment	Material/A	a.i./A lbs	Application Timing	Nutlets/ 1000 cm <sup>3</sup> soil	Nutlets Wt (gr)/ 1000 cm <sup>3</sup> soil	Nutlets Mean wt (gr)	Onion Yield Tons/A	Onion Yield Bulbs/A	Onion Mean wt/head
	Fb Outlook 6.0	7.0 oz	0.33	Post 1 t. leaf						
	Fb Outlook 6.0	7.0 oz	0.33	14 days later						
2	7-7-0-7	35 gallons		Post 1 t. leaf	61.8 a	5.28 a	0.079	47.2	89,854	0.86
	Fb Outlook 6.0	14.0 oz	0.66	Post 1 t. leaf						
3	7-7-0-7	35 gallons		Post 2 t. leaf	116.8 a	7.51 a	0.076	45.7	88,220	0.84
	Fb Outlook 6.0	7.0 oz	0.33	Post 2 t. leaf						
	Fb Outlook 6.0	7.0 oz	0.33	14 days later						
4	7-7-0-7	35 gallons		Post 2 t. leaf	98.2 a	6.21 a	0.070	46.3	90,181	0.84
	Fb Outlook 6.0	14.0 oz	0.66	Post 2 t. leaf						
5	Untreated	----	----	----	290.6 b	25.45 b	0.093	34.7	97,533	0.58
	LSD (0.05)	----	----	----	123.8	8.90	n.s.	9.9	n.s.	0.14

1 – Scale: 0 = no weed control to 10 complete weed control.

Table 3. Trial No. 2: Nutsedge weed rating<sup>1</sup> (upper number in each cell) and Phytotoxicity ratings<sup>2</sup> (lower number in each cell – shaded grey) on six dates.

Treatment	Material /A	Timing	April 25	April 29	May 8	May 14	June 5	July 29
7-7-0-7 Outlook	60 gal 7 oz	1 <sup>st</sup> true leaf 1 <sup>st</sup> true leaf	7.0	7.5	7.0	6.6	7.8	4.5
7-7-0-7 Outlook	30 gal 7 oz	2 <sup>nd</sup> true leaf 2 <sup>nd</sup> true leaf	3.2	2.7	1.2	2.0	1.5	3.0
7-7-0-7 Outlook	60 gal 14 oz	1 <sup>st</sup> true leaf 1 <sup>st</sup> true leaf	8.0	8.5	8.5	8.3	9.1	5.0
7-7-0-7 Outlook	30 gal	2 <sup>nd</sup> true leaf	3.7	3.7	3.0	3.5	4.2	2.8
7-7-0-7 Outlook	60 gal 7 oz	2 <sup>nd</sup> true leaf 2 <sup>nd</sup> true leaf	3.7	6.2	4.7	5.0	4.2	3.8
7-7-0-7 Outlook	60 gal 14 oz	2 <sup>nd</sup> true leaf 2 <sup>nd</sup> true leaf	2.5	2.0	1.0	1.5	2.0	2.3
7-7-0-7 Outlook	60 gal 14 oz	2 <sup>nd</sup> true leaf 2 <sup>nd</sup> true leaf	5.0	6.5	5.5	5.0	6.5	3.5
7-7-0-7 Outlook	60 gal 14 oz	1 <sup>st</sup> true leaf 1 <sup>st</sup> true leaf	3.2	2.0	0.7	1.7	1.7	2.5
7-7-0-7 Outlook	60 gal 14 oz	1 <sup>st</sup> true leaf 1 <sup>st</sup> true leaf	7.8	8.2	8.7	8.0	8.3	5.8
Goal Tender	8 oz	1 <sup>st</sup> true leaf	4.2	4.2	3.0	4.2	3.5	4.0
Untreated	----	----	0.0	0.0	0.0	0.0	0.0	0.0
Pr>F Weed Rating			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD 0.05 Weed Rating			1.5	0.7	1.3	1.3	1.6	1.6
Pr>F Phytotoxicity			<0.0001	<0.0001	<0.0001	<0.0001	0.0004	0.0009
LSD Phytotoxicity			0.6	1.1	0.6	1.2	1.5	1.4

1 – Rating: 0 = no weed control to 10 = total weed control; 2 – Scale: 0 = no crop damage to 10 = crop dead

Table 4. Trial No. 2: Yield evaluation on September 19.

Treatment	Material/A	Timing	Marketable			Culls			Total				
			1000's/A	T/A	Mean lbs	1000's/A	T/A	Mean lbs	1000's/A	T/A	Mean lbs		
7-7-0-7	60 gal	1 <sup>st</sup> true leaf											
Outlook	7 oz	1 <sup>st</sup> true leaf	128.7	14.4	0.22	10.8	0.1	0.04	139.5	14.6	0.21		
7-7-0-7	30 gal	2 <sup>nd</sup> true leaf											
Outlook	7 oz	2 <sup>nd</sup> true leaf											
7-7-0-7	60 gal	1 <sup>st</sup> true leaf											
Outlook	14 oz	1 <sup>st</sup> true leaf	84.9	11.2	0.28	9.1	0.3	0.05	94.0	11.6	0.26		
7-7-0-7	30 gal	2 <sup>nd</sup> true leaf											
7-7-0-7	60 gal	2 <sup>nd</sup> true leaf	110.1	9.4	0.17	36.8	0.8	0.05	147.0	10.3	0.15		
Outlook	7 oz	2 <sup>nd</sup> true leaf											
7-7-0-7	60 gal	2 <sup>nd</sup> true leaf											
Outlook	14 oz	2 <sup>nd</sup> true leaf	143.1	16.2	0.23	18.6	0.5	0.05	161.8	16.7	0.21		
7-7-0-7	60 gal	1 <sup>st</sup> true leaf											
Outlook	14 oz	1 <sup>st</sup> true leaf	102.5	11.8	0.23	14.1	0.4	0.05	116.6	12.1	0.21		
Goal	8 oz	1 <sup>st</sup> true leaf											
Tender													
Untreated	----	----	0.0	0.0	0.0	1.0	0.1	0.01	1.0	0.1	0.01		
Pr>F			<0.0001	<0.0001	<0.0001	0.0870	0.0488	0.0228	<0.0001	<0.0001	<0.0001		
LSD 0.05			33.0	3.5	0.06	23.7	0.5	0.03	48.7	3.5	0.06		