bicide programs during the summer months, using the excuse that they want to keep the labor force busy during a relatively slow period during the year. Robbing nursery stock of valuable water and nutrients as a result of unnecessary weed competition and thereby reducing overall growth, just to keep the help busy is certainly not a very valid justification.

In addition, it should be pointed out that observation is an important key to the use of herbicide programs. The nurseryman should not be looking for 100% year-round control with his program, which could result in eventual soil sterilization, but year-round control more in the range of 95%. Thus by carefully observing when weeds are beginning to reinfest a treated area, carefully timed reapplications can be planned.

SUMMARY

This discussion at least calls attention to the fact that herbicides are not perfect. Weather, soil texture, temperature, weed spectrum, soil organic matter, crop, and many other factors alone, and in combination, influence herbicide performance year after year. There may be seasons when, because of these factors, individual herbicide performance varies. But cultural control also varies year to year, so don't give up on herbicides just because of one bad experience.

HERBICIDE COMBINATIONS FOR WEED CONTROL IN CONTAINER NURSERY STOCK[1]

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Abstract. Herbicide combinations were effective in reducing weed growth in container-grown nursery stock. Trifluralin at 4 lb. ai/A and alachlor at 1 5 lb ai/A gave excellent grass weed control, but poor control of broadleaf weeds Linuron at 1 0 lb, ai/A exhibited excellent broadleaf weed control but poor control of annual grass weeds When linuron at 1.0 lb ai/A and trifluralin at 4 0 lb ai/A were applied in combination, excellent control of both annual broadleaf and grass weeds was observed.

INTRODUCTION

With the increased emphasis of growing nursery stock in containers, a viable program for weed control is essential. Over the past several years a great deal of information has been pub-

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lished comparing the effects of various individual preemergent herbicides for their ability to control weed growth in nursery containers (1, 2, 3, 5). Several effective herbicides are presently available and labeled for usage on field-grown nursery stock; however, at present there is no single herbicide that will give full season control over a wide range of grass and broadleaf weeds which are evident in container nursery stock production. In order to obtain full season weed control, without the expenditure of excessive manual labor, the use of herbicide combinations much like those presently employed in numerous agronomic crops may be necessary.

The objective of this study was to investigate the performance of several preemergence herbicides for their ability to control a broad spectrum of weeds in container-grown nursery stock, when employed in combination, in an attempt to develop a full season weed control system.

MATERIALS AND METHODS

The experiment was established on May 23, 1972. Uniformly rooted cuttings of *Ilex crenata* Thunb. cv. Helleri and *Rhododendron obtusum* Planc. var. *amoenum* Rehd. cv. Coral Bells were planted in 1 gal polyethylene nursery containers in a medium consisting of unsterilized weed infested loam soil, milled pine bark and builders sand (1:1:1 v/v/v). In addition to the natural weed seed population which was present in the unsterilized loam soil, large crabgrass [*Digitaria sanguinales* (L.) Scop.] and redrooted pigweed [*Amaranthus retroflexus* L.] seed were sown into the medium prior to the potting operation to insure an ample weed population.

The common, trade and chemical names of the preemergent herbicides employed in this study are presented in Table 1. Rates of application for the herbicides used in this study are given in Table 2.

Table 1. Nomenclature and formulations of herbicides utilized on container-grown nursery stock [1]

Common Name	Trade Name and Formulation	Chemical Name
Trifluralin	Treflan (4EC)	a, a, a-trifluoro-2, 6-dinitro-N, N-dipropyl-p-toluidine
Linuron	Lorox (50WP)	3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea
Alachlor	Lasso (4 EC)	2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide

[1] Common and chemical names accepted by the terminology committee of the Weed Science Society of America

The herbicides were applied with a 1 gal CO_2 constant pressure sprayer calibrated to deliver an 18 inch band at a volume of 40 gal/A. Immediately after treatment on May 24, 1972, all containers were irrigated with one inch of water in order to seal in the herbicides. All plants were then placed on 6 mil black polyethylene in a nursery area for the remainder of the experiment period, and received a standard nursery fertilization and maintenance program.

Weed control and phytotoxicity evaluations were recorded on September 6, 1972, 106 days after herbicide application. The rating system consisted of a 1 to 10 scale in which 1 represents no weed control or crop phytotoxicity and 10 represents complete kill of crops of weeds. On the basis of a previous study on weed competition effects on container-grown woody ornamentals (6), only a rating of 9.0 or greater was considered to be commercially acceptable.

The principal weed species encountered uniformly in all replicates of the experiment during the experimental period were: large crabgrass [*Digitaria sanguinalis* (L.) Scop.], goose grass [*Eleusine indica* (L.) Gaertn.]. crowsfootgrass [*Dactyloctenium aegyptium* (L.) Richter], redroot pigweed [*Amaranthus retroflexus* L.], dogfennel [*Eupatorium capillifolium* (Lam.) Small], and cutleaf eveningprimrose [*Oenothera laciniata* Hill].

Using a completely randomized design, the experiment included 4 replications of each treatment with 3 single plants per experimental unit. All data were subjected to analysis of variance and Duncan's Multiple Range Test (4) to delineate the treatment effects.

RESULTS AND DISCUSSION

Trifluralin, when employed as a single preemergent application at 2 lb.ai/A, gave poor broadleaf and grass weed control. Previous research (5) has shown that this response was expected when trifluralin was employed at a low rate on soils with high organic matter. When trifluralin was employed at 4 lb. ai/A, excellent control of grass weeds was evident; however, even at this rate, trifluralin exhibited poor overall broadleaf weed control (Table 2). Similar results were obtained when alachlor was employed at 1.5 lb. ai/A. Single applications of linuron gave excellent control of broadleaf weed species, but with little grass controlling ability (Table 2).

In regard to the various combination treatments employed in this study, trifluralin + alachlor combinations at both the 2.0 + 1.5 and 4.0 + 1.5 lb. ai/A rates gave excellent grass weed control, with both species of nursery crops employed in this test, but did not show a significant improvement in ability to control broadleaf weed growth when compared to either rate of trifluralin singly applied (Table 2).

The trifluralin + linuron combination, when employed at the 2.0 + 1.0 lb. ai/A rate, gave excellent grass weed control along with a significant improvement in broadleaf weed control when compared to a single application of trifluralin. When this same trifluralin + linuron combination was used at the 4.0 + 1.0 lb. ai/A rate, both grass and broadleaf weed control was significantly better than either of the materials when used singly (Table 2).

None of the herbicides alone, or in a combination, resulted in any visible phytotoxicity or injury to either of the container-grown test species used in this study (Table 2). While other combinations were not within the scope of this experiment, they should be explored in order to find materials which would give control to the broader spectrum of weed species which are presently indigenous to container nursery stock.

While this study is in no way inclusive, the results do indicate that herbicide combination treatments, such as the trifluralin + linuron at the 4.0 + 1.0 lb.ai/A rate, may provide a means to obtain weed control of a greater spectrum of weed species with no injury to container grown nursery stock. Similar studies using herbicide combinations were conducted during the summer of 1973, and the results appear to substantiate those reported from the 1972 growing season.

Table 2. Effect of various herbicides employed singly or in combination on weed growth and plant phytotoxicity in container-grown Coral Bells azalea and Helleri holly in 1972

Herbicide Treatment	Rate lb ai/A	Coral Bells azalea Weed Control[z]			Helleri holly Weed Control		
		Broadleaf	Grass	Injury	Broadleaf	Grass	Injury
Trifluralin	2.0	5 8 efg[y]	6 0 bc	1 0[ns x]	5 0 e	5 8 c	1.0[ns]
Trifluralin	4 0	5 8 efg	9 0 a	1 0	5 8 de	20 0 a	1 0
Alachlor	1 5	5 8 efg	9 5 a	1,0	7.5 bc	9.0 bc	1 0
Linuron	1 0	8 3 abcd	5.3 c	1 0	9 7 a	5.5 c	1 0
Trifluralin + Alachlor	2 0+1.5	7 0 cde	10 0 a	1 0	6 8 cd	10 0 a	1 0
Trifluralin + Linuron	2.0+1 0	7 5 bdc	8 5 ab	1 0	7 5 bc	9 3 a	1.0
Trifluralin + Alachlor	4 0+1 5	6 5 def	10 0 a	1 0	6 8 cd	10 0 a	1 0
Trifluralin + Linuron	4.0+1 0	9 0 ab	9 2 a	1 0	8 5 b	10 0 a	1 0
Non-Weeded Control	—	4 7 fg	1.8 d	1 0	6.5 cd	2 8 d	1 0
Hand Weeded Control	—	10 0 a	10 0 a	1 0	10 0 a	10.0 a	1 0

[z] Rating Scale 1 0 = no weed control and/or crop injury, 10 0 = complete kill of weeds and/or crop

[y] Means in a column followed by the same letter or letters are not significant at the 5% probability level

[x] Not significantly different at the 5% probability level

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MODERATOR FRETZ: Our next speaker is Charley Parkerson and Charley is going to do something a little different. He is going to show us a movie which he made concerning some of the work he has been doing.