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Preemergence Herbicide Evaluations on Selected Spring and Summer Flowering Bulbs and Perennials[1]

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Abstract

Nine species of field-grown flowering bulbs and perennials were screened for tolerance to the preemergence herbicide products Dacthal (DCPA), Gallery (isoxaben), Pennant (metolachlor), PRE-M (pendimethalin), Stakeout (dithiopyr), Derby (metolachlor + simazine) and Snapshot (isoxaben + oryzalin). Herbicides were applied at recommended rates three to five times over two to three years. No detrimental effects on growth, development or flowering were observed. Most products controlled large crabgrass, horseweed and prostrate spurge. However, control of crabgrass and spurge was poor with Gallery at 0.84 kg ai/ha, and control of horseweed and spurge was poor with Dacthal.

Index words: herbicide tolerance, ornamental plants, weed control, weed management.

Herbicides used in this study: Dacthal (DCPA), dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate; Gallery (isoxaben), *N*-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide; Pennant (metolachlor), 2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide; PRE-M (pendimethalin), *N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine; Stakeout (dithiopyr), *S,S*-dimethyl 2-(difluoromethyl)-4-(2-methylpropyl)-6-(trifluoromethyl)-3,5-pyridinedicarbothioate; Derby (metolachlor) + (simazine), 6-chloro-*N,N'*-diethyl-1,3,5-triazine-2,4-diamine; Snapshot (isoxaben) + (oryzalin), 4-(dipropylamino)-3,5-dinitrobenzenesulfonamide.

Species used in this study: Spring flowering: Drumsticks (*Allium sphaerocephalon* L.); Daffodil (*Narcissus* L. x 'Ice Follies'); and Star of Bethlehem (*Ornithogalum umbellatum* L.); **Summer flowering:** Indian Shot (*Canna* L. x 'Firebird'); Falling Stars (*Crocosmia* x *crocosmiiflora* (Lemoine ex Burbidge & Dean) N. E. Brown[3] 'Lucifer'); Daylily (*Hemerocallis* L. x 'Pink Charm'); German Iris (*Iris* x *germanica* L. 'Matinata'); Sterling Star Asiatic Hybrid Lily (*Lilium* L. x 'Sterling Star'); and Sarah Bernhardt Peony (*Paeonia* L. x 'Sarah Bernhardt').

Weed species evaluated in this study: horseweed (*Conyza canadensis* (L.) Cronq.); large crabgrass (*Digitaria sanguinalis* (L.) Scop.); prostrate spurge (*Euphorbia humistrata* Engelm. ex Gray).

Significance to the Nursery Industry

This study was conducted to determine the effects of selected preemergence herbicides on nine species of field-grown bulbs and perennials and to compare their efficacy on predominant weeds. Six herbicide products were compared to Dacthal. None of them detrimentally affected growth, development or flowering of selected bulbs and perennials when applied at recommended rates repeatedly over several years. Most products controlled a higher number of weed species at lower rates than Dacthal (DCPA).

Introduction

Flowering bulbs and perennials add color and diversity to commercial landscapes, highway roadsides and home gardens. Weed management programs for these sites often include preemergence herbicides on newly planted sites. Although preemergence herbicides are generally safe on woody plants, their effects on flowering bulbs and perennials are largely undetermined.

Of the species in this study, *Hemerocallis* (daylily) has been screened most extensively for tolerance to herbicides. Field-planted *Hemerocallis* 'Downy' was tolerant to Dacthal (DCPA) WP (1), but was temporarily injured by Surflan 75WP (oryzalin) applied at 2.2 and 4.5 kg ai/ha (2.0 and 4.0 lb ai/A) (2). Recent field studies showed that *Hemerocallis* 'Aztec Gold' was tolerant to Pennant 5G (metolachlor) and Dacthal 5G (6), while 'Sammy Russell' was unaffected by Surflan 4AS and Pennant 5G (13).

Container-grown *Hemerocallis* was tolerant to Pennant 5G and Snapshot 2.5TG (isoxaben + trifluralin) at 3.4 kg/ha (3.0 lb/A) (12), and Dual 8E (metolachlor), Snapshot 80DF (isoxaben + oryzalin), and Surflan 4AS, each at up to 3X rates (4). No phytotoxicity was observed on container-grown *Hemerocallis* 'Aztec Gold' treated with Stakeout (dithiopyr) at up to 2.2 kg/ha (2.0 lb/A), Gallery (isoxaben) at 1.1 kg/ha (1.0 lb/A), Snapshot TG at 5.6 kg/ha (5.0 lb/A) or Snapshot DF at 4.5 kg/ha (4.0 lb/A) (5). PRE-M 60WDG (pendimethalin), Southern Weedgrass Control 1.7G (pendimethalin) and Surflan 4AS at 4.5 kg/ha (4.0 lb/A) were also non-phytotoxic (11). However, three Surflan applications at 4-month intervals severely reduced flowering (11). Although Surflan injured daylilies in several studies (2, 11), the other herbicides tested on daylilies caused no injury.

Although evaluations with preemergence herbicides on spring flowering bulbs have been limited, several studies on *Narcissus* (daffodil) have been reported (7–10). *Narcissus* 'Campernelli Flore Pleno' was tolerant to Dacthal, but

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[3]Hortus Third (1976) cited the authority as (V. Lemoine ex E. Morr.) N.E. Brown. P.J. Kostelijk (1984) corrected it in Crocosmia in gardens. The Plantsman 5:246–253.

Table 1. Effect of preemergence herbicides on flowering characteristics of selected flowering bulbs and perennials.

Herbicide treatment	Formulation	Rate kg ai/ha	Julian date of flowering: *Crocosmia* x *crocosmiiflora*[y]	Julian date of flowering: Hemerocallis 'Pink Charm'[y]	No. of flowering spikes *Canna* 'Firebird'[z]
Pennant	5G	4.5	185.1	169.8	26.0
Derby (metolachlor + simazine)	5G	5.6	188.0	167.3	10.3
Stakeout	1G	1.7	184.1	168.5	13.0
Gallery	75DF	0.84	187.0	168.3	18.3
Gallery	75DF	1.1	187.4	170.0	20.3
Snapshot (isoxaben + oryzalin)	80DF	3.4	185.9	168.6	34.3
Dacthal	5G	13.4	186.1	169.4	19.8
PRE-M	60DG	4.5	189.0	168.6	25.3
Check	—	—	187.8	169.1	15.0
LSD (0.05)			2.0	1.6	13.4

[z]Ratings performed October 13, 1992, after five herbicide applications over three growing seasons.

[y]Julian dates of flowering averaged from 1991 and 1992.

Surflan at 2.2 kg/ha (2.0 lb/A) caused temporary stunting of plants (8). Snapshot 80DF and Surflan 75WP were non-phytotoxic to four cultivars of *Narcissus* (10), and *Narcissus* 'Colossal' was tolerant to Surflan 75WP at up to 9.0 kg/ha (8.0 lb/A) (9). Flower ratings and bulb numbers of *Allium sphaerocephalon*, *Iris x germanica*, *Iris reticulata* 'Harmony', *Ornithogalum umbellatum*, and *Narcissus* 'Geranium' and 'Unsurpassable' were unaffected by four applications of Dacthal 5G and Pennant 5G (7). However, Dacthal injured foliage of *Iris reticulata* 'Harmony'.

This study was conducted to determine the tolerance of selected flowering bulbs and perennials to new preemergence herbicide products with Dacthal as a standard treatment.

Materials and Methods

Raised field beds (Cecil clay) at the North Carolina State University Horticultural Field Laboratory, Raleigh, were amended with dolomitic lime and 15 cm (6 in) of pine bark humus, tilled 10 cm (4 in) deep, and fumigated with methyl bromide at 73 g/m^2 (1.5 lb/100 ft^2). Soil pH at planting was approximately 6.4. Fertility was adjusted to recommended levels for field-grown bulbs and perennials (3). A randomized complete block design with four replications was utilized, with individual plots measuring 3.0 × 1.5 m (10 × 5 ft).

Propagules were obtained from commercial sources. Summer flowering species were planted on May 22, 1990, with three propagules per plot. Five bulbs of the spring flowering species were planted per plot on November 20, 1990. Overhead irrigation was provided as needed throughout each growing season.

Herbicide treatments are listed in Table 1. The summer flowering species were treated in 1990 on May 23 and November 2. All species were treated on May 3 and November 6, 1991, and April 23, 1992. Granular herbicides were weighed out on a per plot basis and applied manually with a shaker jar. Liquid treatments were applied over-the-top with a CO_2 backpack sprayer and 8003LP nozzles delivering 234 l/ha (25 gpa) at 138 kPa (20 psi). Treatment area was 4.6 m^2 (50 ft^2). For grass control, Poast (sethoxydim) was applied as a directed spray at 0.28 kg/ha (0.25 lb/A) on August 22, 1991 (spring flowering species), and at 0.56 kg/ha (0.5 lb/A) on September 20, 1991 (summer flowering species).

Table 2. Effect of preemergence herbicides on predominant weed species in selected flower bulbs and perennials.

Herbicide treatment	Formulation	Rate kg ai/ha	Large crabgrass control[x] (%)[w]	Horseweed[y] plants (No.)[v]	Prostrate spruge[y] control[x] (%)[w]
Pennant	5G	4.5	88	2.5	100
Derby (metolachlor + simazine)	5G	5.6	83	0	100
Stakeout	1G	1.7	91	6.3	100
Gallery	75DF	0.84	40	3.3	62
Gallery	75DF	1.1	51	3.3	80
Snapshot (isoxaben + oryzalin)	80DF	3.4	83	3.5	100
Dacthal	5G	13.4	75	14.5	60
PRE-M	60DG	4.5	86	8.8	100
Check	—	—	0	14.3	0
LSD (0.05)			25	4.7	35

[z]Ratings performed in spring-flowering bulbs (planted November 20, 1990).

[y]Ratings performed in summer-flowering perennials (planted May 22, 1990).

[x]Ratings performed visually on a percent scale where 0 = no control and 100 = complete control.

[w]Ratings performed 32 days after treatment.

[v]Ratings performed 152 days after treatment.

Control of predominant weed species was evaluated on April 3, 1991, by counting the total number of plants per plot, and on June 4, 1991, using a scale of 0 to 100 where 0 = no control and 100 = complete control. Plots were hand-weeded following each evaluation.

Julian dates of the commencement of flowering were recorded for each species in 1991 and 1992. *Narcissus* and *Ornithogalum* bullbs were harvested on July 23, 1992, at which time they were graded, counted and weighed. The summer flowering species were harvested on October 13, 1992, and data were recorded from each plot as follows: *Canna* and *Crocosmia*—number of flower spikes; *Hemerocallis*—diameter and quality of the crown-root system; *Iris*—number of rhizomes; *Lilium*—number and size of bulbs; *Paeonia*—number of crowns and number of eyes per crown.

Data were subjected to the analysis of variance (ANOVA) procedure and means separated where appropriate with the least significant difference (LSD) test (P = 0.05).

Results and Discussion

Plant growth and flowering. Julian dates of flowering were comparable in 1991 and 1992. Therefore, flowering dates were averaged across years for *Allium*, *Canna*, *Crocosmia*, *Hemerocallis*, *Lilium*, *Narcissus* and *Ornithogalum*. Only treatment effects significantly different from the check treatment are described.

Pennant promoted earlier flowering of *Crocosmia* (Table 1) and *Lilium* (data not presented). Stakeout promoted earlier flowering of *Crocosmia*, and Derby promoted earlier flowering of *Hemerocallis*. Herbicides did not affect flowering date of *Allium*, *Canna*, *Narcissus* or *Ornithogalum*. Number of flower spikes of *Crocosmia* was not affected, but number of flowering spikes of *Canna* was increased by Snapshot (Table 1). At harvest, no differences were found among treatments for the following: diameter and quality of crown-root system of *Hemerocallis*, number of rhizomes of *Iris*, bulb number and size of *Lilium*, weight and number of bulbs of *Narcissus* and *Ornithogalum*, and number of crowns and eyes per crown of *Paeonia*.

Weed control. Weed control ratings were performed 32 days after treatment (32 DAT), except where noted.

Spring flowering species. The predominant weed in 1991 was large crabgrass. All products except Gallery provided acceptable (≥75%) control (Table 2).

Summer flowering species. Predominant weeds in 1991 were horseweed, prostrate spurge and crabgrass. In April 1991 (152 DAT) the number of horseweed plants was decreased by all treatments except Dacthal, with Derby providing complete control (Table 2). All products except Dacthal and Gallery provided complete control of spurge. Control of crabgrass was similar to that observed in the spring flowering species (data not presented).

Although evaluations of preemergence herbicide products on flower bulbs and perennials have been limited, our findings are in general agreement with other published reports on *Hemerocallis* and *Narcissus* (6–8, 10, 13). Our results suggest that the products evaluated can be used repeatedly on the range of flower bulbs and perennials included in this study with no detrimental effects on their growth or flowering. Furthermore, most of these products provided acceptable control of a range of weed species.

(*Ed. note:* This paper reports the results of research only and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this research paper, be certain of their registration by appropriate state and/or federal authorities).

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