establishment.


Loisel ground cover establish-


Gardner Color Difference Meter was clearly
distinguish between fruit color classes with
texture, or color values, three readings
are three optical sample beaker rotations
indicated that, regardless of fruit color class,
fruit, each fruit color class as established by
of comparison with the AOAC method, data
readings of the sample beaker, and the aL/bL
Comparison of the Gardner Color Dis-
method for Tabasco pepper fresh fruit color extraction
of Munsell Color Plates is quantitatively
classified as by the discriminant analysis. As the primary
generated on the Gardner Color Dif-
ference Meter using pepper fruit mash, three
Evaluation of the fruit mash and using the aL/bL
class (5) = 10R, 5/16; and class 6 (red) = 7.5R, 5/16.

Table 1. Freshly ground Tabasco pepper fruit color values as determined by the Assn. of Official Analytical Chemists (AOAC) and Gardner Color Difference Meter methods.

<table>
<thead>
<tr>
<th>Method</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOAC (color value)</td>
<td>5.20</td>
<td>4.04</td>
<td>3.40</td>
<td>3.08</td>
<td>2.73</td>
<td>2.40</td>
</tr>
<tr>
<td>Mean (aL/bL value)</td>
<td>0.24</td>
<td>0.14</td>
<td>0.07</td>
<td>0.04</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Range</td>
<td>0.00-0.24</td>
<td>0.00-0.14</td>
<td>0.00-0.07</td>
<td>0.00-0.04</td>
<td>0.00-0.01</td>
<td>0.00-0.00</td>
</tr>
</tbody>
</table>

*Determined by the Munsell System of Color Notation (7) where: class 1 (green) = 7.5Y, 7/8; class 2 (green) = 7.5Y, 8/10; class 3 (orange) = 7.5YR, 7/12; class 4 (orange) = 2.5YR, 6/16; class 5 (red) = 10R, 5/16; and class 6 (red) = 7.5R, 5/16.

Table 1 shows that, regardless of fruit color class,


**Veronica repens Establishment with Herbicides and Activated Charcoal**

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Additional index words: ground cover, DCPA, dichlobenil, chlorsulfuron, oxadizon, simazine, trifluralin

**Abstract.** Veronica repens was evaluated in a field study comparing herbicide effects on ground cover establishment. Herbicides were applied 1 day before ground covers were transplanted. Ground cover transplant root systems were either dipped or not dipped in an activated charcoal slurry prior to planting. There was a significant interaction between herbicide and charcoal treatment. Dichlobenil, chlorsulfuron, and simazine caused significant injury and reduced surface coverage. Transplants dipped in activated charcoal and treated with dichlobenil or chlorsulfuron had as much as three times less injury and produced 24% greater surface coverage than those without activated charcoal. DCPA, oxadizon, and trifluralin caused little herbicide injury or ground cover stand reduction, and activated charcoal preconditioning did not influence their responses. These results indicate a broad herbicide range could be used with the activated charcoal system dip procedure during Veronica repens establishment.

Chemical names used: dimethyl tetrachloroterephthalate (DCPA), 2,6-dichlorobenzonitride (dichlobenil); 2-chloro-N-[[4-(methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide (chlorsulfuron); [2,2-dichloro-5-(1-methylthoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one (oxadizon); 6-Chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine (simazine); α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine (trifluralin).

**Literature Cited**


Table 1. Herbicide injury on *Veronica repens* based on herbicide and charcoal (C) vs. no charcoal (NC) treatment.

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate (kg ha$^{-1}$)</th>
<th>6 July</th>
<th>14 July</th>
<th>28 July</th>
<th>12 Aug.</th>
<th>26 Aug.</th>
<th>16 Sept.</th>
<th>7 Oct.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>NC</td>
<td>C</td>
<td>NC</td>
<td>C</td>
<td>NC</td>
<td>C</td>
<td>NC</td>
</tr>
<tr>
<td>Dichlobenil</td>
<td>9.1</td>
<td>2.0</td>
<td>2.9 a</td>
<td>3.1</td>
<td>3.6 a</td>
<td>3.9 a</td>
<td>3.8 a</td>
<td>3.6 a</td>
</tr>
<tr>
<td>Chlorsulfuron</td>
<td>0.07</td>
<td>2.0</td>
<td>3.5 a</td>
<td>3.0</td>
<td>4.0</td>
<td>4.1</td>
<td>3.0</td>
<td>3.1 a</td>
</tr>
<tr>
<td>Simazine</td>
<td>2.3</td>
<td>1.5</td>
<td>4.0 a</td>
<td>3.2</td>
<td>3.6</td>
<td>3.6</td>
<td>3.4</td>
<td>3.6 a</td>
</tr>
<tr>
<td>Trifluralin</td>
<td>2.3</td>
<td>1.3</td>
<td>4.2 a</td>
<td>1.8</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9 a</td>
</tr>
<tr>
<td>Oxadiazon</td>
<td>3.4</td>
<td>1.3</td>
<td>2.3 b</td>
<td>1.0</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>2.0 a</td>
</tr>
<tr>
<td>DCPA</td>
<td>11.9</td>
<td>1.0</td>
<td>1.0 a</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0 a</td>
</tr>
<tr>
<td>Control</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0 a</td>
</tr>
</tbody>
</table>

LSD (C vs. NC)$^a$ 0.8 1.2 1.1 1.1 1.0 1.2

$^a$Herbicide injury was selected based on a visual rating scale of 1 to 9, with 1 = no injury and 9 = 90–100% of plants injured.

$^b$Values are means of four replications. Means separation within columns by Duncan’s multiple range test, $P = 5%$.

$^c$Waller–Duncan k-ratio Bayesian LSD, $P = 5\%$, for separation of charcoal (C) vs. no charcoal (NC).

There were eight plants per plot with four plants dipped in the charcoal slurry and four plants not dipped.

Ground covers were transplanted on 1 July 1983 in a Sharpsburg silty clay loam (*Typic Argudoll*, pH 7.1, and a soil organic matter content of 2.9%). A template was used for planting to minimize soil disruption. Treated soil was not trafficked nor was soil displacement a factor when planting the transplants. Plants were irrigated with 25 mm of water immediately after planting. Ground covers received a minimum of 25 mm of water each week from rainfall or irrigation. Herbicide efficacy was evaluated, since the spectrum of weeds controlled by each herbicide previously had been established, and it was thought that weed competition would interfere with evaluation of potential herbicide injury.

Treatments were hand-weeded to eliminate weed competition, particularly in the control. Weeds were clipped at the soil surface to minimize soil disruption.

Ground covers were evaluated for herbicide injury and for rate of establishment. Plants were rated for herbicide injury seven times in 1983, using a visual rating scale of 1 to 9 ($1 = no injury and 9 = 90\% to 100\%$ of plants injured). Surface coverage was estimated on 2 July 1984, 1 year after treatment. Surface coverage was based on percentage of surface area occupied by ground cover. Surface cover and herbicide injury data were transformed using the arcsin transformation before analysis (7).

**Table 2. Influence of herbicide and charcoal treatment on establishment of *Veronica repens* 1 year after treatment.**

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate (kg ha$^{-1}$)</th>
<th>Surface cover (%)</th>
<th>C</th>
<th>NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dichlobenil</td>
<td>9.1</td>
<td>24 a$^a$</td>
<td>0 a</td>
<td>8 a</td>
</tr>
<tr>
<td>Chlorsulfuron</td>
<td>0.07</td>
<td>33 b</td>
<td>11 b</td>
<td>11 b</td>
</tr>
<tr>
<td>Simazine</td>
<td>2.3</td>
<td>59 c</td>
<td>36 c</td>
<td>36 c</td>
</tr>
<tr>
<td>Trifluralin</td>
<td>2.3</td>
<td>62 c</td>
<td>51 d</td>
<td>51 d</td>
</tr>
<tr>
<td>Oxadiazon</td>
<td>3.4</td>
<td>62 c</td>
<td>54 de</td>
<td>54 de</td>
</tr>
<tr>
<td>DCPA</td>
<td>11.9</td>
<td>65 c</td>
<td>59 de</td>
<td>59 de</td>
</tr>
<tr>
<td>Control</td>
<td>1.0</td>
<td>64 c</td>
<td>63 e</td>
<td>63 e</td>
</tr>
</tbody>
</table>

LSD (C vs. NC)$^b$ 8

$^a$Surface cover was based on an estimate of plot area occupied by ground cover on 2 July 1984. Values were rounded to nearest whole number.

$^b$Charcoal (C) vs. no charcoal (NC).

$^c$Values are means of four replications. Means separation within columns by Duncan’s multiple range test, $P = 5\%$.

*Chlorophasis* plants not dipped. Plants dipped in the charcoal slurry and four plants not dipped. Ground covers were transplanted on 1 July 1983 in a Sharpsburg silty clay loam (*Typic Argudoll*, pH 7.1, and a soil organic matter content of 2.9%). A template was used for planting to minimize soil disruption. Treated soil was not trafficked nor was soil displacement a factor when planting the transplants. Plants were irrigated with 25 mm of water immediately after planting. Ground covers received a minimum of 25 mm of water each week from rainfall or irrigation. Herbicide efficacy was evaluated, since the spectrum of weeds controlled by each herbicide previously had been established, and it was thought that weed competition would interfere with evaluation of potential herbicide injury.

Treatments were hand-weeded to eliminate weed competition, particularly in the control. Weeds were clipped at the soil surface to minimize soil disruption.

Ground covers were evaluated for herbicide injury and for rate of establishment. Plants were rated for herbicide injury seven times in 1983, using a visual rating scale of 1 to 9 ($1 = no injury and 9 = 90\% to 100\%$ of plants injured). Surface coverage was estimated on 2 July 1984, 1 year after treatment. Surface coverage was based on percentage of surface area occupied by ground cover. Surface cover and herbicide injury data were transformed using the arcsin transformation before analysis (7).

**V. repens** transplants differed in response to preplant herbicide applications (Table 1). Dichlobenil, chlorsulfuron, and simazine had higher injury ratings than the untreated control. DCPA, oxadiazon, and trifluralin differed in herbicide injury from the control at one and four weeks after treatment. There was a significant interaction between herbicide and charcoal treatment. Dipping transplant root systems in charcoal slurry reduced dichlobenil, chlorsulfuron, and simazine injury on six of seven dates evaluated after treatment (Table 1). There was a trend for herbicide injury to be greater on plants in the no charcoal vs. charcoal treatment, but only dichlobenil, chlorsulfuron, and simazine benefited significantly from the charcoal treatment. **V. repens** establishment was influenced by herbicide treatment 1 year after application (Table 2). The use of dichlobenil without charcoal resulted in no ground cover stand compared to 24% stand with charcoal-treated plants. Similar results were obtained with chlorsulfuron, simazine, and trifluralin. Charcoal treatment increased stand by 22%, 23%, and 9%, respectively. These data do not suggest that an herbicide such as dichlobenil should be used for *V. repens* establishment, but they do demonstrate the benefit of charcoal-slurry root-dip technique for reducing detrimental herbicide effects.

Activated charcoal has a high absorptive capacity due to its large surface area, and absorption is determined partially by the source of activated carbon (3). Thus, the source of the activated carbon may be important in duplicating research results. The reduction in phytotoxicity of dichlobenil, chlorsulfuron, and simazine to *V. repens* by activated charcoal was likely due to the absorption of the compound by the charcoal. In a highly polar and complex compound like chlorsulfuron, it is the less-polar portion of the molecule that is likely absorbed by the charcoal (3). The zone of activated charcoal around the root mass of the ground cover was thought to prevent or reduce weed coarse uptake. The remaining soil was free of activated carbon, so herbicide efficacy would not be reduced.

The greater reduction in phytotoxicity by charcoal treatment for dichlobenil, chlorsulfuron, and simazine compared to DCPA, oxadiazon, and trifluralin was likely due to the magnitude of herbicide injury, since some detrimental response was noted for all herbicide treatments. The decreased phytotoxicity anticipated from activated charcoal treatment may not have been detectable due to minimal difference in treatment responses for DCPA, oxadiazon, and trifluralin. Activated charcoal should have similar absorptive response on DCPA, oxadiazon, and trifluralin, as it would on the others.

These results demonstrated that dipping **V. repens** root masses in an activated charcoal slurry before transplanting enhanced ground cover establishment when chlorsulfuron, dichlobenil, and simazine were applied to the soil as preplant treatments. The reduced phytotoxicity of simazine to **V. repens** and the improved surface coverage when root
masses were dipped in an activated charcoal slurry suggested that simazine has potential as a herbicide in the establishment of \textit{V. re- pens}. Further studies on application rate and timing are needed.

**Literature Cited**


**Effect of Daminozide and Light Intensity on Growth and Flowering of Calendula as a Potted Plant**

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**Additional index words.** B-9, growth regulator, \textit{Calendula officinalis}

**Abstract.** Two applications of 3500 ppm daminozide applied 4 to 5 weeks from sowing and at visible bud stage resulted in excellent height control of \textit{Calendula officinalis} L. ‘Mandarin’ by reducing both peduncle and internodal elongation. There were no differences in flowering time between any daminozide concentrations (1500, 3500, or 5000 ppm) and control. Light reduction of 50% during the spring months did not increase plant height or prolong flowering times compared with ambient, but 75% light reduction increased internode elongation and duration of flowering. There were no interactions between light reduction and number of daminozide applications. Chemical name used: butanedioic acid mono(2,2-dimethylhydrazide) (daminozide).

Calendula has been grown for many years as a cut flower crop in the United States, Canada, and northern Europe. Historically, it has been grown in the greenhouse in northern latitudes at night temperatures <10°C under high light intensity (9). Plants were grown for early summer or late fall bloom only (9), but they are also grown in the field as far south as Miami, Fla. (B. Tija, personal communication). New breeding efforts have resulted in dwarfed Calendula cultivars applicable to pot culture.

Moham Ram and Mehta (8) showed that application of 100 and 250 ppm GA\(_3\) to cut flower cultivars of Calendula increased growth of axillary branches and that methyl-2-chloro-9-hydroxy-fluorene-9-carboxylate (morphectin) resulted in initial damage of the short apices followed by an increase in growth of lateral shoots and number of inflorescences (7). Calendula is a qualitative long-day plant with a photoperiod of 6.5 hr (10).

Little has been reported on Calendula as a potted crop. The objective of this research was to determine the effect of daminozide and light intensity on the growth and flowering of Calendula grown as a potted crop. Daminozide has been effective on height control of Calendula (2), but the number of applications and timing of daminozide have not yet been elucidated for pot culture. Calendula is a full-sun species during the winter months. One of our objectives, however, was to determine if light reduction during the spring months would help to extend production time without a loss of crop quality.

A series of preliminary experiments conducted in glass greenhouses at the Univ. of Georgia indicated that the cultivar Mandarin

(Park Seed Co., Greenville, S.C.) and ‘Bonbon’ (Bodger Seed Co., Lompac, Calif.) would be appropriate for study as a potted crop. Daminozide was selected as the growth regulator because of previous work and also due to its effectiveness in height retardation of species belonging to the Asteraceae family (1, 6, 11). Initial experiments with daminozide were conducted to determine the effective concentration and further experimentation was done to determine the proper time of application and the influence of light.

Seeds of ‘Mandarin’ and ‘Bonbon’ were sown either in Apr. 1983 or Apr. 1984 under intermittent mist, and uniform seedlings were transplanted =14 days later into a 10-cm container filled with a 1 peat : 1 vermiculite (v/v) soilless medium (4). All pots received constant liquid fertilizer application of 200 ppm N from 15N–9.9P–13.9K. Every fourth irrigation was with tap water to reduce soluble salt build-up. The greenhouses were cooled with an adiabatic cooling system, and day temperatures were 20°C ± 4°C. Treatments were arranged in completely randomized experiments. Trend analysis and analysis of variance were conducted on the data, and Duncan’s multiple range test was used for mean comparisons.

Twenty-five uniform seedlings were initially sprayed with 0 (tap water), 1500, 3500, or 5000 ppm daminozide 5 weeks from sowing, and a second spray was applied when the flower bud was just visible (<3 cm diameter, =10 days later). Plants were grown under ambient light conditions, and flower diameter, days from sowing to flowering, peduncle length, and total height (from soil to top of flower) were measured at time of anthesis.

Twenty-five uniform seedlings were sprayed with 0 (tap water) or 3500 ppm daminozide 3, 4, 5, 6, or 7 weeks form sowing.

<table>
<thead>
<tr>
<th>Table 1. The effect of two applications of daminozide on growth and flowering of \textit{Calendula officinalis} ‘Mandarin’.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concen</strong></td>
</tr>
<tr>
<td>**Flowe...</td>
</tr>
<tr>
<td>**Significan...</td>
</tr>
</tbody>
</table>