stem production or quality. A disadvantage because the model is a quadratic equation is that stem height will eventually curve down with time; however, this downward trend will occur long after the floral spikes are harvested. The only significant difference among the growth curves was between the Papaikou winter study and Waiakea (t = 2.31; $P < 0.05$). Stems may grow longer in other fields (Criley, 1984) and long stem inflorescences are commercially preferable in some situations.

Another approach to measuring growth was using the number of leaves on the stem (Fig. 2). Again, the summer study at Papaikou and the Waiakea study were similar. Generally, the stem had seven to eight leaves at time of harvest (after ca. 4 months of growth). In contrast, Criley (1984) reported a linear relationship between the number of leaf nodes and time; after 11 to 13 nodes, growth slows, the inflorescence appears, and the floral spikes are harvested ca. 5 months after stem emergence.

The above analyses suggest that plant growth follows a particular pattern. Seasonal, rather than locational, factors may be more important in determining growth rates, even when the plants are poorly maintained. Although temperature can limit growth (Broschat and Donselman, 1988), other factors must be involved to explain why stems grew longer during the winter than the summer at the same site. Perhaps cloud cover or light intensity was also important.

For commercial production in Florida, Broschat and Donselman (1988) recommended growing red ginger in greenhouses. Growth rates reported here for Hawaiian field grown ginger may differ from those produced in Florida or other sites in Hawaii. Additional data are required to determine if the growth model is applicable elsewhere. However, the growth model provides a standard for comparisons in developing a cut flower industry in Florida for red ginger. Quantifying growth may be an important tool for making management decisions.

Literature Cited

Broschat, T. K. and H. Donselman. 1988. Production and postharvest culture of red ginger in south Florida. Proc. Fla. State Hort. Soc. 101:326-327.

Burch, D., E. W. Demmy and H. Donselman. 1987. Gingers for Florida gardens. Proc. Fla. State Hort. Soc. 100:153-155.

Criley, R. A. 1984. Yield and production of red ginger and bird-of-paradise at Waimanalo as influenced by fertilizer, planting density and season. Proc. Second Fert. and Orn. Short Course. Univ. Hawaii HITAHR 01.04.85. pp. 129-138.

Criley, R. A. 1989. Development of *Heliconia* and *Alpinia* in Hawaii: cultivar selection and culture. Acta Hort. 246:247-258.

HASS (Hawaii Agricultural Statistics Service). 1992. Statistics of Hawaiian agriculture 1991. HASS, Honolulu. p. 28.

Jandel Scientific. 1991. TableCurve v 3.0 User's Manual. Jandel Scientific. Corte Madera, CA.

Neal, M. C. 1965. In Gardens of Hawaii. Bishop Museum Press. Honolulu.

SAS Institute. 1982. SAS User's Guide. SAS Institute. Cary, NC.

Zar, J. H. 1974. Biostatistical Analysis. Prentice-Hall, Inc. Englewood Cliffs, NJ.

Proc. Fla. State Hort. Soc. 106:292-294. 1993.

PREEMERGENT CONTROL OF *PHYLLANTHUS TENELLUS* AND *PHYLLANTHUS URINARIA*

JEFFREY G. NORCINI AND JAMES H. ALDRICH
University of Florida, IFAS
North Florida Research and Education Center
Monticello, FL 32344

Additional index words. chamberbitter, leafflower, long-stalked phyllanthus, chemical weed control.

Abstract. **Two applications of 10 preemergent herbicides or herbicide combinations applied 10 weeks apart were compared for control of *Phyllanthus urinaria* and *P. tenellus* in a containerized medium of pine bark:Canadian sphagnum peat:sand medium (3:1:1, by vol.). After the treatments were applied and irrigated in, 25 seeds per species were applied to each weed-free 2.5-liter container. For each species, there were four replications per treatment and three pots per replication. Weed control was evaluated 5 and 10 weeks after each treatment; weeds were also harvested at 10 weeks. Oxadiazon (4.5 kg ai/ha) provided excellent control of both species for 10 weeks after one or two applications. Good to excellent control of both species was obtained with dithiopyr (2.2 kg ai/ha) and prodiamine (2.2 kg ai/ha). However, metolachlor (2.2 kg ai/ha) tank-mixed with prodiamine (2.2 kg ai/ha) caused a reduction in weed control. Isoxaben + oryzalin (0.9 + 3.6 kg ai/ha) and isoxaben + metolachlor (1.1 + 2.2 kg ai/ha) provided good control of both species 10 weeks after one application but only 5 weeks after the second application.**

[1]Florida Agricultural Experiment Station Series No. N-00820. The authors gratefully acknowledge Monsanto, DowElanco, and Rhône-Poulenc for their support, and Ms. Luch Rogers and Mr. Judd Butler for their technical assistance.

Introduction

Phyllanthus urinaria L. (chamberbitter, leafflower) and *Phyllanthus tenellus* Roxb. (long-stalked phyllanthus) are two warm season weeds that are becoming major problems in turf and ornamentals in Florida and other states in the southeastern U.S. (Elmore, 1990). Only a limited amount of research has been published with regard to their control. However, oxadiazon seems to be the active ingredient that consistently provides preemergent control of both species (Norcini and Aldrich, 1992; Stamps, 1991; Stamps and Poole, 1987; Wehtje et al., 1992). Other herbicides that provide preemergent control of one or both species are dithiopyr, isoxaben + oryzalin, oxyfluorfen + oryzalin, and oxyfluorfen + pendimethalin (Norcini and Aldrich, 1992; Wehtje et al., 1992). Paraquat, glyphosate, oxyfluorfen, and acifluorfen provide excellent postemergent control of *P. urinaria* (Wehtje et al., 1992). The objective of this experiment was to evaluate several preemergent herbicides and herbicide combinations for control of these two species under container nursery conditions.

Materials and Methods

Containers (2.5-liters) were filled with a medium of pine bark:Canadian sphagnum peat:sand (3:1:1, by vol.). One cubic meter of medium was amended with 6.1 kg dolomite, 1.6 kg triple superphosphate, 0.9 kg Micromax (12S-0.1B-0.5Cu-12Fe-2.5Mn-0.05Mo-12Zn, and 6.1 kg Osmocote 18N-2.6P-10K. A top dressing of 7.5 g Osmocote 18N-2.6K-10P was applied 5 May 1992.

The experiment was a randomized complete block design with four replications per treatment and three pots per replication; there was one complete set of treatments per species. On 5 May and 15 July, the following treatments were applied: 4.5 kg ai/ha oxadiazon (Ronstar 2G), 2.2 kg ai/A dithiopyr (Stakeout 1G), 1.1 kg ai/ha isoxaben (Gallery 75DF), 1.1 kg ai/ha isoxaben (Gallery 75DF) + 2.2 kg ai/ha metolachlor (Pennant 7.8EC), preformulated 0.9 kg ai/ha isoxaben + 3.6 kg ai/ha trifluralin (Snapshot 2.5TG), preformulated 1.1 kg ai/ha isoxaben + 4.5 kg ai/ha trifluralin (Snapshot 2.5TG), preformulated 0.9 kg ai/ha isoxaben + 3.6 kg ai/ha oryzalin (Snapshot 80DF), 2.2 kg ai/ha metolachlor (Pennant 7.8EC), 2.2 kg ai/ha prodiamine (Barricade 65WDG), and 2.2 kg ai/ha metolachlor (Pennant 7.8EC) + 2.2 kg ai/ha prodiamine (Barricade 65WDG); an untreated control was included. Individual aliquots of the granular herbicides were applied uniformly to each container. Sprayable herbicides were applied as a broadcast spray using a compressed-air backpack sprayer which delivered 374 liters/ha through a single Teejet 8004 flat fan tip. Containers were overseeded with 25 seeds per species per pot after the treatments were overhead irrigated with ca. 1.3 cm water on 5 May and 15 July.

Treatment efficacy was determined 5 and 10 weeks after treatment (WAT). Percent weed cover (consensus of two observers) and number of *Phyllanthus* per pot were recorded 5 WAT (9 June and 19 Aug.). Percent weed cover, number of *Phyllanthus* per pot, and total weed dry weight (shoot + root) per pot were recorded 10 WAT (13 July and 23 Sept.). Pots were top-dressed with 7.5 g Osmocote 18N-2.6P-10K on 15 July.

The experiment was conducted under full sun. Containers were irrigated daily with 1.3 cm once per day after the first application and twice per day after the second application. Rainfall for the 10-week period after the first application was 19.2 cm, and for the 10-week period after the second application was 33.2 cm.

Data were analyzed using general linear model (GLM) procedures of SAS. Percentage data were analyzed after arcsin transformation, and weed counts were analyzed after square root transformation; however, untransformed means are presented.

Results and Discussion

All herbicides except metolachlor provided good to excellent preemergent control of both species 5 weeks after the first application based on reductions in number and percent coverage compared to the untreated controls (Tables 1, 2). After the second application, only oxadiazon, dithiopyr, prodiamine, isoxaben + metolachlor, and prodiamine + metolachlor provided acceptable control for 5 weeks (Tables 3, 4).

Oxadiazon provided the most effective preemergent control of *P. tenellus* and *P. urinaria* for 10 weeks after one or two applications. Prodiamine provided preemergent control of *P. urinaria* equivalent to oxadiazon but at only half the rate (2.2 vs 4.5 kg ai/ha; Tables 1, 3), a result which could reduce the environmental impact. Interestingly, prodiamine, as well as dithiopyr (2.2 kg ai/ha), re-

Table 1. Preemergent control of *Phyllanthus urinaria* in a soilless medium after one application.

		Weeks after 1st application[z]				
		5		10		
Herbicide	kg/ha	Number	Percent coverage	Number	Percent coverage	Dry wt (g)
Control	---	20.1 a	76 a	19.8 a	100 a	49.1 a
Oxadiazon	4.5	0.4 e	<1 c	0.9 g	15 de	1.5 e
Dithiopyr	2.2	15.2 b	2 c	5.9 d	67 b	5.9 d
Isoxaben	1.1	8.4 c	3 bc	9.0 c	96 a	11.5 c
Isoxaben + metolachlor	1.1 + 2.2	3.3 d	1 c	3.2 ef	51 c	3.3 de
Isoxaben + trifluralin	0.9 + 3.6	6.5 c	6 bc	6.8 cd	99 a	16.4 b
Isoxaben + trifluralin	1.1 + 4.5	6.9 c	9 b	6.0 de	89 a	16.6 b
Isoxaben + oryzalin	0.9 + 3.6	4.2 d	1 c	4.7 def	26 d	1.4 e
Prodiamine + metolachlor	2.2 + 2.2	6.7 c	1 c	3.2 f	2 e	< 0.1 e
Prodiamine	2.2	16.8 ab	1 c	9.2 c	5 de	0.2 e
Metolachlor	2.2	14.5 b	6 bc	13.8 b	96 a	14.9 bc

[z]Mean separation (in columns) by Duncan's multiple range test (5% level) after square root (Number) or arcsine (Percent coverage) transformation; however, untransformed means are reported.

Table 2. Preemergent control of *Phyllanthus tenellus* in a soilless medium after one application.

		Weeks after 1st application[z]				
		5		10		
Herbicide	kg/ha	Number	Percent coverage	Number	Percent coverage	Dry wt (g)
Control	---	20.4 a	85 a	20.7 a	100 a	27.0 a
Oxadiazon	4.5	0.1 g	<1 e	0.4 f	1 d	<0.1 e
Dithiopyr	2.2	4.5 e	1 de	9.3 cde	10 cd	0.5 e
Isoxaben	1.1	5.1 de	2 cde	8.6 cde	90 b	9.4 d
Isoxaben + metolachlor	1.1 + 2.2	1.1 f	1 e	7.3 de	21 c	0.6 e
Isoxaben + trifluralin	0.9 + 3.6	6.5 cd	8 c	10.3 c	100 a	14.6 c
Isoxaben + trifluralin	1.1 + 4.5	4.5 de	8 cd	9.2 cd	98 a	12.9 c
Isoxaben + oryzalin	0.9 + 3.6	1.2 f	1 e	7.1 e	17 c	0.8 e
Prodiamine + metolachlor	2.2 + 2.2	10.7 c	2 cde	14.5 bc	16 c	1.0 e
Prodiamine	2.2	13.1 b	3 cde	13.3 bc	14 c	0.3 e
Metolachlor	2.2	15.2 b	26 b	17.6 ab	100 a	20.0 b

[z]Mean separation (in columns) by Duncan's multiple range test (5% level) after square root (Number) or arcsine (Percent coverage) transformation; however, untransformed means are reported.

Table 3. Preemergent control of *Phyllanthus urinaria* in a soilless medium after two applications.

Herbicide	kg/ha	Weeks after 2nd application[z] 5 Number	5 Percent coverage	10 Number	10 Percent coverage	10 Dry wt (g)
Control	---	38.1 a	81 a	33.9 a	100 a	31.8 a
Oxadiazon	4.5	0.3 f	<1 e	0.7 f	15 bc	1.0 e
Dithiopyr	2.2	3.8 e	2 e	2.0 de	22 b	1.4 e
Isoxaben	1.1	17.6 b	74 b	18.2 b	98 a	26.6 b
Isoxaben + metolachlor	1.1 + 2.2	7.6 d	9 de	7.5 c	97 a	13.0 d
Isoxaben + trifluralin	0.9 + 3.6	17.6 b	30 c	18.0 b	100 b	22.6 b
Isoxaben + trifluralin	1.1 + 4.5	18.4 b	14 de	19.5 b	99 a	17.2 cd
Isoxaben + oryzalin	0.9 + 3.6	10.0 cd	20 cd	10.5 c	98 a	17.6 c
Prodiamine + metolachlor	2.2 + 2.2	6.1 de	1 e	3.4 d	8 c	0.4 e
Prodiamine	2.2	3.4 e	1 e	1.6 ef	1 c	<0.1 e
Metolachlor	2.2	16.1 bc	19 cd	17.4 b	98 a	14.2 cd

[z]Mean separation (in columns) by Duncan's multiple range test (5% level) after square root (Number) or arcsine (Percent coverage) transformation; however, untransformed means are reported.

Table 4. Preemergent control of *Phyllanthus tenellus* in a soilless medium after two applications.

Herbicide	kg/ha	Weeks after 2nd application[z] 5 Number	5 Percent coverage	10 Number	10 Percent coverage	10 Dry wt (g)
Control	---	92.2 a	88 a	90.4 a	100 a	26.2 a
Oxadiazon	4.5	0 f	0 e	7.2 d	2 e	<0.1 e
Dithiopyr	2.2	3.2 e	1 e	51.9 b	7 e	0.1 e
Isoxaben	1.1	74.2 b	88 a	76.3 a	99 a	25.9 a
Isoxaben + metolachlor	1.1 + 2.2	14.3 d	22 d	28.2 c	61 c	8.9 d
Isoxaben + trifluralin	0.9 + 3.6	92.5 a	94 a	91.5 a	100 a	25.8 a
Isoxaben + trifluralin	1.1 + 4.5	81.1 ab	82 ab	88.1 a	100 a	24.7 a
Isoxaben + oryzalin	0.9 + 3.6	26.9 c	40 c	33.7 c	85 b	14.5 c
Prodiamine + metolachlor	2.2 + 2.2	11.7 d	3 e	49.1 b	25 d	1.8 e
Prodiamine	2.2	5.4 de	1 e	24.4 c	5 e	0.2 e
Metolachlor	2.2	86.7 a	82 b	88.2 a	100 a	20.2 b

[z]Mean separation (in columns) by Duncan's multiple range test (5% level) after square root (Number) or arcsine (Percent coverage) transformation; however, untransformed means are reported.

duced the number of *P. urinaria* from 5 to 10 WAT. Good control of *P. tenellus* was obtained with prodiamine, although it was not as effective as oxadiazon after the second application (Tables 2, 4). Metolachlor at 2.2 kg ai/ha proved to be antagonistic to prodiamine at 2.2 kg ai/ha. The number/pot of both species was greater in pots treated with the tank mix than in pots treated with prodiamine alone (Tables 1, 3, 4).

Dithiopyr at 2.2 kg ai/ha provided good control of *P. tenellus* 10 weeks after one application but only 5 weeks after the second application. However, it took two applications of dithiopyr to achieve good control of *P. urinaria* for 10 weeks.

Isoxaben formulated with oryzalin or tank-mixed with metolachlor provided good to excellent control of both species 10 weeks after the first application but not after two applications. The lack of control by these treatments after the second application may have been due to additional pressure resulting from self-seeding, the increased irrigation, and/or a greater disturbance of the herbicidal barrier due to more weeds being removed as compared to treatments where only a few small weeds were present. Major disturbance of the medium surface of ineffective treatments may also have precluded a carryover effect of these treatments.

Literature Cited

Elmore, C. D. 1990. Weed Identification Guide, Vol. 5. Southern Weed Sci. Soc. Champaign, Illinois.

Norcini, J. G. and J. H. Aldrich. 1992. Preemergent control of *Phyllanthus* species. Proc. Fla. State Hort. Soc. 105:200-202.

Stamps, R. H. 1991. Effects of preemergence herbicides on newly established leatherleaf fern. Proc. Fla. State Hort. Soc. 104:325-327.

Stamps, R. H. and R. T. Poole. 1987. Herbicide effects during leatherleaf fern bed establishment. HortScience 22(2):261-264.

Wehtje, G. R., C. H. Gilliam, and J. R. Reeder. 1992. Germination and growth of leafflower (*Phyllanthus urinaria*) as affected by cultural conditions and herbicides. Weed Tech. 6(1):139-143.

Proc. Fla. State Hort. Soc. 106:294-297. 1993.

COMPARATIVE EFFECT OF GROWTH REGULATORS ON POINSETTIA

G. J. Wilfret

Gulf Coast Research & Education Center

University of Florida, IFAS

Bradenton, FL 34203

Additional index words. chlormequat, daminozide, paclobutrazol, uniconazole, *Euphorbia pulcherrima*.

Florida Agricultural Experiment Station Journal Series No. N-00835.

Abstract. **Poinsettia (*Euphorbia pulcherrima* Willd.) cvs. 'Gutbier V-14 Glory' and 'Gross Supjibi', grown in 6-inch pots in a shadehouse during the fall of 1992, were treated with plant growth regulators (PGRs). PGRs were applied as a foliar spray (2 qt/100 gal), as a soil drench (5 oz/pot), or as a paclobutrazol impregnated spike when the uppermost lateral was 2 to 2.5 inches long. Single foliar sprays of uniconazole (10 ppm a.i.), paclobutrazol (60 ppm a.i.), or a combination of chlormequat (2000 ppm a.i.) plus daminozide (1000 ppm a.i.) yielded 'Glory' plants 11.9 to 13.2 inches tall, compared**