

Evaluation of Fall Application of Dual Magnum for Control of Yellow Nutsedge in Onions Grown on Muck Soils

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Background:

Yellow nutsedge (*Cyperus esculentus* L.) pressure is very high in certain muck areas where onions are grown. It appears to have become more of a problem in recent years. Onion growers and chemical company representatives believe that applying Dual Magnum, active ingredient metalochlor, in the fall can significantly reduce nutsedge pressure the following spring. However, weed scientists across the country do not believe that fall applications of metalochlor would have any effect on nutsedge populations the following spring, because the dissipation of metolachlor, is relatively rapid, 4-7 weeks in the northern United States. Dual Magnum is labeled as a fall application in field corn and soybeans only in Iowa, Minnesota, Minnesota, North Dakota, South Dakota and Wisconsin. For this use, there are restrictions on the label that state the date after which Dual Magnum may be applied, that soil temperature in the top 4 inches must consistently be 55°F and lower, and that tillage following incorporation must not exceed the 2-3 inch depth of incorporation.

Objectives:

1. To determine whether a fall application of Dual Magnum controls yellow nutsedge the following spring in onions grown on muck soil in New York.
2. To determine onion tolerance to a fall application of Dual Magnum.

If applying Dual Magnum in the fall is effective at controlling yellow nutsedge in onions and does not cause an unreasonable amount of crop injury, we would like to pursue adding this use to the label in New York for onions grown on muck.

Trials were conducted in 2007-2008, 2008-2009 and in 2009-2010.

Year One: 2007-2008

Trial Establishment:

The first trial was located on the Webster Muck near Clarendon, New York in a grower field that suffered from severe yellow nutsedge pressure. During the second week of September 2007, after the onion crop was harvested, the grower applied Dual Magnum at a rate of 2 quarts per acre, approximately 4 times the recommended rate to use on an onion crop (0.6 – 1.3 pt per acre). Dual Magnum was applied using the grower's sprayer, leaving 20 foot wide strips untreated, between 60 foot strips that were treated. After application, Dual Magnum was shallowly incorporated 2-4 inches. September 2007 had an average air temperature of 61.5 °F, with the minimum and maximum temperatures being 35°F and 91.8 °F, respectively. Rainfall for the month was 2.3 inches.

Evaluations:

The field was divided into three replications, each including a fall Dual Magnum treatment and an untreated. Each treatment-replicate was divided into 8 sections/sub-samples along its length, from which data was collected on June 20, 2008. ***Efficacy of Dual Magnum to Control***

Nutsedge: An area 25 cm x 25 cm (=625 cm²) was randomly selected from each section, from which the minimum and maximum height of the nutsedge plants that fell within the quadrat were measured. Also, above-ground parts of all the yellow nutsedge plants that were within the quadrat were collected and dried to determine their dry weight. ***Onion Tolerance:*** In close proximity to the randomly selected quadrat, a 3-foot section of row was selected and the total number of onions counted. Within the 3-foot row, 10 plants were randomly selected and the number of leaves per plant counted and plant height measured.

Results (Table 1):

Efficacy of Dual Magnum to Control Nutsedge: The fall application of Dual Magnum significantly reduced yellow nutsedge in onions the following spring. Fall applied Dual Magnum reduced dry weight of yellow nutsedge to one tenth of its weight in the untreated from 102.1 g/m² to 10.72 g/m². The maximum (Dual: 21.4 cm; untreated: 6.0 cm) and minimum (Dual: 5.5 cm; untreated: 2.2 cm) heights of the nutsedge plants were significantly 15.4 cm and 2.2 cm shorter, respectively, in the Dual Magnum treatment compared to the untreated. ***Onion Tolerance:*** There was no significant difference in stand between Dual Magnum (6.7 plants per foot) and the untreated (7.2 plants per foot). Fall applied Dual Magnum resulted in plants that were significantly 4 cm shorter with significantly 0.2 fewer leaves per plant than the untreated.

Table 1. Efficacy and crop tolerance of Dual Magnum applied in the fall (2 qts/A, 2nd week of September 2007, shallow incorporated) for control of yellow nutsedge in onions grown on muck soil, Clarendon, NY: 2007-2008.

June 20, 2008	<u>Efficacy</u>			<u>Crop Tolerance</u>		
Treatment	Dry weight of yellow nutsedge (g/m ²) ¹	Maximum height of yellow nutsedge (cm)	Minimum height of yellow nutsedge (cm)	Onion stand (No. plants /foot)	No. leaves per onion plant	Height of onion plant (cm)
Untreated	102.1 a ²	21.4 a	5.5 a	6.7	3.0 a	26 a
Fall Dual Magnum @ 2 qts/acre	10.7 b	6.0 b	3.3 b	7.2	2.8 b	22 b
<i>P Value (α=0.05)</i>	<i>0.0000</i>	<i>0.0000</i>	<i>0.0054</i>	<i>NS</i> ³	<i>0.0000</i>	<i>0.0000</i>

¹above-ground plant parts only.

²Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, p <0.05.

³NS: not significant, Fisher's Protected LSD test, p>0.05.

Conclusions: Fall applied Dual Magnum at 2 quarts per acre shallowly incorporated significantly controlled yellow nutsedge in onions grown on muck soil by 89.5% with no reduction to stand and only minor yet significant reductions in plant size.

Year Two: 2008-2009

Trial Establishment:

In the second year, the same field was used as in 2007-2008 in the Webster Muck near Clarendon, NY. On November 11, 2008, a couple months after the onion crop was harvested, the grower applied Dual Magnum at a rate of 1.5 quarts per acre, approximately 3 times the recommended rate to use on an onion crop (0.6 – 1.3 pt per acre). Dual Magnum was applied using the grower's sprayer, leaving 6 foot wide strips untreated, between 84 foot strips that were treated. After application, the grower did not mechanically incorporate the Dual Magnum, instead, it was incorporated naturally by rainfall. November 2008 had an average air temperature of 35.4 °F, with minimum and maximum temperatures being 3.8 °F and 67.6 °F, respectively. Rainfall for November was 1.78 inches. In spring of 2009, the field was plowed followed by a packer prior to planting.

Evaluations:

The field was divided into five replications, each including a fall Dual Magnum treatment and an untreated. Each treatment-replicate was divided into 4 sections/sub-samples along its length, from which data was collected on June 5, 2009. ***Efficacy of Dual Magnum to Control***

Nutsedge: An area 50 cm x 50 cm (=2500 cm²) was randomly selected from each section, from which the number of nutsedge plants were counted. ***Onion Tolerance:*** In close proximity to the randomly selected quadrat, a 3-foot section of bed with 6 rows per bed was selected and the total number of onions counted for each row. Within the 3-foot area, 10 plants were randomly selected and plant height measured.

Results (Table 2) and Discussion:

The fall application of Dual Magnum failed to control yellow nutsedge in onions the following spring. ***Efficacy of Dual Magnum to Control Nutsedge:*** Nutsedge density where Dual Magnum was applied in the fall (76 plants/m²) was significantly three times higher than in the untreated (23 plants/ m²). ***Onion Tolerance:*** There was no significant difference in stand between Dual Magnum (7.0 plants per foot) and the untreated (7.0 plants per foot). Fall applied Dual Magnum resulted in plants that were significantly 0.9 cm shorter than the untreated.

The differences between the 2007-2008 and 2008-2009 trials include:

	<u>2007-2008</u>	<u>2008-2009</u>
Rate of Dual Magnum:	• 2 quarts per acre	• 1.5 quarts per acre
Fall weather conditions:	• Applied in September when temperatures were much warmer	• Applied in November when temperatures were much cooler
Fall incorporation:	• Shallow incorporation	• Rained in
Spring soil disturbance:	• Did not exceed depth of fall incorporation of Dual Magnum	• Plowed: burying and diluting fall application of Dual Magnum.

We believe that it was the spring plowing in 2009 that was the main reason why the fall application of Dual Magnum failed to control yellow nutsedge. The reason why there was more

yellow nutsedge in the treated than in the untreated was because, it just so happened that the areas that were treated in fall of 2008, which were spring plowed inactivating the Dual Magnum, laid over the areas that were treated with Dual Magnum in fall of 2007, where nutsedge was controlled very effectively, and vice versa. In 2009, the field exhibited the same strips of controlled and uncontrolled nutsedge as it did in 2008. Essentially, what we ended up measuring was the effect of a fall application of Dual Magnum two years later. In this case, two years after fall application Dual Magnum resulted in nutsedge density reduced to one third of the untreated. It had no effect on onion stand, but the onion plants were still significantly slightly stunted by 0.9 cm. In retrospect, this trial should not have been conducted at the same site as was used the previous year.

Table 2. Efficacy and crop tolerance of Dual Magnum applied in the fall 2007 (2 qts/A, 2nd week of September, shallow incorporated) for control of yellow nutsedge in onions grown on muck soil in spring 2009, 2 years later, Clarendon, NY: 2007-2009.

<i>June 5, 2009</i>			
Treatment	<u>Efficacy</u>	<u>Crop Tolerance</u>	
	Number of yellow nutsedge plants per m²	Onion stand (No. plants per foot)	Height of onion plant (cm)
Untreated	75.8 a ¹	7.0	13.2 a
Fall Dual Magnum @ 2 qts/A Sep 2007	23.4 b	7.0	12.3 b
<i>P Value (α=0.05)</i>	0.0002	NS²	0.0001

¹Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, p < 0.05.

²NS: not significant, Fisher's Protected LSD test, p > 0.05.

Conclusions:

It is imperative that growers do not disturb the soil deeper than the depth to which Dual Magnum is incorporated during the previous fall, or else it will not control yellow nutsedge. Significantly reduced densities of yellow nutsedge are evident two years after a successful application of Dual Magnum. Growers should be aware that minor onion stunting may occur in the second year after Dual Magnum is applied in the fall when the 2 quart per acre rate is used.

Year Three: 2009-2010

Trial Establishment:

In the third year, the trial was moved to the Potter Muck land into a field that suffered from heavy patches of nutsedge pressure. On November 16, 2009, a couple of months after the onion crop was harvested, the grower cooperator applied Dual Magnum at a rate of 1.5 quarts per acre, approximately 3 times the recommended rate to use on an onion crop (0.6 – 1.3 pt per acre). Dual Magnum was applied using the grower's sprayer, leaving 18.5 foot strips untreated and 21.5 foot strips that were treated. After application, the grower incorporated shallowly the Dual Magnum to a depth no greater than 4 inches. November 2009 had an average air temperature of 40.9 °F, with minimum and maximum temperatures being 16 °F and 69.8 °F, respectively. Rainfall for November was 0.74 inches.

Evaluations:

The field was divided into six replications, each containing a fall applied Dual Magnum treatment and an untreated. Four sub-samples of data were collected from each replicate on June 10, 2010. ***Efficacy of Dual Magnum to Control Nutsedge:*** Each sub-sample consisted of a randomly selected area of 50 cm x 50 cm (=2500 cm²), from which all of the above-ground plant parts of yellow nutsedge plants were collected and put in a drying oven to obtain dry weight. ***Onion Tolerance:*** In close proximity to the randomly selected quadrat, a 3-foot section of bed with 4 rows per bed was selected and the total number of onions counted for each row. Within the 3-foot area, 10 plants were randomly selected and number of leaves counted and plant height measured.

Results (Table 3):

Efficacy of Dual Magnum to Control Nutsedge: The fall application of Dual Magnum significantly reduced yellow nutsedge in onions the following spring. Fall applied Dual Magnum reduced dry weight of yellow nutsedge by 91.4% from 14 g/m² in the untreated to 1.2 g/m² in the treated. ***Onion Tolerance:*** There was a significant reduction in onion stand by 25% when Dual Magnum was applied in the fall (5.0 plants/ft) compared to the untreated (6.7 plants/ft). Fall applied Dual Magnum resulted in plants that were significantly 1 cm shorter with significantly 0.1 fewer leaves per plant than the untreated.

Table 3. Efficacy and crop tolerance of Dual Magnum applied in the fall (1.5 qts/A, November 16, 2009, shallow incorporated) for control of yellow nutsedge in onions grown on muck soil, Potter, NY: 2009-2010.

<i>June 10, 2010</i> Treatment	<u>Efficacy</u>	<u>Crop Tolerance</u>		
	Dry weight of yellow nutsedge (g/m ²) ¹	Onion Stand (No. plants per foot)	No. leaves per onion plant	Height of onion plant (cm)
Untreated	14.0 a ²	6.7 a	2.9 a	17.2 a
Fall Dual Magnum @ 1.5 qts/A	1.2 b	5.0 b	2.8 b	16.1 b
<i>P Value (α=0.05)</i>	<i>0.0000</i>	<i>0.0000</i>	<i>0.0096</i>	<i>0.0003</i>

¹weight of above-ground plant parts only. ²Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, p <0.05.

Conclusions:

Fall applied Dual Magnum at 1.5 quarts per acre shallowly incorporated significantly controlled yellow nutsedge in onions grown on muck soil by 91.45% with a significant 25% reduction in onion stand and minor yet significant reductions in plant size.

Recommendation:

A fall application of Dual Magnum at 1.5 and 2.0 qts/A provided 90% control of yellow nutsedge the following spring in onions grown on muck soils. Based on our results, we expect a 1.0 qrt/A rate would also provide significant control and would be a very valuable option for

onion growers battling nutsedge in onions on muck soils. Growers must be aware that onion stand may be significantly reduced by up to 25%, and plant size may also be significantly slightly reduced. It is critical that growers incorporate Dual Magnum in the fall and not disturb the soil in the springtime below the depth of incorporation of Dual Magnum. Reduced nutsedge populations resulting from a fall application of Dual Magnum will last for at least two seasons.

Photo Gallery

**Webster Muck, Clarendon, NY: Dual Magnum applied 2nd week of September 2007
the green strips show where nutsedge is growing in the untreated checks.**



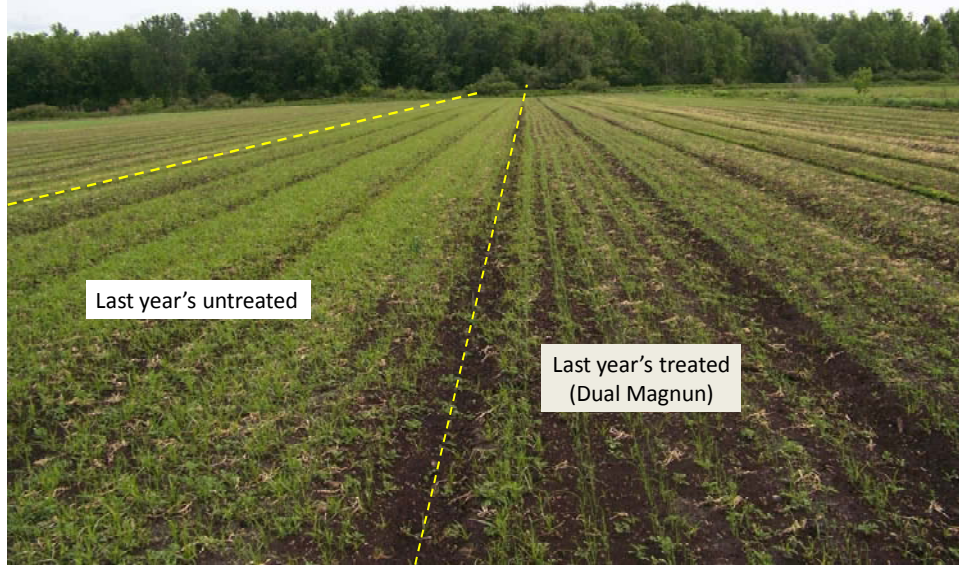
Webster Muck, Clarendon, NY, Dual applied 2nd week of September in 2007



June 20, 2008

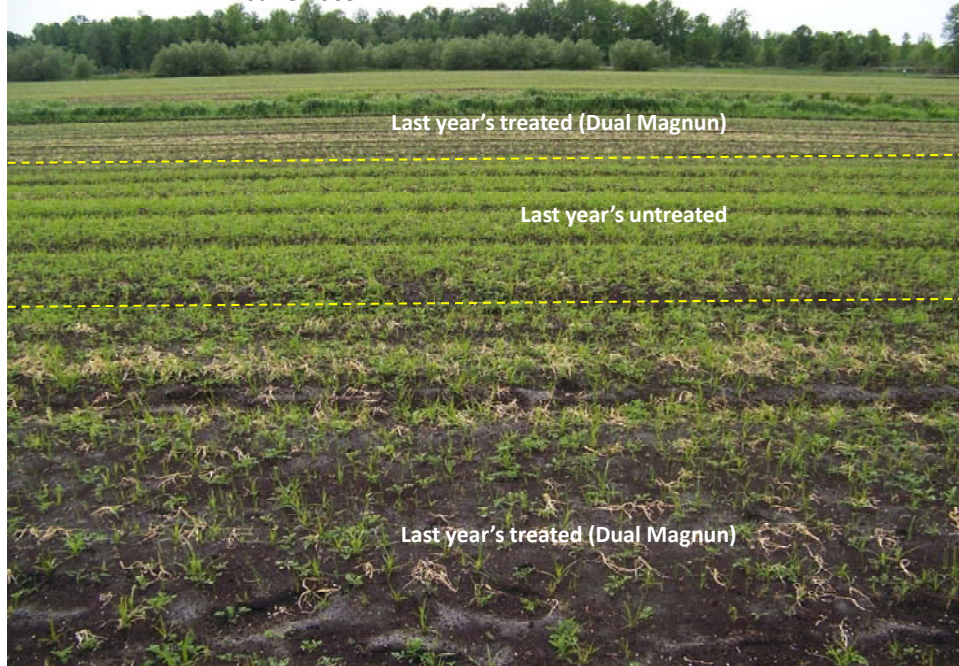
Webster Muck, Clarendon, NY, Dual applied 2nd week of September in 2007

June 2009



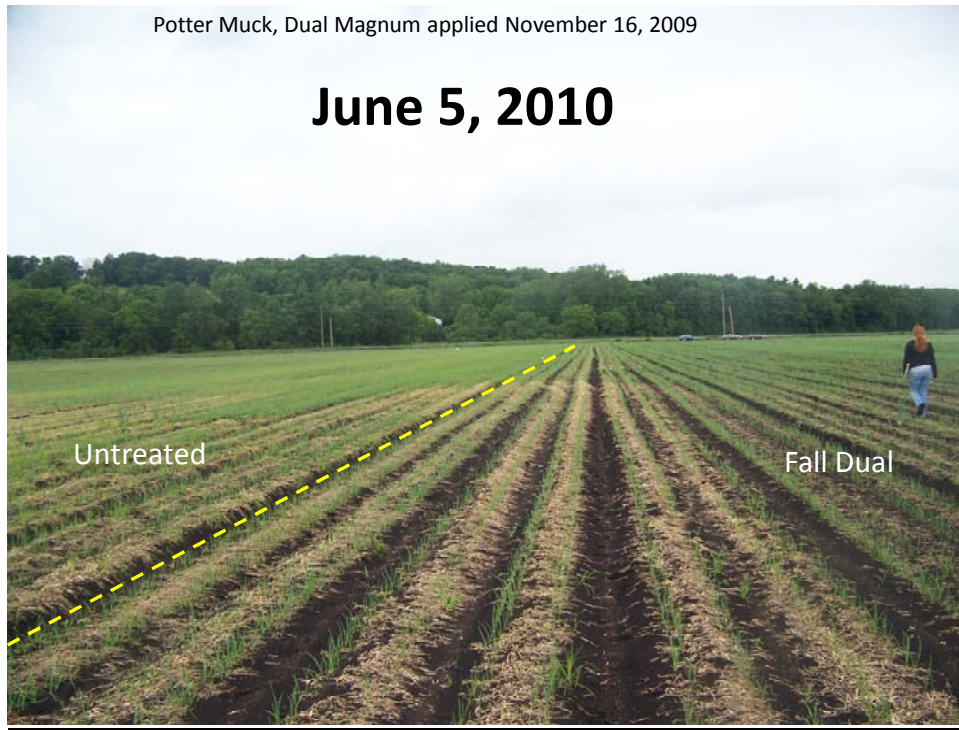
Webster Muck, Clarendon, NY, Dual applied 2nd week of September in 2007

June 2009



Potter Muck, Dual Magnum applied November 16, 2009

June 5, 2010



Potter Muck, Dual Magnum applied November 16, 2009

June 5, 2010

