Field Evaluation of Herbicide Treated Mulches

Principle investigators: Luke Case and Hannah Mathers

Significance to Industry: Weed control is essential for both nursery growers and landscape professionals. Many of the herbicides applied in the ornamental industry are granular; two of those reasons being reduced phytotoxicity compared to the respective liquid formulation and ease of application. However, it is often essential to apply herbicides 3-5 times per growing season in container nurseries (Gilliam et al., 1990), and usually twice a year in field nurseries and landscapes with supplemental glyphosate applications or hand-weeding. Increasing the duration of weed control while keeping phytotoxicity levels low would be advantageous for growers and landscape professionals.

Materials and Methods: It has been found that mulches treated with various herbicides are effective for weed control (1, 2, 3). Work done at The Ohio State University has shown that weed control can be extended to 303 days with herbicide treated bark nuggets in containers (data not published). However, it is not known how long herbicide treated mulches are effective in a field or landscape situation. The objectives of this study were: 1) to compare efficacy of over-the-top (OTT) sprays without mulch to OTT sprays under mulch, OTT sprays on top of mulch, herbicide treated mulch, mulch alone, and bare, untreated soil at 30, 60, 90, and 120 days after treatment (DAT) and 1 year after treatment (YAT), and 2) to compare phytotoxicity of the treatments, methods, and dates described above.

The two experiments conducted were efficacy (experiment 1) and phytotoxicity (experiment 2). Each experiment was replicated in time, trial 1 starting on May 1, 2004 and ending April 15, 2005, and trial 2 starting on May 11, 2005 and ending April 21, 2006. The experiments were conducted at the Waterman Farm of The Ohio State University, Columbus, OH. The plots in experiment 1 contain no crop plants. Evaluations of efficacy and phytotoxicity were conducted at 30, 60, 90, and 120 DAT and 1 YAT. Efficacy was evaluated by taking visual ratings of 3 X 3 ft (0.9m) plots and dry weights from 1 X 1 ft (0.3 m) sections of the plot. Efficacy ratings were on a scale of 0 (no control) to 10 (complete control) and ≥ 7 (commercially acceptable). In experiment two, dogwood shrubs (*Cornus alba*) (both years) and crabapple tree liners (*Malus* x'Indian Summer) (year 1 only) were evaluated. A visual rating score of 1 (no injury) to 10 (complete kill) and ≤ 3 (commercially acceptable) were used for the shoots. Measurements of height × width were also taken on the dogwoods. One week after planting, treatments were applied. The five chemicals applied were oryzalin, (Surflan AS) at 2 lb ai/acre, flumioxazin, (SureGuard WDG) at 0.34 (ai) lb ai/acre, acetochlor (Harness) at 2.5 lb ai/ac, dichlobenil (Casoron CS) at 4 lb ai/acre and a combination of oryzalin and flumioxazin. Mulches were applied untreated, over the top of soil surfaces sprayed with the different herbicides. Mulches were also applied untreated to untreated soil surfaces and then sprayed with the different herbicides in the field. Two bark types were evaluated, pine nuggets and shredded hardwood. Pretreated bark mulch treatments were prepared by placing the mulches on a sheet of plastic, as a single layer (pieces of mulch side by side with minimal overlap) thick and sprayed over the top with the different herbicide treatments and allowed to dry for 48 h. Treated barks when dry and

untreated mulches were applied directly to evaluation plots in varying amounts according to the mulch thickness. The mulches were applied as close as possible to a single layer. The herbicide treated mulches and herbicide-mulch application methods were compared to sprays of the five chemicals applied directly to the surfaces of the plots, the two untreated mulches applied to the plots and a weedy check (no herbicide, no mulch).

Results and discussion.

Experiment 1 – phytotoxicity. No phytotoxicity was evident from any of the treatments on the crabapples (data not shown), so they were excluded from trial 2. There was death among the dogwoods in both years of the study that was not treatment related, but instead due to hot, dry weather and lack of water shortly after planting. However, Dunnett's t-test was performed to show differences in comparison to controls. Six treatments provided significantly higher visual ratings over the controls combined over the four evaluation dates and the two years (Table 1). Four of the six most phytotoxic treatments included both Surflan and SureGuard. However, if not sprayed directly on the dogwoods (treated mulch), Surflan and SureGuard had no effect on the dogwoods. There were no treatments providing higher visual ratings than the control 1 YAT averaged over both trials (data not shown), which was probably due to the high death rate and poor growth of the controls. It should be mentioned that there was high weed competition with the control plants, and the lack of mulch around the control plants to conserve water may have contributed to the high death rate and poor growth of the controls.

Experiment 2 – efficacy.

There were many treatments that were effective for weed control across all dates in both trials combined (Table 1). None of the OTT sprays or treatments that involved OTT sprays on top of, or below hardwood mulch provided visual ratings ≥7, and only the Surflan+SureGuard treated hardwood provided a visual rating of 7. Twelve out of fifteen treatments that involved an herbicide in combination with pine bark (over, under, or treated) had visual ratings of ≥7. At 1 YAT averaged over both trials, there were no treatments that provided visual ratings of ≥7 (Table 1). SureGuard, Surflan, Harness, and SureGuard+Surflan applied OTT all provided acceptable control at 30 DAT (data not shown); however, by 90 DAT, only SureGuard+Surflan provided acceptable control. If applied OTT of pine nuggets, Casoron, and SureGuard+Surflan can provide acceptable control up to 1 YAT. Data from this trial supports that mulches should and can be used to enhance the efficacy of herbicides, applying the herbicides above, below, or to treat the mulch. Phytotoxicity can be reduced by the use of herbicide treated mulch.

Literature Cited:

1. Fretz, T.A. 1973. Herbicide-impregnated mulches for weed control in container nursery stock. Scientia Hort. 19:165-170.
2. Fretz, T.A. and C.W. Dunham. 1971. The incorporation of herbicides into organic mulches for weed control in ornamental plantings. J. Amer. Soc. Hort. Sci. 96:280-284.
3. Mathers, H. 2003. Novel methods of weed control in containers. HortTechnology 13:28-31.

Table 1. Phytotoxicity and efficacy visual ratings of herbicide treated mulch field study

Treatment	Phytotoxicity[z]	Efficacy[y]	Efficacy 1 YAT[x]
1 Control	4.6	0.18 s	0.2 q
2 Surflan OTT[w]	7.2*	4.7 nop	1.3 opq
3 Harness OTT	5.8	4.8 nmop	1.5 nopq
4 SureGuard OTT	5.4	4.4 op	2.4 jklmnop
5 Casoron OTT	6	1.8 r	1.0 pq
6 Surflan+SureGuard OTT	9.8*	6.2 fghij	2.1klmnop
7 Surflan under HW	4.2	5.6 ijkl	4.8cdefgh
8 Harness under HW	5.6	5.3 klmn	1.9 lmnopq
9 SureGuard under HW	7.6*	6.5 defghi	3.6 ghijklm
10 Casoron under HW	5.3	5.6 ijkl	2.8 hijklmnop
11 Surflan+SureGuard under HW	5.2	6.3 efghij	3.9 fghijkl
12 Surflan over HW	3.8	4.0 p	2.2 klmnop
13 Harness over HW	3.4	5.0 lmno	2.1 klmnop
14 SureGuard over HW	6.1	5.7 hijkl	3.3 ghijklmno
15 Casoron over HW	3.9	6.0 ghijk	4.4 defghij
16 Surflan+SureGuard over HW	7.6*	6.2 fghij	4.0 efghijk
17 Surflan under PN	4.2	7.0 cdef	4.4 defghij
18 Harness under PN	3.4	7.2 cd	3.5 ghijklmn
19 Sureguard under PN	5.4	7.3 cd	4.6defghi
20 Casoron under PN	2.9	7.2 cd	6.8 abc
21 Surflan+SureGuard under PN	7.7*	8.8 a	5.8 abcdef
22 Surflan over PN	2.7	7.5 bc	4.4 defghij
23 Harness over PN	3.2	7.2 cde	6.0 abcde
24 Sureguard over PN	5.3	8.9 a	6.7 abc
25 Casoron over PN	2.2	6.8 cdefg	7.3 a
26 Surflan+SureGuard over PN	7.5*	7.6 bc	7.0 ab
27 Surflan treated HW	4.2	5.6 jklm	3.8 fghijklm
28 Harness treated HW	4.3	5.0 lmno	1.7 mnopq
29 SureGuard treated HW	3.4	5.8 hijkl	4.3 defghij
30 Casoron treated HW	2.9	4.3 op	2.3 jklmnop
31 Surflan+Sureguard treated HW	2.7	7.0 cdef	5.0 bcdefg
32 Surflan treated PN	3.5	6.6 defgh	3.4 ghijklmn
33 Harness treated PN	3.9	7.0 cdef	6.1 abcd
34 SureGuard treated PN	2.2	7.2 cd	6.0 abcde
35 Casoron treated PN	2.6	6.0 hijk	6.1 abcd
36 Surflan+SureGuard treated PN	3	8.3 ab	6.2 abcd
37 Untreated HW	4.8	1.0 rs	1.0 pq
38 Untreated PN	3.1	2.7 q	2.6 ijklmnop

z: Phytotoxicity visual ratings averaged over 30, 60, 90, and 120 DAT in 2004 and 2005 combined in herbicide treated mulch field study, those marked by * are different from control, using Dunnett's t-test ($\alpha = 0.05$)

y: Efficacy visual ratings averaged over 30, 60, 90, and 120 DAT in 2004 and 2005 combined in herbicide treated mulch field study, treatments with similar letters are not significantly different, using lsd ($\alpha=0.05$)

x: Efficacy visual ratings 1 YAT averaged over both trials in herbicide treated mulch field study, treatments with similar letters are not significantly different, using lsd ($\alpha=0.05$)

w: OTT = over the top, HW = hardwood, PN = pine nuggets