Liverwort Control in Containerized Ornamentals.

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Nature of Work: Liverwort (Marchantia spp.) can be an extremely difficult plant to control in propagation houses and containerized ornamentals. Although several herbicides claim to control liverwort, no reliable labeled herbicide exists. This, however, could change as Mogeton/Gentry 25WP (quinoclamine) is currently seeking registration. This product has been tested for several years, and has proven to control liverwort, but much testing is needed on performance and safety quinoclamine in hot humid conditions. To help answer some of these questions, study was designed to determine safety and liverwort efficacy of quinoclamine.

On June 26, 2007 at the Center for Applied Nursery Research, 32 pots one gallon pots of each of the following were assembled: Pawpaw (*Asimina triloba*), Oakleaf hydrangea (*Hydrangea quercifolia* 'Snowflake'), and Tradition azalea (*Rhododendron* x 'Tradition'). All plants were sized up from liners in April of 2007. Liners were sized using Fafard 52 mix (one of several industry standards). Farfard 52 has a bulk density of 17 to 20 pounds per cubic feet, and a pH range is 5.5 to 6.5. The mix contains processed pine bark, peat moss, vermiculite, and perlite. All plants also received a slow release fertilizer application (~1 Tablespoon of a 13-13-13 Osmocote or 16-6-11 Polyon) one time before treatments. Six, one gallon pots of each species were than placed in a 6 ft. x 6 ft. area. Before treatments were applied, 500 ml of a liverwort slurry was applied to each pot. The liverwort slurry was created by filling up a 5 gallon bucket with liverwort thallus and water. The thallus water mixture was than mixed vigorously for 5 minutes. Thallus was then removed, and the remaining water contained reproductive tissues (gammae) that easily infest containers. After applying 500 ml of the liverwort slurry, the herbicide treatment was applied, and pots were moved to assigned test area where they were arranged in a randomized complete block (RCB) design. Each treatment contained 4 replications, and each replication contained 1 subsample (pot). The process was continued for each herbicide treatment. Except for the quinoclamine treatments, sprayable herbicides were applied with a CO_2 backpack sprayer calibrated to deliver 20 gallons per acre (GPA). Quinclamine treatments were applied with a CO_2 backpack sprayer calibrated to deliver 100 gallons per acre (GPA). A repeat application was applied to treatment one and two on July 16, 2007. Treatment one also received a third application on July 24, 2007. Granular herbicides were applied at the appropriate rate with a cheese shaker jar. Watering occurred on an as needed basis, and this represented approximately 2 to 1 inch of water per day. The treatment list was as follows:

Treatment#	Treatment	Active ingredient	Rate
1	Mogeton 26 WP	Quinoclamine	4.08 lb/A (1.06 lb ai/A)
1	Mogeton 26 WP	Quinoclamine	4.08 lb/A (1.06 lb ai/A)
1	Mogeton 26 WP	Quinoclamine	4.08 lb/A (1.06 lb ai/A)
2	Mogeton 26 WP	Quinoclamine	6.15 lb/A (1.6 lb ai/A)

2	Mogeton 26 WP	Quinoclamine	6.15 lb/A (1.6 lb ai/A)
3	Mogeton 26 WP	Quinoclamine	12.3 lb/A (3.2 lb ai/A)
4	Mogeton 26 WP	Quinoclamine	24.6 lb/A (6.4 lb ai/A)
5	Ronstar 2 GR	Oxadiazon	200 lb/A (4.0 lb ai/A)
6	Showcase 2.5 GR	Isoxaben, Oxyfluorfen, Trifluralin.	100 lb/A (2.5 lb ai/A)
7	Broadstar 0.25 GR	Flumioxazin	100 lb/A (0.25 lb/A)
8	Check		

% Liverwort cover and plant injury was taken at 2, 4,8, and 12 weeks after treatment (WAT). Plant injury was taken on a (0-100 scale) and numbers represented the following:

Value	Plant Symptoms
0	No visual injury present
10-30	Minimal injury to desirable plant. Less than 10% of the plant leaf service area showing chlorosis and necrosis.
40-70	More noticeable plant injury or stunting. Greater than 50% of the leaf area showing symptoms of chlorosis and/or necrosis.
80-90	Plants severally injured. Most of the leaves and leaf surface showing signs of chlorosis and necrosis.
100	Plant appears dead. No signs of regrowth.

Results and Discussion:

No treatments caused significant injury to Tradition azalea. Oakleaf hydrangea showed significant injury at 4 weeks after first treatment WAFT with treatment one. Pawpaw showed significant injury with treatments one thur three at two WAFT (Tables 1-4). Although some significant injury occurred to hydrangea and pawpaw, injury did exceed 25 percent with any of the Mogeton treatments (Table 1-4). At 4 WAFT, all treatments were providing significantly better control than the UTC. By 12 WAFT, only treatments one and two were providing significant better control than the untreated control (UTC).

Significance to Industry:

Results of this study have shown that Mogeton and other registered herbicide can provide adequate safety to some ornamentals and control of liverwort in containerized ornamentals. More research needs to be performed in order to determine safety and efficacy of Mogeton in the

Southeast.

Table 1. Injury to Pawpaw (*Asimina triloba*), Oakleaf hydrangea (*Hydrangea quercifolia* 'Snowflake'), and Tradition azalea (*Rhododendron* x 'Tradition'), and liverwort (Marchantia spp.) control at 2 WAT.

Treatment#	Treatment	Rate	Azalea	Hydrangea	Pawpaw *	Liverwort*
			Plant injury 2 WAT			Control 2 WAT
1	Mogeton 26 WP (3 applications)	4.08 lb/A (1.06 lb ai/A)	0 a	0 a	0 a	78 a
2	Mogeton 26 WP (2 applications)	6.15 lb/A (1.6 lb ai/A)	0 a	0 a	0 a	96 a
3	Mogeton 26 WP (2 applications)	12.3 lb/A (3.2 lb ai/A)	0 a	0 a	0 a	98 a
4	Mogeton 26 WP (2 applications)	24.6 lb/A (6.4 lb ai/A)	0 a	0 a	0 a	100 a
5	Ronstar 2 GR	200 lb/A (4.0 lb ai/A)	0 a	0 a	0 a	100 a
6	Showcase 2.5 GR	100 lb/A (2.5 lb ai/A)	0 a	0 a	0 a	98 a
7	Broadstar 0.25 GR	100 lb/A (0.25 lb/A)	0 a	0 a	0 a	99 a
8	Check		0 a	0 a	0 a	99 a
LSD			0	0	0	24

*Means followed by same letter do not significantly differ (P=0.05, LSD)

Table 2. Injury to Pawpaw (*Asimina triloba*), Oakleaf hydrangea (*Hydrangea quercifolia* 'Snowflake'), and Tradition azalea

(*Rhododendron* x ‘Tradition’), and liverwort (Marchantia spp.) control at 4 WAT.

Treatment#	Treatment	Rate	Azalea	Hydrangea	Pawpaw *	Liverwort*
			Plant injury 2 WAT			Control 2 WAT
1	Mogeton 26 WP (3 applications)	4.08 lb/A (1.06 lb ai/A)	0 a	0 a	15 a	100 a
2	Mogeton 26 WP (2 applications)	6.15 lb/A (1.6 lb ai/A)	0 a	0 a	1 a	98 a
3	Mogeton 26 WP (2 applications)	12.3 lb/A (3.2 lb ai/A)	0 a	0 a	6 a	93 a
4	Mogeton 26 WP (2 applications)	24.6 lb/A (6.4 lb ai/A)	0 a	0 a	6 a	92 a
5	Ronstar 2 GR	200 lb/A (4.0 lb ai/A)	0 a	0 a	13 a	93 a
6	Showcase 2.5 GR	100 lb/A (2.5 lb ai/A)	0 a	0 a	8 a	90 a
7	Broadstar 0.25 GR	100 lb/A (0.25 lb/A)	0 a	0 a	0 a	98 a
8	Check		0 a	0 a	0 a	0 b
LSD			0	0	16	7

*Means followed by same letter do not significantly differ (P=0.05, LSD)

Table 3. Injury to Pawpaw (*Asimina triloba*), Oakleaf hydrangea (*Hydrangea quercifolia* 'Snowflake'), and Tradition azalea (*Rhododendron* x ‘Tradition’), and liverwort (Marchantia spp.) control at 8 WAT.

Treatment#	Treatment	Rate	Azalea	Hydrangea	Pawpaw *	Liverwort*
			Plant injury 2 WAT			Control 2 WAT
1	Mogeton 26 WP (3 applications)	4.08 lb/A (1.06 lb ai/A)	0 a	5 a	15 a	100 a
2	Mogeton 26 WP (2 applications)	6.15 lb/A (1.6 lb ai/A)	0 a	0 a	1 a	100 a
3	Mogeton 26 WP (2 applications)	12.3 lb/A (3.2 lb ai/A)	0 a	5 a	6 a	85 a
4	Mogeton 26 WP (2 applications)	24.6 lb/A (6.4 lb ai/A)	0 a	10 a	6 a	88 a
5	Ronstar 2 GR	200 lb/A (4.0 lb ai/A)	0 a	3 a	13 a	78 a
6	Showcase 2.5 GR	100 lb/A (2.5 lb ai/A)	0 a	5 a	8 a	78 a
7	Broadstar 0.25 GR	100 lb/A (0.25 lb/A)	0 a	15 a	0 a	93 a
8	Check		0 a	0 a	0 a	0 b
LSD			0	0	16	22

*Means followed by same letter do not significantly differ (P=0.05, LSD)

Table 4. Injury to Pawpaw (*Asimina triloba*), Oakleaf hydrangea (*Hydrangea quercifolia* 'Snowflake'), and Tradition azalea (*Rhododendron* x 'Tradition'), and liverwort (Marchantia spp.) control at 12 WAT.

Treatment#	Treatment	Rate	Azalea	Hydrangea	Pawpaw *	Liverwort*
			Plant injury 2 WAT			Control 2 WAT
1	Mogeton 26 WP (3 applications)	4.08 lb/A (1.06 lb ai/A)	0 a	3 a	25 a	100 a
2	Mogeton 26 WP (2 applications)	6.15 lb/A (1.6 lb ai/A)	0 a	0 a	0 a	98 ab
3	Mogeton 26 WP (2 applications)	12.3 lb/A (3.2 lb ai/A)	0 a	5 a	0 a	83 ab
4	Mogeton 26 WP (2 applications)	24.6 lb/A (6.4 lb ai/A)	0 a	5 a	0 a	80 ab
5	Ronstar 2 GR	200 lb/A (4.0 lb ai/A)	0 a	0 a	0 a	68 b
6	Showcase 2.5 GR	100 lb/A (2.5 lb ai/A)	0 a	0 a	0 a	75 ab
7	Broadstar 0.25 GR	100 lb/A (0.25 lb/A)	0 a	0 a	0 a	80 ab
8	Check		0 a	0 a	0 a	0 c
LSD			0	7	26	20

*Means followed by same letter do not significantly differ (P=0.05, LSD)