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# Herbicide Performance on Transplanted Annual Bedding Plants[1]

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*Abstract.* **Alachlor (2-chloro-2',6'-diethyl-*N*-(methoxymethyl)-acetanilide), diphenamid (*N,N*-dimethyl-2,2-diphenylacetamide) and napropamide (2-(α-naphthoxy)-N,N-diethylpropionamide) provided excellent broadleaf and grass weed control. Alachlor significantly injured the 'St. John's Fire' Salvai while diphenamid caused moderate injury to 'Golden Torch' Celosia. Both trifluralin (α,α,α-trifluoro-2,6-dinitro-*N,N*-dipropyl-*p*-toluidine) and DCPA (dimethyl tetrachloroterephthalate) provided less than acceptable control of broadleaf weeds at the rates employed, but neither caused significant injury to any of the 15 cultivars of transplanted annual bedding plants used in this study.**

Table 1. Effectiveness of several herbicides on broadleaf and grass weed control in transplanted bedding plants.

| Treatment | Rate (kg/ha) | Overall weed control[z] Broad-leaf | Grass |
|---|---|---|---|
| Chloramben | 4.5 | 5.7 | 10.0 |
| EPTC | 4.5 | 3.0 | 6.7 |
| Alachlor | 3.4 | 9.3 | 9.7 |
| DCPA | 11.2 | 3.3 | 6.7 |
| Diphenamid | 6.7 | 8.0 | 8.7 |
| Napropamide | 3.4 | 8.0 | 9.7 |
| Butralin | 3.4 | 5.3 | 8.7 |
| Trifluralin | 2.2 | 5.3 | 8.7 |
| Non-weeded check | – | 1.0 | 2.0 |
| LSD 5% | | 1.3 | 1.4 |

[z]Visual rating scale: 1.0 (no weed control) to 10.0 (complete weed control).

Control of weeds in annual plant beds is a serious problem most often accomplished by laborious and costly hand weeding. Previous research has shown that DCPA when employed as a preemergence soil application produced no injury to many species of direct-seeded and transplanted annual bedding plants (1, 3). Haramaki and Atmore (3) observed satisfactory weed control with no injury on transplanted marigolds (*Tagetes patula* L.) 10 weeks after pre-transplant applications of diphenamid, trifluralin and EPTC (*S*-ethyl dipropylthiocarbamate) at a rate of 4.5 kg/ha. Fretz and Freeman (2) also noted that trifluralin at 2.2 kg/ha will satisfactorily control annual grass weeds with no injury to transplanted 'Boomershine' petunias, 'Nittany Lion' geranium, (*Pelargonium hortorum* Bailey) 'Blue Surf' ageratum, 'Golden Rocket' snapdragons (*Antirrhinum majus* L.) and 'Spun Yellow' marigolds.

This study was initiated to evaluate weed control and plant phytotoxicity from post-transplant applications of 8 preemergent herbicides on annual bedding plants.

Rates of application were selected as a result of previous herbicide demonstrations performed during the summers of 1972 and 1973. This study was conducted in 1974 using a completely randomized design with 3 replications. Individual treatment areas measured 1.8 x 14.6 m. Twelve plants of each of 15 cultivars (Table 2) were transplanted into replicated plots in a Brookston silty clay loam soil on June 5, 1974 and overhead irrigated with 2.5 cm of water immediately after completion of the planting operation. All bedding plants with the exception of the geraniums, were commercially produced from seed in 6/12 cell packs and were about 8 weeks old when transplanted. The 'Sprinter Red' geraniums were raised from cuttings and were fully developed in 10 cm pots when transplanted.

All herbicides were applied on June 11, 1974 using a $CO_2$ constant pressure sprayer calibrated to deliver the herbicides in the equivalent of 335 liters/ha and were leached in with 1.2 cm of water within 30 min following application. Herbicides and rates are listed in Table 1.

Control of weeds and phytotoxicity was recorded using a visual rating scale with 1.0 representing no weed control or no crop injury and 10.0 representing complete weed control or complete crop kill. A value of 8.0 or better was considered as acceptable weed control while phytotoxicity ratings of 3.0 or greater produced a degree of injury that would be unacceptable. At the time of the weed control evaluations, the major indigenous weed species included: *Galinsoga parviflora* Cav. (galinsoga) and *Digitaria sanguinalis* (L.) Scop. (large crabgrass) with lesser infestations of *Eleusine indica* (L.) Gaertn. (goosegrass), *Chenopodium album* L. (lambsquarter), *Amaranthus retroflexus* L. (redroot pigweed), *Portulaca oleraceae* L. (purslane), *Mollugo verticillata* L. (carpetweed) and *Hibiscus trionum* L. (venice mallow).

Of the herbicides evaluated in this study, only diphenamid, trifluralin and DCPA are labelled for usage on a wide variety of ornamentals, including some annual bedding plants. Among these materials, diphenamid exhibited the best overall grass and broadleaf weed control (Table 1), however, some phytotoxicity was observed on the transplants of celosia and caution should be exercised in applying diphenamid near these plants (Table 2). Trifluralin, as might be expected from previous research (2), provided excellent grass but poor broadleaf weed control with slight but not significant injury to salvia and amaranthus. Both broadleaf and grass weed control was observed to be unacceptable with DCPA at the rate employed and although not statistically significant some moderate injury in the form of stunting and overall reduced growth, was noted on several of the annual bedding plant species including snapdragon, chrysanthemum, salvia and amaranthus. In general, the results with diphenamid, trifluralin and DCPA compare favorably with those from similar tests conducted during previous summers here and with those previously published (1, 2, 3).

Among the other herbicidal materials evaluated in this study, both alachlor and napropamide provided acceptable grass and broadleaf weed control with satisfactory plant tolerance (Tables 1 and 2). Alachlor clearly gave better broadleaf weed control than napropamide at the rates employed in this study. Of the remaining herbicides evaluated, chloramben (3-amino-2,5-dichlorobenzoic acid) and butralin (4-(1,1-dimethylethyl)-*N*-(1-methylpropyl) -2,6-dinitrobenzenamine) exhibited acceptable control of the grass weeds present, but were unable to adequately control the broadleaf weeds present in the test area. EPTC, at the rate employed in this study, provided unsatisfactory grass and broadleaf weed control. Although broadleaf weed control with all of the herbicides evaluated was significantly better than the non-weeded check, only alachlor, napropamide and diphenamid exhibited a level of broadleaf control that would be acceptable in

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Table 2. Visual phytotoxicity[z] evaluation of 15 cultivars of transplanted bedding plants treated with post-transplant herbicides.

| | Visual phytotoxicity rating | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Chloramben (4.5 kg/ha) | EPTC (4.5 kg/ha) | Alachlor (3.4 kg/ha) | DCPA (11.2 kg/ha) | Diphenamid (6.7 kg/ha) | Napropamide (3.4 kg/ha) | Butralin (3.4 kg/ha) | Trifluralin (2.2 kg/ha) | Non-weeded control | LSD 5% |
| *Ageratum Houstonianum* Mill. cv. Blue Serf. | 1.7 | 1.0 | 1.7 | 1.0 | 1.0 | 1.0 | 2.3 | 1.0 | 1.0 | 1.2 |
| *Amaranthus tricolor* L. cv. Tricolor Splendens Perfecta. | 9.3 | 2.7 | 2.3 | 4.3 | 2.7 | 2.7 | 4.0 | 4.0 | 1.7 | 3.0 |
| *Antirrhinum majus* L. cv. Floral Carpet Mix. | 4.0 | 4.0 | 4.0 | 4.0 | 2.7 | 2.7 | 2.7 | 1.7 | 1.0 | ns |
| *Celosia argentea* L. cv. Golden Torch. | 9.7 | 4.0 | 1.7 | 2.3 | 5.7 | 4.0 | 3.3 | 1.0 | 1.0 | 4.6 |
| *Chrysanthemum morifolium* Ramat. cv. Minnautumn | 2.7 | 1.0 | 1.0 | 4.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | ns |
| *Dahlia pinnata* Cav. cv. Early Bird Mix. | 1.0 | 1.0 | 1.0 | 1.7 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | ns |
| *Dianthus chinensis* L. Rainbow Pink. | 10.0 | 4.0 | 1.0 | 1.0 | 2.0 | 4.7 | 3.0 | 1.0 | 1.0 | 4.1 |
| *Pelargonium hortorum* Bailey. cv. Sprinter Red. | 5.7 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.6 |
| *Petunia hybrida* Vilm. cv. Candy Apple. | 3.3 | 1.0 | 1.0 | 1.7 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.3 |
| *Petunia hybrida* Vilm. cv. Snow Cap. | 1.7 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | ns |
| *Salvia splendens* Sello. cv. St. Johns Fire. | 8.3 | 4.7 | 10.0 | 4.7 | 1.0 | 3.7 | 4.0 | 3.7 | 1.0 | 4.8 |
| *Tagetes patula* L. cv. Lemon Drop. | 4.7 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 |
| *Tagetes patula* L. cv. Moonshot. | 2.7 | 1.0 | 1.3 | 1.0 | 1.7 | 1.7 | 1.0 | 1.0 | 1.0 | 1.2 |
| *Verbena hybrida* Vass. cv. Ideal Florist's Strain. | 9.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 3.7 | 1.0 | 1.0 | 1.0 |
| *Zinnia elègans* Jacq. cv. Lilliput Mix. | 1.0 | 1.0 | 1.7 | 1.7 | 1.0 | 1.0 | 1.7 | 1.0 | 1.0 | ns |

[z]Visual rating scale: 1.0 (no injury) to 10.0 (complete plant kill).

a planting of annual bedding plants (Table 1).

An evaluation 2 months after herbicide applications showed that all of the herbicides in this study, with the exception of chloramben, produced only minimal phytotoxicity on annual bedding plants (Table 2). Alachlor caused excessive plant phytotoxicity to salvia transplants but could be successfully employed on other annual bedding plants if so labelled. Both chloramben and butralin injured many cultivars and they should not be employed as post-transplant applications to annuals at least at the rates employed in this test.

Napropamide injury as foliar chlorosis and leaf burn was observed on the celosia, dianthus and salvia transplants (Table 2). As a result of the excellent overall weed control with napropamide, this material might be used for weed control on selected annuals.

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# Changes in Ambient $SO_2$ by Rhododendron and Pyracantha[1]


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*Abstract.* **The capacity of rhododendron (*Rhododendron catawbiense* Michx., cv. Nova Zembla) and firethorn (*Pyracantha coccinea* M. J. Roem. var. Lalandii (Duren) Dipp.) to change ambient $SO_2$ levels in a closed fumigation system was studied. *P. coccinea* removed greater quantities of $SO_2$ at faster rates than *R. catawbiense*. Differences in leaf surface characteristics between the 2 species suggest that at least part of the $SO_2$ uptake mechanism may involve a surface-mediated response to the pollutant.**

The ability of vegetation to alter air quality remains a controversial subject, although numerous studies show that plants possess at least the potential to ameliorate air contamination. However, the efficiency of the process remains largely unresolved (8).

Although the relative sorptive capacities of many tree species have been reported (2, 5, 7) very little information exists on the uptake of gaseous pollutants by shrubs and woody ornamentals. Thorne and Hanson (6) included a single species each of *Bougainvillea* and *Camellia* in their research on ozone absorption, and Roberts (5) used 4 ornamental species in his investigation of $SO_2$ sorption by woody plants. In both these studies, however, the uptake of gaseous pollutants was measured either by cuttings or by individual leaves. In this investigation we measured $SO_2$ depletion by intact plants of 2 popular woody ornamentals.

Three- and 12-month-old rooted cuttings of rhododendron and firethorn, respectively, were potted in 2 peat:2 perlite:1 soil, (v/v) in 10-cm plastic containers and were grown under a 16-hr photoperiod in the greenhouse for 7 months before experimentation. During this period, all plants were watered daily and fertilized weekly with a modified nutrient solution (3).

Before starting the experiment, each container was inclosed in a polyethylene bag sealed at the base of the stem to minimize $SO_2$ absorption by the potting medium. After preconditioning for 1 hr in charcoal-filtered air, individual plants were transferred to a plexiglass fumigation chamber within which a steady-state $SO_2$ concn of approximately 0.5 ppm was maintained. Fumigation was discontinued at this point, and $SO_2$ depletion in the chamber was measured flame-photometrically by recording changes in pollutant concentration at 5-min intervals over a period of 0.5 hr. After removing each plant from the fumigation chamber, the experimental procedure was repeated with the foliage removed. Depletion rates were calcula-

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