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A Survey of Weed Control Costs and Strategies in Container Production Nurseries¹

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Abstract

Thirty-two container nurseries were surveyed concerning weed management strategies. Handweeding costs ranged from \$608–\$1401/ha (\$246–\$567/acre), with hourly wages paid for handweeding ranging from \$3.53 to \$3.97/hour. Nurseries averaged 3 applications of preemergence applied herbicides annually. Primary herbicides applied were OH-2 (oxyfluorfen + pendimethalin), Rout (oxyfluorfen + oryzalin) and Ronstar (oxadiazon). Problem weeds identified by the participants were prostrate spurge (*Euphorbia supina* Raf.), oxalis (*Oxalis* sp.), eclipta (*Eclipta alba* (L.) Hasskarl) and nutsedge [*Cyperus esculentus* L. (yellow) and *C. rotundus* L. (purple)]. Weed control material used under containers varied with the nursery size.

Index words: herbicides, container production.

Herbicides used in this study: OH-2 (oxyfluorfen), 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene, plus (pendimethalin) N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine; Rout (oxyfluorfen), 2-chloro-1-(3 ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene, plus (oryzalin) 3,5-Dinitro-*N*⁴,*N*⁴-dipopylsulfanilamide; Ronstar (oxadiazon), {3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one}; Pennant (metolachlor), 2-chloro-*N*-(2-ethyl-6-methylpenyl)-*N*-(2-methoxy-1-methylethyl)acetamide; Southern Weedgrass Control (pendimethalin), N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine; Princep (simazine), 2-chloro-4,6-bis(ethylamino)-*S*-triazine.

Weed species used in this study: Prostrate spurge (*Euphorbia supina* Raf.); eclipta [*Eclipta alba* (L.) Hasskarl]; Wood sorrel (*Oxalis* sp.); Yellow nutsedge (*Cyperus esculentus* L.); purple nutsedge (*Cyperus rotundus* L.).

Significance to the Nursery Industry

This survey provides growers with comparison data on container weed management strategies. Information concerning problem weeds and plants sensitive to some herbicides was also obtained in the nursery. Management strategies presented will benefit recently organized nurseries. Research opportunities are identified in the areas of problem weeds and sensitive plants.

Introduction

Chemical weed control in container nurseries has become standard practice since the early 1970's when weed control was estimated to account for 20% of the total cost of production (3). Weeding costs in Florida were estimated to be in excess of \$3,600 per acre in 1974 when no herbicides were used (3). The 1980's have seen tremendous changes in container weed control programs (1, 4). New herbicides and formulations have been developed to meet nursery weed control requirements (2, 4). The success of these new products has not been well documented. The objective of this survey was to determine current weed control strategies used in container production of nursery crops in Alabama.

Materials and Methods

Thirty-two nurseries in Alabama were surveyed during 1987. Nurseries were subdivided into the following cate-

gories with the number of nurseries interviewed in parentheses: 1.0–4.0 ha [2.5–10 acres (8)], 4.4–9.7 ha [11–24 acres (8)], 10.1–20.2 ha [25–50 acres (9)] and 20.2 ha + [50 acres + (7)]. All container nurseries in Alabama with 4.9 ha (10 acres) or more in production were included in the survey. Eight nurseries ranging in size from 1.0–4.0 ha (2.5–10 acres) were randomly selected. The survey was conducted using personal interviews and a 25-question questionnaire pertaining to weed control strategies at the container nurseries.

Results and Discussion

Weeding labor costs ranged from \$608–\$1401/ha (\$246–\$567/acre) annually with the lower cost occurring with nurseries from 4.4–9.7 ha (11–50 acres) in size and the higher cost associated with nurseries under 4.0 ha (10 acres) and 20.2 ha + (50 acres +) (Table 1). Hourly wages were similar, ranging from \$3.53 to \$3.97 among the different nursery sizes. Mean number of herbicide applications was also similar, ranging from 2.9–3.2 applications per year.

Response to the inquiry concerning time of application, (averaged across nursery size) was: spring—62%, summer—75%, fall—50%, winter—19%, and at potting—56% (data not shown). Current cost of Rout (oxyfluorfen plus oryzalin) and OH-2 (oxyfluorfen plus pendimethalin) are approximately \$90/22.7 kg (50 lb) bag. At a labeled rate of 112 kg/ha (100 lb/Acre) of product, 3 applications would cost \$540 per acre for the herbicide product, not including labor. Current piece work rates for herbicide application are about 8 cents/37 m² (400 ft²) [1.5 m (5 ft) × 24 m (80 ft) bed,] or \$21.52/ha (\$8.71/acre). Total cost/ha (acre) for 3 applications of Rout (oxyfluorfen plus oryzalin) or OH-2 (oxyfluorfen plus pendimethalin) is about \$1398/ha (\$566/acre); labor for handweeding of weeds not controlled adds

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Table 1. Selected factors associated with weed cost in container nursery production, Alabama, 1987.

Factor	Unit	Nursery size (acres)				Avg.
		2.5-10	11-24	25-49	50+	
Weeding/acre	hours	145	68	76	143	106
Hourly wages	\$	3.69	3.64	3.53	3.97	3.71
Average size	acre	6.7	15.6	35.8	119.3	41.7
No. application/yr	—	2.9	3.0	3.0	3.2	3.1
Cost/acre handweeding	\$	535	246	269	567	404
No. of nurseries		8	8	9	7	—

another \$608–\$1401/ha (\$256–\$567/acre), resulting in a total cost for weed control of about \$2006–\$2800/ha (\$812–\$1133/acre). Compared to the \$3600/acre spent in 1974 when no herbicides were applied (3), weed control in container nurseries cost slightly less than one-third of the 1974 cost with no adjustments for inflation.

These data show that the 3 primary preemergence applied herbicides used in container nursery stock were OH-2 (oxyfluorfen plus pendimethalin), Rout (oxyfluorfen plus oryzalin) and Ronstar (oxadiazon) (Table 2). Several nurseries in the survey used Rout (oxyfluorfen plus oryzalin) or OH-2 (oxyfluorfen plus pendimethalin) on their general line of products while Ronstar (oxadiazon) was applied on plant species suspected to be sensitive to OH-2 (oxyfluorfen plus pendimethalin) and Rout (oxyfluorfen plus oryzalin). Pennant (metolachlor) and Southern Weedgrass Control (pendimethalin), 2 relatively new products, had limited utilization.

Nurserymen were asked which weeds were not controlled by their preemergence applied herbicides in the containers. Weeds listed, with the percentage of respondents in parentheses were: prostrate spurge (24%), oxalis (22%), nutsedge (18%) and eclipsta (13%). In a second question appearing later in the survey, nurserymen were asked which weeds were the most difficult to control and their responses were:

nutsedge (27%), prostrate spurge (23%), oxalis (16%) and eclipsta (12%). Ten other weeds were mentioned in both questions, but the percentages of each were less than 5 percent.

Weed control under containers has received limited attention from researchers, however, most growers practice some type of weed control under their containers. Primary methods of physical weed suppression were black plastic (44%), weed mat (9%), rock or shell (12%) and combinations of the preceding (23%). The use of soil applied herbicides prior to container placement varied by nursery size. With increasing nursery size, the use of soil applied herbicides under containers increased (Table 2). Princep (simazine) used alone or in combination accounted for about 70% of applied soil herbicides. Normally these herbicides were applied in the spring (42%) or when new container beds (17%) were developed.

Two questions addressed sensitivity of nursery crops to herbicides. One question asked, have you experienced/suspected any injury from preemergence herbicides, while a second question inquired about plants handled differently from normal production. Plants identified from these 2 questions were similar. Those showing phytotoxicity symptoms included: *Liriope* spp. (liriope), *Hosta* spp. (hosta) and *Rho-*

Table 2. Preemergence applied herbicides and time of application in container nursery production, Alabama, 1987.

Herbicide	Herbicide use (%) by nursery size (acres)				Avg.
	2.5-10	11-24	25-49	50+	
	(%)	(%)	(%)	(%)	(%)
OH-2	38	38	77	43	49
Rout	25	29	44	57	39
Ronstar	63	38	11	43	39
Pennant	0	0	14	0	3
SWG	13	0	0	14	7
<i>Time of herbicide application</i>					
Spring	50	57	63	100	67
Summer	50	86	88	80	77
Fall	50	43	63	40	53
Winter	13	29	25	20	20
Potting	75	57	75	20	60
<i>Material used under containers</i>					
Shell	13	0	0	14	7
Rock (R)	63	0	11	14	22
Plastic (P)	25	63	22	43	38
Weed Mat (M)	25	0	0	0	6
R & P	0	25	22	0	12
P & M	0	13	33	0	12
<i>Soil Sterilants</i>					
Yes	12	50	67	100	56
No	88	50	33	0	44

dodendron spp. (azaleas). Herbicides identified by nurserymen as causing injury on these plants were OH-2 (oxyfluorfen plus pendimethalin), Rout (oxyfluorfen plus oryzalin) and Ronstar (oxadiazon).

This survey, in addition to providing information on the status of weed control in the container industry, also points out opportunities and problems with weed control research in container-grown crops.

Growers are making an average of 3 herbicide applications annually, however, most researchers evaluate 1 or 2 applications made at potting and 90 days later. Fifty-three percent of all nurseries surveyed applied preemergence herbicides in the fall. Limited evaluation of the effectiveness of fall application of preemergence herbicides in container grown plants has been reported. Opportunities exist for evaluating weed control strategies under containers. With increasing environmental concerns, more attention should be given to this area of weed control. Our study raises questions

with respect to the effectiveness of weed mats, disposal of plastics, alternatives to Princep use, use of mats or plastic impregnated with herbicides, and other possibilities.

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Overwintering Container-grown Herbaceous Perennials in Northern Regions¹

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Abstract

A 3 year study was initiated to evaluate the survival of several species of container-grown herbaceous perennials with various overwintering techniques. Although species reacted individually to overwintering covers, those with white reflective surfaces generally provided adequate protection. Straw, non-reflective Plantfoam[®], or no cover usually resulted in large losses. Container medium temperatures were 4° to 7°C (8° to 15°F) degrees warmer than surrounding air temperatures, with a "sandwich" of 30 cm (1 ft) fluffed oat straw between layers of white polyfilm providing the least medium temperature fluctuation (3°C or 6°F with ambient fluctuation of 16°C or 34°F), and the most temperature moderation (1°C or 34°F with ambient - 16°C or 3°F). Uncovering plants later than the first week in April occasionally resulted in plant losses.

Index words: cold hardiness, cold protection, microfoam

Species used in this study: Yarrow (*Achillea filipendulina* Lam. 'Parker's Variety'); Wallflower (*Cheiranthus Cheiri* L. 'Apricot Delight'); Shasta daisy (*Chrysanthemum × superbum* Bergmans ex J. Ingram 'Alaska'); Larkspur (*Delphinium elatum* L. 'Blue Fountains'); Pink (*Dianthus* L. 'Double Sonate Mix'); Baby's-breath (*Gypsophila paniculata* L. 'Double Snowflake'); Coralbells (*Heuchera sanguinea* Engelm. 'Bressingham Hybrids'); Coralbells (*Heuchera* L. 'Firesprite'); Lavender (*Lavandula angustifolia* Mill.).

Significance to the Nursery Industry

Since most nurseries overwinter all herbaceous perennials under the same cover, general recommendations are needed for type of covering and time of covering-uncovering. In northern climates some protection is needed to ensure survival when overwintering container-grown perennials. Al-

though a few of the hardiest species may survive with no cover in mild winters, this risk is unacceptable.

For most species type of cover is not as important as having a white reflective surface, with straw or non-reflective Plantfoam[™] alone often resulting in poor survival. For the less hardy perennials such as *Digitalis*, *Geum* and *Kniphofia*, under severe winters or where there may be little additional protection from snowfall, the sandwich cover should be used. It results in the least fluctuation and most moderation in temperature, equivalent to three layers of microfoam with white polyfilm on top, but is less expensive. This sandwich cover may also be best for hardier species, since roots on the edge and surface of the container will be close to the surrounding air temperature. Covering before

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