

The Effect of Water Stress on the Efficacy of Mesotrione to Control Weeds in Cool-season Turfgrass Stands

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Final Report
Protocol ID#: HMS801D4-2006US

A study was conducted at the Washington State University Turfgrass and Agronomy Research Center (TARC) in Pullman, WA. on 4 different cool-season turfgrass species ('Treasure' chewing fescue, 'NuDestiny' Kentucky bluegrass, 'Gallery' perennial ryegrass, and 'Inferno' tall fescue) to evaluate the effect of water stress on the efficacy of mesotrione to control weeds. Two independently irrigated 80' x 80' plots were used. One plot was irrigated to 50% ET and the other to 100% ET. Within each plot all 4 turfgrass species were planted each in a 36' x 40' block on 1 Jun 06. Weeds in the study were naturally occurring and no additional weeds were planted. The following weeds were present in the study area: pigweed *Amaranthus spp.* (3 different types redroot, prostrate, and tumble), common lambsquarter *Chenopodium album*, prickly lettuce *Lactuca serriola*, pineappleweed *Matricaria matricarioides*, Canada thistle *Cirsium arvense*, mayweed chamomile *Anthemis cotula*, dandelion *Taraxacum officinale*, common groundsel *Senecio vulgaris*, common mallow *Malva neglecta*, shepardspurse *Capsella bursa-pastoris*, witchgrass *Panicum capillare*, and barnyardgrass *Echinochloa crusgalli*. The weeds and grasses were grown for approximately 10 weeks prior to the first application of mesotrione. Each irrigation regimen was mowed once per week at 2 inches. The first application of mesotrione was applied on 10 Aug 06 and split application treatments applied 3 weeks later on 31 Aug 06. Individual plot size was 6' x 10'. Each week following the first application percent weed control and phytotoxicity were rated through week 6. Percent weed control was rated compared to the control and phytotoxicity was rated on a scale from 0-10; with 10 = dead turf. A log of ET (in), watering time (min), max/min temperatures (°F), precipitation (in), were taken during the study (Table 1).

RESULTS

Note: Within each of the irrigation regimens most of the annual weeds were setting seed when the first application of mesotrione was applied 10 weeks after planting on 10 Aug 2006 (Figure 1). With the weeds at such an advanced growth stage it was apparent that mesotrione was not as effective in controlling them as we had noted in earlier studies, especially following single applications of mesotrione.

Weed control: Generally, in this study, there appeared to be no increase in weed control under the water stressed (50% ET) irrigation regimen when compared to the 100% ET regimen for any of the 4 turfgrass species (Tables 2, 3, 4, and 5). As expected weed control increased with increased rates and following split applications. The highest level of weed control was achieved following each of the 3 split applications. Of the annual grass weeds in the study, mesotrione was effective in controlling barnyardgrass and not very effective in controlling witchgrass.

Phytotoxicity: Generally, in each of the 4 turfgrasses, phytotoxicity was higher in the 100% ET irrigation regimen when compared to the 50% ET regimen (Tables 6, 7, 8, and 9). Figure 2 illustrates the difference in phytotoxicity of 'Treasure' chewing fescue 3 WAT. Overall, Kentucky bluegrass showed the least amount of phytotoxicity followed by perennial ryegrass, tall fescue, and then fineleaf fescue.

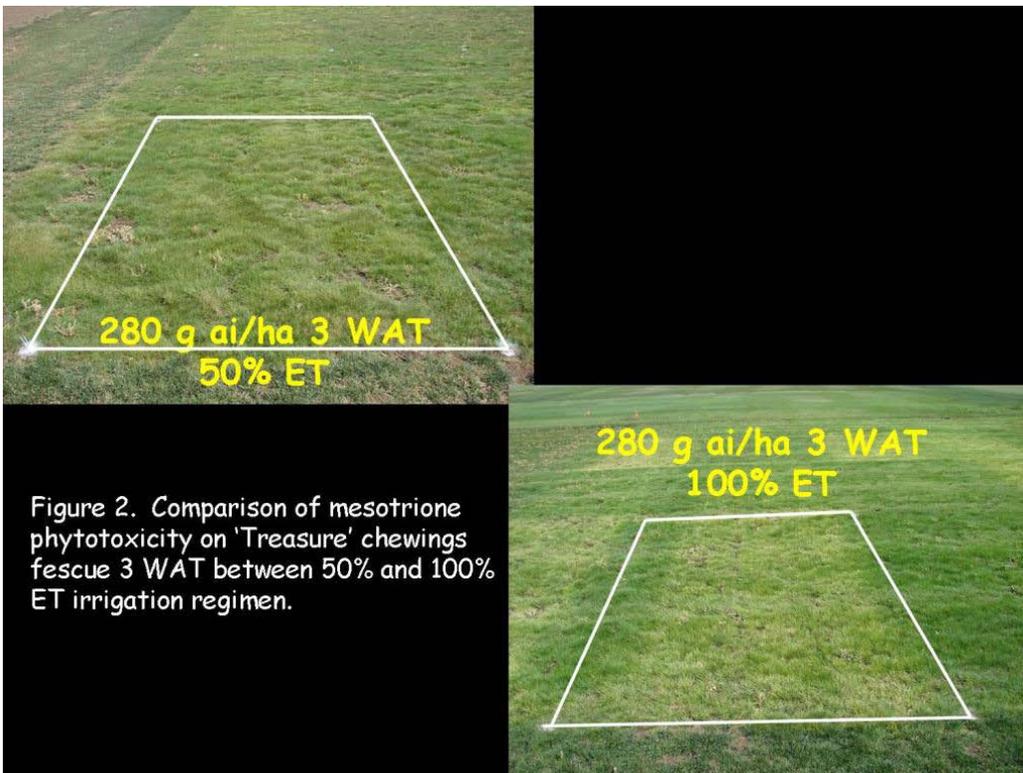
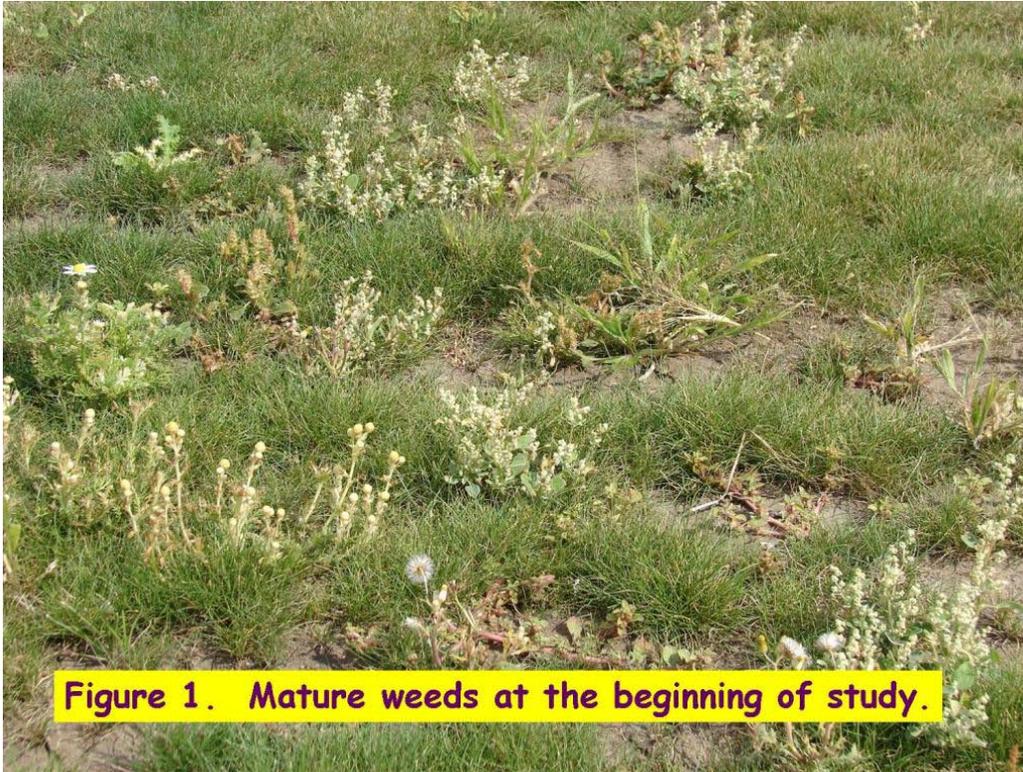


Table 1. Weather and Irrigation Data

Date	ET (inches)	Precip. (inches) Daily	Irrigation		Air Temperature (deg. F)	
			100% (minutes watered)	50%	Max	Min
Aug 10	0		0	0	83	50
11	0.3	0.10	20	10	88	51
12	0		0	0	74	41
13	0.3		20	10	79	41
14	0.3		10	5	84	45
15	0.3		15	8	89	49
16	0.1	0.01	6	0	84	46
17	0.2		12	6	79	52
18	0.2		12	6	80	55
19	0.2		12	6	86	50
20	0		0	0	92	49
21	0.5		24	12	94	57
22	0.3		15	7	100	56
23	0.4		20	10	88	51
24	0.15		12	6	80	43
25	0.2		12	6	77	45
26	0.2		12	6	78	46
27	0.2		12	6	84	47
28	0.4		24	12	89	52
29	0.3		15	8	95	63
30	0.2		12	6	78	46
31	0	T	0	0	65	36
Sept 1	0.3		18	9	70	37
2	0.2		12	6	81	43
3	0.2		12	6	90	49
4	0.2		12	6	95	55
5	0.4		24	12	90	53
6	0.1		6	3	91	49
7	0.3		15	8	90	51
8	0.3		15	8	85	52
9	0.2		12	6	88	54
10	0.1		6	3	74	39
11	0.3		15	8	76	42
12	0.3		15	8	86	43
13	0.2		12	6	87	50
14	0.1	T	6	3	75	43
15	0.1		6	3	61	28
16	0.1		6	3	60	39
17	0.1		6	3	63	32
18	0.1		6	3	67	45
19	0	0.04	0	0	72	48
20	0	0.19	0	0	56	41
Total	8.35	0.34	469	234	81	47

Application
dates



Table 2. Percent weed control with mesotrione in 'Treasure' chewings fescue.

Treatment	Meso Rate (g ai/ha)	NIS Rate (% v/v)	Spray date*	Irrigation**	Weed control (%)					
					1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	5.0	25.0	35.0	36.7	53.3
Mesotrione + NIS	210	0.25	1	1	0.0	6.7	33.3	48.3	41.7	65.0
Mesotrione + NIS	280	0.25	1	1	0.0	8.3	36.7	50.0	51.7	76.7
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	3.3	26.7	58.3	81.7	88.3
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	6.7	28.3	60.0	80.0	93.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	13.3	56.7	78.3	88.3	98.3
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	8.3	35.0	26.7	31.7	33.3
Mesotrione + NIS	210	0.25	1	2	0.3	6.7	26.7	23.3	25.0	25.0
Mesotrione + NIS	280	0.25	1	2	1.0	11.7	63.3	46.7	50.0	58.3
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.3	8.3	25.0	50.0	70.0	80.0
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.7	8.3	56.7	78.3	91.7	96.7
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	1.0	11.7	60.0	80.0	88.3	91.7
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

Table 3. Percent weed control with mesotrione in 'NuDestiny' Kentucky bluegrass.

Treatment	Meso Rate (g ai/ha)	NIS Rate (% v/v)	Spray date*	Irrigation**	Weed control (%)					
					1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	1.7	25.0	21.7	30.0	40.0
Mesotrione + NIS	210	0.25	1	1	0.0	8.3	33.3	33.3	30.0	36.7
Mesotrione + NIS	280	0.25	1	1	0.0	8.3	40.0	36.7	35.0	40.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	1.7	33.3	50.0	46.7	56.7
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	5.0	31.7	60.0	71.7	86.7
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	8.3	43.3	61.7	63.3	91.7
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	5.0	31.7	25.0	26.7	33.3
Mesotrione + NIS	210	0.25	1	2	0.0	11.7	36.7	36.7	40.0	40.0
Mesotrione + NIS	280	0.25	1	2	0.0	10.0	31.7	36.7	35.0	33.3
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.0	5.0	35.0	63.3	75.0	78.3
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.0	6.7	28.3	63.3	66.7	78.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	0.0	11.7	36.7	73.3	78.3	85.0
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

Table 4. Percent weed control with mesotrione in 'Gallery' perennial ryegrass.

Treatment	Meso Rate (g ai/ha)	NIS Rate (% v/v)	Spray date*	Irrigation**	Weed control (%)					
					1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	1.7	26.7	43.3	50.0	66.7
Mesotrione + NIS	210	0.25	1	1	0.0	10.0	43.3	60.0	65.0	90.0
Mesotrione + NIS	280	0.25	1	1	0.0	8.3	45.0	48.3	53.3	91.7
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	3.3	31.7	51.7	63.3	68.3
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	8.3	43.3	81.7	88.3	96.7
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	6.7	50.0	73.3	83.3	95.0
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	5.0	30.0	36.7	40.0	40.0
Mesotrione + NIS	210	0.25	1	2	0.0	6.7	40.0	43.3	53.3	55.0
Mesotrione + NIS	280	0.25	1	2	0.0	11.7	41.7	35.0	36.7	36.7
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.0	6.7	43.3	81.7	86.7	96.7
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.0	10.0	40.0	88.3	95.0	96.7
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	0.0	8.3	56.7	90.0	93.3	100.0
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

Table 5. Percent weed control with mesotrione in 'Inferno' tall fescue.

Treatment	Meso Rate (g ai/ha)	NIS Rate (% v/v)	Spray date*	Irrigation**	Weed control (%)					
					1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	1.7	23.3	23.3	33.3	68.3
Mesotrione + NIS	210	0.25	1	1	0.0	1.7	30.0	41.7	46.7	75.0
Mesotrione + NIS	280	0.25	1	1	0.0	10.7	43.3	41.7	48.3	76.7
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	1.7	30.0	56.7	78.3	93.3
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	5.0	35.0	68.3	81.7	98.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	5.0	36.7	71.7	86.7	93.3
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	5.0	20.0	27.5	62.5	77.5
Mesotrione + NIS	210	0.25	1	2	0.0	5.0	28.3	33.3	53.3	60.0
Mesotrione + NIS	280	0.25	1	2	0.0	8.3	28.3	41.7	50.0	56.7
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.0	5.0	26.7	63.3	86.7	95.0
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.0	5.0	25.0	70.0	85.0	93.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	0.0	5.7	30.0	78.3	90.0	96.7
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

Table 6. Phytotoxicity of mesotrione on 'Treasure' chewings fescue.

Treatment	Meso	NIS	Spray date*	Irrigation**	Phytotoxicity (rated 0-10; 10 = dead)					
	Rate (g ai/ha)	Rate (% v/v)			1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	210	0.25	1	1	0.0	0.0	0.3	1.0	1.0	1.0
Mesotrione + NIS	280	0.25	1	1	0.0	0.3	0.3	1.3	1.3	2.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	0.0	0.0	2.0	2.7	3.0
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	0.3	0.3	2.7	4.0	4.0
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	1.3	1.3	4.7	7.0	7.0
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	1.7	2.0	0.3	0.0	0.0
Mesotrione + NIS	210	0.25	1	2	0.0	1.3	2.7	1.0	0.7	0.3
Mesotrione + NIS	280	0.25	1	2	0.0	4.0	5.3	2.3	0.3	0.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.0	1.0	2.0	5.0	5.0	3.7
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.0	2.7	4.3	7.0	7.0	6.0
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	0.0	4.0	5.3	7.7	7.3	6.7
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

Table 7. Phytotoxicity of mesotrione on 'NuDestiny' Kentucky bluegrass.

Treatment	Meso	NIS	Spray date*	Irrigation**	Phytotoxicity (rated 0-10; 10 = dead)					
	Rate (g ai/ha)	Rate (% v/v)			1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	210	0.25	1	1	0.0	0.0	0.3	1.0	1.0	1.0
Mesotrione + NIS	280	0.25	1	1	0.0	0.3	0.3	1.3	1.3	2.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	0.0	0.0	2.0	2.7	3.0
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	0.3	0.3	2.7	4.0	4.0
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	1.3	1.3	4.7	7.0	7.0
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	1.7	2.0	0.3	0.0	0.0
Mesotrione + NIS	210	0.25	1	2	0.0	1.3	2.7	1.0	0.7	0.3
Mesotrione + NIS	280	0.25	1	2	0.0	4.0	5.3	2.3	0.3	0.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.0	1.0	2.0	5.0	5.0	3.7
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.0	2.7	4.3	7.0	7.0	6.0
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	0.0	4.0	5.3	7.7	7.3	6.7
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

Table 8. Phytotoxicity of mesotrione on 'Gallery' perennial ryegrass.

Treatment	Meso	NIS	Spray date*	Irrigation**	Phytotoxicity (rated 0-10; 10 = dead)					
	Rate (g ai/ha)	Rate (% v/v)			1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	210	0.25	1	1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	280	0.25	1	1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	0.0	0.0	0.7	0.7	0.0
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	0.0	0.0	2.0	2.3	1.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	0.0	0.3	1.7	2.3	2.0
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	210	0.25	1	2	0.0	0.0	0.3	0.0	0.0	0.0
Mesotrione + NIS	280	0.25	1	2	0.0	0.3	1.0	0.0	0.0	0.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.0	0.0	0.0	0.7	1.3	1.0
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.0	0.0	0.7	3.3	3.0	2.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	0.0	0.3	1.0	4.0	4.0	3.7
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

Table 9. Phytotoxicity of mesotrione on 'Inferno' tall fescue.

Treatment	Meso	NIS	Spray date*	Irrigation**	Phytotoxicity (rated 0-10; 10 = dead)					
	Rate (g ai/ha)	Rate (% v/v)			1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT
Mesotrione + NIS	140	0.25	1	1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	210	0.25	1	1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	280	0.25	1	1	0.0	0.0	0.7	0.7	0.3	0.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	1	0.0	0.0	0.0	1.3	2.3	0.3
Mesotrione + NIS	210 + 210	0.25	1 & 2	1	0.0	0.0	0.0	1.0	1.7	1.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	1	0.0	0.0	0.0	1.7	2.7	1.3
Non-treated Control	0	0		1	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	140	0.25	1	2	0.0	0.0	0.0	0.0	0.0	0.0
Mesotrione + NIS	210	0.25	1	2	0.0	0.7	0.3	0.0	0.0	0.0
Mesotrione + NIS	280	0.25	1	2	0.0	0.7	1.0	0.3	0.0	0.0
Mesotrione + NIS	140 + 140	0.25	1 & 2	2	0.0	0.0	0.0	1.7	2.7	1.3
Mesotrione + NIS	210 + 210	0.25	1 & 2	2	0.0	0.3	0.7	3.0	4.0	3.3
Mesotrione + NIS	280 + 280	0.25	1 & 2	2	0.0	0.7	1.3	5.0	5.0	5.7
Non-treated Control	0	0		2	0.0	0.0	0.0	0.0	0.0	0.0

* Spray date 1 = 10 Aug 06 and 2 = 31 Aug 06

**Irrigation 1 = 50% ET and 2 = 100% ET

