chlor tablets at 10 kg/ha to be non-injurious, while the 40 kg/ha tablets exhibited moderate injury to both species (Table 2). Metolachlor and alachlor granules exhibited moderate injury at the higher rates to both species. Injury exhibited on cranberry cotoneaster was characterized as a stunting of growth, while that with border forsythia was a stunting of growth and a leaf distortion. Alachlor was more injurious than metolachlor to the species included in this study.

Results indicate that the slow release herbicide tablets reduced the relative concentration of herbicide that came into contact with the plant roots and as a result phytotoxicity was reduced.

Table 2. Evaluation of metolachlor and alachlor granules and slow release tablets for crop tolerance to 2 container grown species.

			Border forysthia		Cranberry cotoneaster	
Herbicide	Formulation	Rate (kg/ha)	Visual injury[z]	Dry wt (g)	Visual injury[z]	Dry wt (g)
Metolachlor	Tablet	10	1.6	.92	1.0	.95
		40	6.0	.80	1.3	.81
	Granule	10	5.3	.84	3.6	.77
		40	6.3	.78	5.0	.75
Alachlor	Tablet	10	2.6	.83	2.6	.80
		40	6.6	.74	2.6	.78
	Granule	10	6.3	.77	3.3	.75
		40	8.3	.73	6.0	.78
Control			1.0	.99	1.0	.96
LSD 5%			4.1	.10	1.7	.06

[z]Visual rating scale: 1 = no injury; 10 = complete kill.

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Influence of Sulfur Dioxide Fumigation on Regrowth of American Sycamore Seedlings Treated with Maleic Hydrazide[1]

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Abstract. **Two-year-old containerized seedlings of American sycamore (*Platanus occidentalis* L.) were treated with maleic hydrazide (MH) before, after, or in the absence of sulfur dioxide (SO_2) fumigation. Exposure to SO_2 did not reduce the effectiveness of MH in controlling regrowth of this species. A strong negative linear trend was observed between SO_2 concentration and sprout growth, either with or without MH treatment. In all instances, exposure to 1.0 ppm SO_2 resulted in high levels of phytotoxicity.**

Management of vegetation along utility rights-of-way has become an increasingly important problem in many urban communities. Although mechanical pruning is presently considered the most effective means of controlling growth, there are inherent disadvantages with this technique (1,3). Consequently, the use of growth-regulating chemicals has gained wider acceptance over the last 25 years (4). With the expanded use of growth regulators has come the necessity of understanding how these chemicals interact with various stress factors that prevail in most urban environments. This study was designed to investigate the influence of sulfur dioxide (SO_2) — a major urban air pollutant–on the effectiveness of MH in controlling sprout regrowth of American sycamore.

One-hundred-ten 2-year-old seedlings of American sycamore were potted in 15-cm plastic containers in a mixture of 2 peat: 1 perlite: 1 soil (v/v/v) and placed in the greenhouse during mid-April. About 8 weeks later, when the seedlings were in full leaf, serum vial caps were affixed to the main stem of each plant using the technique described by Gregory (5). The serum caps served as a chemical reservoir for those seedlings treated with MH. One week after placement of the serum caps, about one-third of the foliage was trimmed from the top of each seedling and groups of 10 plants each were subjected to one of the following treatments: MH applied 24 hr *before* fumigation at 0.25, 0.50 or 1.00 ppm SO_2; MH applied 48 hrs *after* fumigation at 0.25, 0.50, or 1.00 ppm SO_2; MH applied without SO_2 fumigation; fumigation at 0.25, 0.50, or 1.00 ppm SO_2 without MH treatment; and no SO_2 fumigation or MH treatment (control).

For seedlings treated with MH, 5 ml of chemical solution at a concentration of 3.0 g/liter was added to each serum cap reservoir prior to wounding the stem with a scapel. For seedlings not receiving MH treatment, 5 ml of water was added before wounding. Uptake of liquid (either MH solution or water) occurred through stem wounds via normal transpirational processes. The serum caps were left in place until all the liquid was absorbed (usually within 24 hr), after which the caps were removed to prevent possible girdling of young stem tissue.

For seedlings fumigated with SO_2, treatments were made in a series of continuous stirred-tank reactors similar to those described by Heck et al. (7). The fumigant was added to a charcoal-filtered air stream before it entered each chamber. Average chamber temperature

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was 29 ± 3°C and relative humidity ranged from 35 to 75%. Exposure of seedlings to each SO_2 concentration (0.25, 0.5, and 1.0 ppm) lasted 6 hr (9 AM-3PM), after which the plants were returned to the greenhouse for further observation.

Eight weeks after treatment, measurements of height increase, number of sprouts, sprout length, and relative phytotoxicity were determined. Phytotoxicity was measured subjectively on a numerical scale from 0 to 5 (13). Seedlings with ratings of 3 or more were considered unacceptable for landscape purposes in terms of their foliar appearance. The data were statistically analyzed (one-way analysis of variance), after which a series of orthogonal contrasts was made between means (2).

Sprout regrowth (height and sprout length) was significantly reduced by MH treatment whether the chemical was applied before fumigation, after fumigation, or in the absence of SO_2 (Table 1). There was no significant difference in growth for those seedlings treated with MH before or after fumigation, except for the group fumigated with 1.0 ppm SO_2. At this concentration, height and sprout length were significantly less in seedlings treated with MH *before* fumigation. It is possible that MH was not as effective in controlling growth in seedlings treated first with 1.0 ppm SO_2 because of the influence of the pollutant on the diffusion resistance of fumigated leaves (9). An increase in diffusion resistance caused by SO_2 fumigation would decrease transpiration and, thus, reduce the quantity of MH translocated to the active meristematic areas of the plant. With proportionately less MH, the subsequent effect on growth would be expected to decline.

Exposure to SO_2 only, without MH treatment, also reduced height growth and sprout length when compared with untreated control plants (Table 1). This was particularly true at the higher SO_2 concentrations (0.5 and 1.0 ppm). These data were reflected in the existance of a strong negative linear trend between sprout regrowth and SO_2 concentration 2 months after fumigation. Sprout number was not significantly affected by any of the treatments (Table 1).

In general, phytotoxicity of sycamore seedlings fumigated with SO_2, either with or without MH treatments, was greater than comparable seedlings not exposed to the pollutant (Table 1). Also, as the concentration of SO_2increased, phytotoxicity became more pronounced until at 1.0 ppm, foliar appearance exceeded the limits of acceptability established for this study.

The results of ths investigation show that exposure to SO_2 does not decrease the effectiveness of MH in controlling sprout regrowth of American sycamore seedlings. Although the primary physiological effects of MH and SO_2 are different (6,8,9,11), both compounds function together to alter normal growth patterns by disrupting plant metabolism — MH directly inhibiting nucleic acid synthesis (11), and SO_2 acting indirectly through its influence on ethylene production (12), which in turn alters RNA-directed protein synthesis (10).

Table 1. Growth and phytotoxicity of 2-yr-old American sycamore seedlings 8 weeks after treatment with maleic hydrazide (MH) and/or exposure to sulfur dioxide (SO_2).[z]

	MH (3 g/liter)							No MH			
	Before SO_2			After SO_2				SO_2			
Growth index	0.25 ppm	0.25 ppm	1.0 ppm	0.25 ppm	0.5 ppm	1.0 ppm	No SO_2	0.25 ppm	0.5 ppm	1.0 ppm	Control
Height (cm)	10.1*	4.5*	0.1*	8.6*	6.3*	5.5*	5.4*	21.0	15.7	8.7*	21.2
Sprout length (cm)	7.6*	4.4*	0.3*	7.5*	3.7*	3.2*	4.2*	13.3	6.8*	4.2*	14.0
Sprout no.	6.0	6.3	1.8	3.6	3.1	2.8	5.3	2.8	4.9	3.0	3.5
Phytotoxicity rating[y]	1.8	2.3	3.8*	2.2	3.0*	3.5*	2.2	2.6	2.9*	3.4*	2.1

[z]Each value represents the mean of 10 seedlings.
[y]Values based on numerical rating scale from 0 to 5. Phytotoxicity ratings of 3 or more are considered unacceptable for landscape purposes.
*Treatment mean significantly different from the control, 5% probability level.

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