Efficacy and phytotoxicity of various herbicide treated mulches in the field

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Significance to the industry: Herbicide treated mulches could offer a distinct advantage to homeowners and landscapers who wish to decrease the amount of time devoted to handweeding. Past research conducted at The Ohio State University led by Dr. Hannah Mathers provides evidence that herbicide treated mulches do provide better and longer weed control than mulches or herbicides applied alone. There are now several companies that have incorporated granular herbicides into the mulch, but as of yet, no one has treated mulch with liquid herbicides. Mulch Manufacturing, Inc., has taken the initiative to incorporate liquid herbicides into dyed and undyed mulches. This study was set up to compare various mulches, with dye and without dye, treated with various herbicides to mulches that have granular herbicides, untreated mulches, and an untreated control for efficacy and phtyotoxicity over a 90 day period.

Materials and Methods: Mulches were prepared by Mulch Manufacturing, Inc. and brought to The Ohio State University Waterman Farm on June 29, 2007. On July 2 and July 3, 2007, the study was initiated. 'Mugo' pine and geraniums were planted into the 10' X 2' plots prior to putting out the treatments. The study was set up in a randomized complete block design with 4 replications per treatment. The plots were separated by 2 feet within the row and rows were separated by 6 feet. Evaluations of phytotoxicity and efficacy were conducted approximately 30, 60, and 90 days after treatment (DAT). Phytotoxicity was evaluated by taking visual ratings on a scale of 1-10 with 1 being no phytotoxicity, 10 death, and ≤3 commercially acceptable. Efficacy was evaluated by taking visual ratings on a scale of 0-10 with 0 being no weed control, 10 perfect weed control, and ≥7 commercially acceptable; efficacy was also evaluated by taking fresh weight of a 1 ft^2 area within each plot. Weeds were taken from the same approximate location within each plot at each evaluation to reduce bias. Data was subjected to ANOVA using Proc Mixed in SAS. Treatments were separated by using lsmeans with α = 0.05 (efficacy visual ratings) to find the best treatment, or by using Dunnett's t-test with α = 0.05 (phytotoxicity visual ratings and weed fresh weights) to compare to the control.

Results and discussion:
Phytotoxicity. The pines and geraniums from the untreated controls showed the most phytotoxicity, due to the hot, dry summer with inadequate irrigation. The mulch greatly helped to keep in moisture in the ground. The six worst treatments [other than the control (5.8)] which gave a visual rating of above 3 on geranium were 0.75X rate of SureGuard treated red mulch, 1.25X rate of SureGuard treated red mulch, 1.25X rate of animal retardant on red mulch, both Borax products on Softscape, and SureGuard + granular fertilizer on red mulch (Table 1). One geranium from the four replications died from the 0.75X- and 1.25X- rate of SureGuard treated red mulch, which explains the difference from the 1X rate. None of the treatments provided a phytotoxicity visual rating of greater than 3 to the pines.

Efficacy. There was not a treatment by date interaction for visual ratings for efficacy, meaning that efficacy generally went decreased across dates for all the treatments. Most herbicides lose efficacy by 60 DAT, but many of the herbicide mulch combinations maintained a visual rating of ≥7. Fifteen of 27 treatments provided commercially acceptable control when averaged over the dates by visual ratings (highlighted in Table 2). However, by 90 DAT of those highlighted, Borax #2 on Softscape, SureGuard + Fertilizer on colored mulch, SureGuard + Fertilizer on Softscape, red mulch alone, and Softscape alone had reduced efficacy scores of below 7 (data not shown). Overall, all mulch treatments provided good control of weeds, and some provided excellent control. When phytotoxicity and efficacy are both accounted for, treating colored mulch with liquid Snapshot (isoxaben + trifluralin) or SureGuard is suitable for weed control in landscape beds and provides at least 90 days of weed control. By weed fresh weight (≤ 3 grams), only 10 treatments were efficacious over the three evaluation dates. Differing from the results by visual ratings, one of the two herbicide plus granular mulch treatments evaluated, i.e. Preen HW Mulch Plus; 1.25X SureGuard on Red mulch, Borax #2 on Softscape, SureGuard + Fert on colored mulch, and colored mulch and Softscape alone did not provide acceptable weed control by weight. Of the top 10 efficacy treatments remaining and comparing to phytotoxicity, four combinations are best overall, Preen Colored Mulch Plus, 0.75X and 1.25X liquid Snapshot on red mulch, and Surflan on red mulch. Three of the four best overall treatments are liquid + mulch formulations indicating a possible advantage to liquid applications + mulch over granular formulations + mulch. A future study should include more annuals and perennials such as purple coneflower and salvia, as these are usually more susceptible to herbicide injury. SureGuard, for example, is not labeled for use in landscapes because it causes burning on many landscape plants; however, as is shown here when used to treat mulch, phytotoxicity is greatly reduced with SureGuard.

Table 1. Effect of various herbicide treated and untreated mulches on phytotoxicity of 'Mugo' pine and Geranium averaged over 30, 60, and 90 DAT

Treatment	Mugo Pine	Geranium
Preen HW Mulch Plus	1.5^z	1.8*
Preen Colored Mulch Plus	1.5	1.5*
Liquid Snapshot on Red mulch	1.5	2.4*
0.75X Liquid Snapshot on Red mulch	1.7	1.8*
1.25X Liquid Snapshot on Red mulch	2.6	2.3*
SureGuard on Red mulch	1.9	1.8*
0.75X SureGuard on Red mulch	1.9	3.5
1.25X SureGuard on Red mulch	1.7	3.7
Surflan on Red mulch	1.5	1.5*
0.75X Surflan on Red mulch	1.4	1.2*
1.25X Surflan on Red mulch	2	1.4*
Animal Retardant on Red mulch	1.9	1.8*
0.75X Animal Retardant on Red mulch	2.1	1.4*
1.25X Animal Retardant on Red mulch	2.4	3.1
Liquid Snapshot on Softscape	2.8	1.1*
SureGuard on Softscape	1.2*	1.4*
Surflan on Softscape	1.2*	2.7
Borax #1 on Softscape	2.1	3.6
Borax #2 on Softscape	1.3*	3.7
SureGuard+Fertilizer on colored mulch	1.6	1.6*
SureGuard+Fertilizer on Softscape	1.2	2.6
Borax+Fertilizer on Softscape	2	1.3*
SureGuard+Granular Fertilizer on Colored mulch	2.6	3.9
Borax+Granular Fertilizer on Colored mulch	2.2	1.8*
Red colored mulch	1.2*	1.4*
Softscape	1.3*	2.1*
Untreated control	2.8	5.2

z = For 'Mugo' pine and geranium, no treatments are significantly higher than the control, those treatments marked by * are significantly lower than the control

Table 2. Efficacy of various herbicide treated and untreated mulches averaged over 30, 60, and 90 DAT

Treatment	Visual Rating	Fresh weight
Preen HW Mulch Plus	5.6 k[z]	13.1[y]
Preen Colored Mulch Plus	8.9 abcd	0.0
Liquid Snapshot on Red mulch	9.2 abc	2.5
0.75X Liquid Snapshot on Red mulch	9.9 a	0.0
1.25X Liquid Snapshot on Red mulch	9.8 ab	0.5
SureGuard on Red mulch	9.6 ab	0.0
0.75X SureGuard on Red mulch	8.8 bcde	0.0
1.25X SureGuard on Red mulch	8.1 defg	21.9
Surflan on Red mulch	7.8 efgh	0.2
0.75X Surflan on Red mulch	6.2 ijk	6.0
1.25X Surflan on Red mulch	6.3 ijk	21.0
Animal Retardant on Red mulch	5.5 k	33.0
0.75X Animal Retardant on Red mulch	6.2 ijk	31.7
1.25X Animal Retardant on Red mulch	6.2 ijk	51.7
Liquid Snapshot on Softscape	6.1 jk	30.6
SureGuard on Softscape	8.1 defg	0.3
Surflan on Softscape	6.9 hij	21.1
Borax #1 on Softscape	5.5 k	21.0
Borax #2 on Softscape	7.5 fgh	7.2
SureGuard+Fertilizer on colored mulch	7.2 ghi	7.4
SureGuard+Fertilizer on Softscape	7.7 fgh	0.7
Borax+Fertilizer on Softscape	6.2 ijk	46.9
SureGuard+Granular Fertilizer on Colored mulch	8.5 cdef	0.0
Borax+Granular Fertilizer on Colored mulch	6.2 ijk	35.9
Red colored mulch	7.2 ghi	4.5
Softscape	7.2 ghi	38.8
Untreated control	0 l	152.2

z = Treatments with similar letters are not significantly different based on lsmeans (α = 0.05)

y = All treatments have significantly lower weight than the untreated control based on Dunnett's t-test (α = 0.05)