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Efficacy of Prodiamine for Weed Control in Container Grown Landscape Plants Under High Temperature Production Conditions¹

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Abstract

Applications of preemergent herbicide prodiamine 65 WDG (wetttable dry granule) (2,4-dinitro-N³,N³-dipropyl-6(trifluoromethyl)-1,3-benzenediamine) at 1.12, 2.24, 4.48, and 8.96 kg ai/ha (1.0, 2.0, 4.0 and 8.0 lb ai/A) controlled large crabgrass (*Digitaria sanguinalis* L. Scop.), bermudagrass (*Cynodon dactylon* L. Pers.), purslane (*Portulaca oleracea* L.), and red sorrel (*Rumex acetosella* L.) for 16 weeks after application. A granular application at 1.12 kg ai/ha (1.0 lb ai/A) resulted in unsatisfactory weed control and subsequently decreased shoot weight of container grown landscape plants. Prodiamine 65 WDG did not cause phytotoxic effects to landscape plants at any rate evaluated.

Index words: variegated privet, crape myrtle, gardenia, waxleaf ligustrum, weed control

Introduction

Weed control in container grown landscape plants is one of the most critical cultural problems facing nurserymen. Weeds compete with desirable plants and can reduce size and aesthetic quality resulting in a less marketable product. Manual weeding can account for up to 30 percent of total production costs, while preventative weed control with herbicides may account for as little as 3 percent of total production costs (2).

Fretz and Sheppard (1) reported that preemergence applications of prodiamine 2%G at 1.7 to 13.4 kg ai/ha (1.5 to 12.0 lb ai/A) controlled a wide spectrum of annual grass and broadleaf weeds for 113 days after application, without injury to eleven landscape plant species. Prodiamine 2G at 4.5, 9.0, and 13.4 kg ai/ha (4.0, 9.0 and 12.0 lb ai/A) resulted in 95-100% weed control; however, higher rates restricted growth, root development and marketability of azaleas (3). Singh et al (4) obtained 95% weed control with prodiamine granules (2% ai) at 4.5 to 13.4 kg ai/ha (4.0 to 12.0 lb ai/A) with less than 10% injury to two *Ilex* species.

This study was conducted to evaluate weed control and crop phytotoxicity with liquid applications of prodiamine under high temperature production conditions found in the southwestern U.S.

Materials and Methods

Liners of 4 species of landscape plants were obtained from a commercial nursery and planted in 3.8 l (#1) black plastic containers on June 1, 1985. Container medium consisted of 4 parts milled pine bark: 1 part coarse builders sand (by vol.) amended with 5 lb/yd³ dolomite and gypsum, 2 oz/yd³ fritted trace elements,

and 8 lb/yd³ 18N-2.6P-9.9K (18-6-12) slow release fertilizer. Prodiamine (2% ai) was applied as a granular product at 1.12 kg ai/ha (1.0 lb ai/A) or as a foliar spray from the liquid concentrate (WDG) at 0.56, 1.12, 2.24, 4.48, and 8.96 kg ai/ha (0.5, 1.0, 2.0, 4.0 and 8.0 lb ai/A) to 'Potomac' crape myrtle (*Lagerstroemia indica* 'Potomac'), variegated privet (*Ligustrum sinense* 'Variegata'), waxleaf ligustrum (*Ligustrum japonicum* 'Texanum'), and mystery gardenia (*Gardenia jasminoides* 'Mystery'). A second application was made six weeks later to the plants previously treated at 4.48 and 8.96 kg ai/ha (4.0 and 8.0 lb ai/A) to determine crop phytotoxicity. Containers were overseeded with a mixture of large crabgrass, bermudagrass, red sorrel and purslane prior to herbicide application and reseeded six weeks later to insure uniform and heavy weed population pressure. Herbicides were applied on June 12, 1985. Liquid applications were made with a hand-held CO₂ sprayer at 30 gpa and 30 psi using TeeJet 8003 nozzle tips, and the premeasured granular formulation was applied by hand. Containers were hand-irrigated with 2.5 cm (1 in) of water immediately following herbicide application to incorporate the herbicide. Plants were watered as needed with an overhead sprinkler system. Maximum container media temperature ranged from 32°-44°C (90-110°F), depending on location in the production bed. The study was arranged in a completely randomized design with 10 replications per treatment and one containerized plant per replication.

Phytotoxicity and weed control was evaluated 6, 37, and 100 days after initial herbicide application. Both landscape plants and weeds were harvested for dry weight analysis on September 10, 1985. Plants were evaluated using a 0-100% rating scale where 0 represented no weed control and 100 equaled complete weed control.

Results and Discussion

All 'Mystery' gardenia and variegated privets in the study, including the control plants, were necrotic at the

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Table 1. Response of weeds and *Lagerstroemia indica* 'Potomac' to Prodiamine.^z

Treatment	Rate		Weed Control %	Grass Weed Wt. (g)	Broadleaf Weed Wt. (g)	Ornamental Shoot Wt. (g)
	(kg/ha)	lb/A				
Prodiamine 1.25G	1.12	1.0	53.5 c ^y	18.4 b	0.9 a	3.4 bc
Prodiamine 65WDG	0.56	0.5	80.0 b	7.2 c	0.6 ab	4.7 ab
	1.12	1.0	87.6 ab	3.4 c	0.5 ab	6.7 a
	2.24	2.0	97.5 a	0.0 c	0.1 b	6.6 a
	4.48	4.0	97.0 a	0.3 c	0.0 b	7.0 a
	4.48 + 4.48 ^x	4.0 + 4.0	99.8 a	0.0 c	0.1 b	6.6 a
	8.96 + 8.96 ^x	8.0 + 8.0	100.0 a	0.0 c	0.0 b	7.1 a
Hand-Weeded	—	—	100.0 a	0.0 c	0.0 b	6.4 a
Unweeded Control	—	—	3.0 d	29.8 a	0.5 ab	1.2 c

^zRatings 100 days after initial application on June 12, 1985.^yMeans in a column followed by the same letter or letters are not significantly different at the 5% level using Duncan's multiple range test.^xRepeat application on July 22, 1985.**Table 2. Response of weeds in containers of *Ligustrum sinensis* 'variegata' to Prodiamine.^z**

Treatment	Rate		Weed Control %	Grass Weed Wt. (g)	Broadleaf Weed Wt. (g)	Ornamental Shoot Wt. (g)
	(kg/ha)	lb/A				
Prodiamine 1.25G	1.12	1.0	43.3 b ^y	18.6 a	0.1 b	— ^w
Prodiamine 65WDG	0.56	0.5	53.1 b	15.9 a	1.0 a	—
	1.12	1.0	93.9 a	0.3 b	0.2 b	—
	2.24	2.0	100.0 a	0.0 b	0.0 b	—
	4.48	4.0	98.1 a	0.0 b	0.0 b	—
	4.48 + 4.48 ^x	4.0 + 4.0	96.7 a	0.3 b	0.1 b	—
	8.96 + 8.96 ^x	8.0 + 8.0	100.0 a	0.0 b	0.0 b	—
Hand-Weeded	—	—	100.0 a	0.0 b	0.0 b	—
Unweeded Control	—	—	2.2 c	27.0 a	0.0 b	—

^zRatings 100 days after initial application on June 12, 1985.^yMean separation in column followed by the same letter or letters are not significantly different at the 5% level using Duncan's multiple range test.^xRepeat application on July 22, 1985.^wOrnamental shoot weight omitted due to plant necrosis.**Table 3. Response of weeds and *Ligustrum recurvifolia* to Prodiamine.^z**

Treatment	Rate		Weed Control %	Grass Weed Wt. (g)	Broadleaf Weed Wt. (g)	Ornamental Shoot Wt. (g)
	(kg/ha)	lb/A				
Prodiamine 1.25G	1.12	1.0	26.0 c ^y	26.3 a	0.5 ab	2.7 c
Prodiamine 65WDG	0.56	0.5	86.5 b	4.9 b	1.2 a	17.9 a
	1.12	1.0	95.5 ab	0.3 b	0.8 ab	18.8 a
	2.24	2.0	94.6 ab	0.6 b	1.6 a	19.3 a
	4.48	4.0	100.0 a	0.0 b	0.0 b	19.2 a
	4.48 + 4.48 ^x	4.0 + 4.0	100.0 a	0.0 b	0.0 b	19.9 a
	8.96 + 8.96 ^x	8.0 + 8.0	100.0 a	0.0 b	0.0 b	20.1 a
Hand-Weeded	—	—	100.0 a	0.0 b	0.0 b	20.1 a
Unweeded Control	—	—	14.0 d	25.2 a	0.1 b	9.3 b

^zRatings 100 days after initial application on June 12, 1985.^yMeans in column followed by the same letter or letters are not significantly different at the 5% level using Duncan's multiple range test.^xRepeat application on July 22, 1985.

Table 4. Response of weeds in containers of *Gardenia jasminoides* 'Mystery' to Prodiamine^z

Treatment	Rate		Weed Control %	Grass Weed Wt. (g)	Broadleaf Weed Wt. (g)	Ornamental Shoot Wt. (g)
	(kg/ha)	lb/A				
Prodiamine 1.25G	1.12	1.0	22.2 c ^y	29.9 a	0.4 b	— ^w
Prodiamine 65WDG	0.56	0.5	65.0 b	7.7 b	2.0 a	—
	1.12	1.0	78.8 b	0.2 c	1.3 ab	—
	2.24	2.0	66.7 b	12.6 b	0.5 b	—
	4.48	4.0	98.8 a	0.0 c	0.0 b	—
	4.48 + 4.48 ^x	4.0 + 4.0	99.4 a	0.0 c	0.0 b	—
	8.96 + 8.96 ^x	8.0 + 8.0	100.0 a	0.0 c	0.0 b	—
Hand-Weeded	—	—	100.0 a	0.0 c	0.0 b	—
Unweeded Control	—	—	0.0 d	31.6 a	0.5 b	—

^zRatings 100 days after initial application on June 12, 1985.

^yMean separation in column by Duncan's multiple range test, 5% level.

^xRepeat application on July 22, 1985.

^wOrnamental shoot weight omitted due to plant necrosis.

termination of the experiment. Rate of necrosis was similar in treated and control plants suggesting that environmental factors were responsible. Both species are susceptible to high media temperature and full sun production conditions in commercial nurseries. Weed control ratings and weed shoot weights were also recorded in these containers. No visual phytotoxic effects were evident on the crape myrtle or waxleaf ligustrum at rates evaluated.

Prodiamine decreased grass and broadleaf weed pressure compared to the untreated control at all rates tested (Table 1, 2, 3, 4). Spray applications of prodiamine at 1.12, 2.24, 4.48, and 8.96 kg ai/ha (1.0, 2.0, 4.0 & 8.0 lb ai/A) provided excellent weed control for 16 weeks and was not significantly different from the hand-weeded control (Table 1, 2, 3). A second prodiamine application did not cause crop phytotoxicity, nor was weed control improved over the single application rate. Spray applications of prodiamine at 0.56 kg ai/ha (0.5 lb ai/A) and granular applications at 1.12 kg ai/ha (1.0 lb ai/A) resulted in unsatisfactory weed control which caused a decrease in shoot weight of ornamentals. Large crabgrass and purslane were the predominant weeds remaining after treatment.

Significance to the Nursery Industry

This study indicates that prodiamine 65WDG can be used as a safe and effective herbicide in selected container grown landscape plants. Prodiamine has a relatively long residual effect when compared to other

herbicides registered for use in container grown ornamentals, which is of importance in reducing production costs. Spray applications at 1.12 kg ai/ha (1.0 lb ai/A) provided superior weed control when compared to the granular formulation at the same rate. The liquid application of prodiamine offers an alternative method for nurserymen in situations where a landscape plant may be damaged due to lodging of granules in a whorled leaf.

(*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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