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Influence of Metolachlor on *Ilex crenata* Thunb. for Control of Yellow Nutsedge[1]

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Abstract

A single spring or fall application of Dual 8E (metolachlor) at 13.5 kg/ha (12.0 lb/A) to newly planted 'Hetzii' and 'Howardi' Japanese holly caused 15 to 18% injury during the first few weeks after treatment. No additional injury or reduced growth was evident with any Dual treatments 4 weeks after application. Applications of Dual at rates up to 13.5 kg/ha (12.0 lb/A) to established 'Hetzii' holly did not cause injury or affect plant height × width. Dual at 4.5 kg/ha (4.0 lb/A) to 13.5 kg/ha (12.0 lb/A) was adequate to control yellow nutsedge (*Cyperus esculentus* L.).

Index words: Dual 8E, herbicide, holly, raised beds, Pennant, preemergence

Plants used in this study: *Ilex crenata* Thunb. 'Hetzii', *Ilex crenata* Thunb. 'Howardi'

Herbicides used in this study: Dual 8E (metolachlor) 2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxyl-1-methylethyl)acetamide; Ronstar 2G (oxadiazon) {3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethyl-ethyl)-1,3,4-oxadiazol-2-(3*H*)-one}.

Significance to the Nursery Industry

Weed control is essential to hollies grown in raised beds. Yellow nutsedge is difficult to control in perennial crops. Dual 8E, which is now marketed as Pennant (metolachlor), effectively controlled yellow nutsedge for a single season without permanent injury to 'Hetzii' and Howardi' Japanese hollies at rates of 4.5 to 13.5 kg/ha (4.0 to 12.0 lb/A). Dual at 13.5 kg/ha (12.0 lb/A) provides a 3X safety factor for these varieties. No real differences in injury were observed with either fall or spring applications. Repeat applications may be beneficial after the second growing season.

Introduction

Over 300 cultivars of hollies (*Ilex* spp.) are grown in commercial nurseries in the United States (17). With the introduction of herbicides such as Surflan (oryzalin) [4-(dipropylamino)-3-,5-dinitrobenzene-sulfonamide], Goal (oxyfluorfen) [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene], Devrinol (napropamide) [*N,N*-diethyl-2-(1-naphthalenyloxy) propanamide], and combinations of these compounds, annual weed problems in floral and nursery crops have been reduced (4, 5). However, improved control of annual weeds in the nursery has allowed numerous monocotyledonous perennials to become established. These perennial weeds include purple nutsedge (*Cyperus rotundus* L.) (6), yellow nutsedge (2, 4, 8, 16), Bermudagrass [*Cynodon dactylon* (L.) Pers.] (9), and quackgrass [*Agropyron repens* (L.) Beauv.] (1, 14).

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Yellow nutsedge tubers are often found in mulching materials used for field production of nursery crops (3). Numerous herbicides have been evaluated for yellow nutsedge control including Attrex (atrazine) [6-chloro-*N*-ethyl-*N'*-(1-methylethyl)-1,3,5-triazine-2,4-diamine] (15), Basagran (bentazon) [3-(1-methyl-ethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide] (8), Roundup (glyphosate) [*N*-(phosphonomethyl)glycine] (17), paraquat (1,1′-dimethyl-4,4′-bipyridinium ion) (15), and Dual or Pennant. Although Dual controls yellow nutsedge in turf, it causes injury to gladiolus (10), Korean azaleas, and boxleaf Japanese holly (*I. crenata* 'Buxifolia') (11) but will not injure American holly (*I. opaca* Ait.) (12). The recommended use rate for Dual or Pennant for labeled nursery crops is 2.2 to 4.5 kg/ha (2.0 to 4.0 lb/A).

Field experiments were conducted to determine the efficacy of Dual for control of yellow nutsedge from tubers found in the soil mix and/or mulch, and its phytotoxicity on newly planted and established 'Hetzii' and 'Howardi' Japanese hollies.

Materials and Methods

Four field experiements were conducted during 1985, 1986, 1987 and 1988 at a commercial nursery near Salisbury, Maryland. All hollies used in these experiments were rooted from stem cuttings during July 1984 (Holly I), 1985 (Holly II and III), or 1986 (Holly IV). The Holly I, II, and III experiments included only liners of 'Hetzii' Japanese holly while Holly IV used liners of 'Howardi' Japanese holly. 'Hetzii' and 'Howardi' Japanese holly were selected because no herbicide is now labeled for yellow nutsedge control in these cultivars. The liners were propagated and overwintered in flats in the greenhouse and transplanted on September 5, 1985 (Holly I), September 17, 1986 (Holly II and III) or May 14, 1987 (Holly IV) into field blocks in raised 30 cm (12 in.) beds in a Matapeake silt loam (Typic hapludult, fine-silty mixed mesic) modified to 5% organic matter with 324 m^3/ha (520 yd^3/A) or approximately 390 mt/ha (173 T/A) fresh wt of composted pine bark and wood mulch. Each plot was 1.8 × 3.1 m (6 × 10 ft) and contained 20 holly plants which were planted approximately 45 cm (18 in) apart. A 5 cm (2 in) mulch of composted pine shavings was also applied immediately after planting. The

experimental design was a randomized complete block with 3 replications. In Holly I, II and IV Dual was applied on the date of transplanting as a broadcast spray to half of one set of plots just prior to mulching and to the other half immediately after mulching. In Holly III, Dual was applied seven months after 'Hetzii' were transplanted into the field (April 17, 1987). In all experiments, a single application of Dual was made to weed-free plots as a topical spray on day of planting September 5, 1985, (Holly I), September 17, 1986 (Holly II, Holly III) or May 14, 1987 (Holly IV) at 4.5, 6.7, 9.0 and 13.5 kg/ha (4, 6, 8 or 12 lb/A). Irrigation was applied 24 hours after the Dual treatments.

Ronstar was applied at 2.2 kg/ha (2.0 lb/A) to all plots during May 1986 (Holly I) or 1987 (Holly II, III and IV) to control annual weeds. All treatments were made using a backpack CO_2 boom sprayer with flat fan 9503 teejet nozzles (Spraying Systems Co.) calibrated at 20 in spacing to deliver 215 L/ha (25 gal/A) at 40 psi (275 kpa). Wind velocity was less than 3.5 km/hr (3 mph) during all applications.

In all experiments ten hollies in each plot were labeled and the height and width were measured. Phytotoxicity evaluations were also made on the same dates as the height and width (cm^2) measurements. Phytotoxicity was related to % foliage injury as crop quality and marketability, using a rating system of 0 to10 (0-100%). Plants with a rating of 0 to 3 would be acceptable for sale and those with a rating of 4 to 10 would be considered of poor quality and not marketable. Dead plants were rated as 10 or 100% phytotoxicity. In 1985 (Holly I) height × width was measured 252, 280, 308, 342 and 376 DAT. In 1986 and 1987 (Holly II) height × width measurements were made on the date of treatment and regularly during the next 706 DAT. Phytotoxicity was rated on the same days and on October 11, 1988 753 DAT.

In a third experiment (Holly III), the 'Hetzii' hollies were planted in the field on September 17, 1986 and Dual was applied on April 17, 1987 to the established plants, which were approximately 21 cm (8 in) × 21 cm (8 in). These plants were rated regularly for the next 594 DAT. In the fourth experiement (Holly IV) which was initiated on May 14, 1987 the height × width measurements and phytotoxicity ratings were made at treatment and regularly up to 508 DAT.

The SAS Categorical Modeling Procedure Catmod was used to analyze phytotoxicity data. A linear model relating the mean rating to treatment effects was fit to the data (12). The SAS General Linear Model procedure (GLM) was used to analyze height × width data. A one-way analysis of variance was used to compare height × width means in different treatments. Significant probabilities were adjusted according to Sidaks inequality with per degree of freedom error rate.

Results and Discussion

Weed control. Because of Ronstar applications, weed cover, including yellow nutsedge, during the evaluations of all experiments, did not exceed 5% in any plot (data not shown). The low percentage of yellow nutsedge cover was unexpected because in previous years adjacent growing areas, using similar mulch materials, were dominated by this weed. No differences in degree of yellow nutsedge control were observed between fall or spring applications of Dual. Dual at 4.5 kg/ha (4 lb/A) or more controlled yellow nutsedge when applied before mulching or on top of mulch (data not shown).

Holly quality and marketability. Dual applied at 13.5 kg/ha (12.0 lb/A) on September 5, 1985 at planting before mulching or on top of the mulch caused 15% injury to the foliage of 'Hetzii' holly 11 DAT (data not shown). Injury observed was desiccation or necrosis and chlorosis to new terminal growth. No injury was observed with Dual applications of 9.0 kg/ha(8 lb/A) or less. During the following growing season, no injury was observed in 'Hetzii' hollies treated with Dual at 13.5 kg/ha (12.0 lb/A) (data not shown).

In the Holly II experiment Dual at 4.5, 6.7, 9.0 and 13.5 kg/ha (4, 6, 8 or 12 lb/A) was applied to 'Hetzii' Japanese hollies before mulching or on top of the mulch. Foliage injury of 15 or 17% was observed at nine days with Dual at 13.5 kg/ha (12.0 lb/A) (Table 1). No significant injury was observed at lower rates. During the 1987 growing season no injury was observed at any treatment rate.

In Holly III no injury was observed in 1987 and 1988 with established 'Hetzii' holly planted in September 1986 (Holly III) and treated with Dual at rates up to 13.5 kg/ha (12.0 lb/A) on April 17, 1987 (data not shown).

Dual applied on May 14, 1987 on top of the mulch to newly planted 'Howardi' hollies (Holly IV) at 6.7, 9 or 13.4 kg/ha (6, 8 or 12.0 lb/A) caused 12 to 17% injury 6 DAT

Table 1. Quality of *Ilex crenata* 'Hetzii'[z] (Holly II) and *I. crenata* 'Howardi'[z] (Holly IV) as influenced by a single application of Dual on September 17, 1986 and May 4, 1987, respectively, before mulching or on top of mulch.

	'Hetzii'				'Howardi'	
	Days after treatment					
Rate kg/ha (lb/A)	9 (9/16/86)	22 (10/9/86)	9 (9/16/86)	22 (10/9/86)	6 (5/20/87)	6 (5/20/87)
	Before mulching		Top of mulch		Before mulching	Top of mulch
0.0	1 a[y]	2[x]	3 a	2[x]	1 a[y]	1 a
4.5 (4)	2 a	5	0.3 a	3	3 a	1 a
6.7 (6)	2 a	1	2 a	2	8 b	2 b
9.0 (8)	6 b	4	7 b	4	8 b	4 bc
13.5 (12)	15 c	11	17 c	2	18 c	17 c

[z]0 = no effect, 100 = complete kill or 100% phytotoxicity.

[y]Mean ratings within columns followed by the same letter are not significantly different at the 0.05 level determined by Categoric Modeling and with the significance level adjusted by Sidaks inequality.

[x]Non-significant.

(Table 1). Dual applied at 13.4 kg/ha (12.0 lb/A) followed by mulching caused 18% foliar injury 6 DAT (Table 1). The injury appeared as foliar desiccation and necrosis on terminal growth. No significant injury was observed at 41 DAT or during the remainder of the 1987 and 1988 growing seasons (data not shown).

Plant size. 'Hetzii' holly (Holly I) treated with Dual at 6.7 or 13.5 kg/ha (6.0 or 12.0 lb/A) applied before mulching in September 1985, were significantly smaller than the control plants in June 1986, but were similar in size to control plants and in total growth at the end of the growing season (Table 2). Dual applied on top of mulch at planting, had no effect on plant size (data not shown).

'Hetzii' holly (Holly II) treated September 17, 1986 with Dual at 13.5 kg/ha (12.0 lb/A) followed by mulching, were significantly smaller than control plants after 280 days (data not shown). Plant size for all treatments was similar to control plants from July 1987 until harvest in May 1988 after treatment. Plants treated with Dual on top of the mulch were similar to the controls during the entire evaluation period.

Dual applied at rates up to 13.5 kg/ha (12.0 lb/A) on April 17, 1987 to established 'Hetzii' holly (Holly III), had no effect on growth in 1987 or 1988 (data not shown).

No significant size differences were observed on newly planted 'Howardi' hollies (Holly IV) during 1987 or 1988 following a single application of Dual at 13.5 (12.0 lb/A) applied before mulching or on top of the mulch (data not shown). Dual was effective in controlling yellow nutsedge in 'Hetzii' or 'Howardi' hollies at rates of 4.5 to 13.5 kg/ha (4.0 to 12.0 lb/A) without significant injury. Dual should be evaluated on other holly varieties before it is included in a regular weed control program. (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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Table 2. Growth of 'Hetzii' holly (Holly I) (height × width cm²) as influenced by a single application of Dual before mulching on September 5, 1985[z,y]

Rate kg/ha (lb/A)	Days after treatment			Total growth from 5/15 to 7/10/86	Days after treatment		Total growth from 7/10 to 9/16/86	Total new growth for 1986 growing season
	252	280	308		342	376		
—	569 ab	1349 b	2852[x]	2283	1956 a	2255[x]	299	2582
4.5 (4)	602 ab	1253 ab	2982	2380	1733 b	2170	437	2817
6.7 (6)	583 ab	1178 a	2717	2134	1755 b	2156	401	2535
9.0 (8)	633 b	1395 b	2928	2295	1737 b	2249	512	2807
13.5 (12)	545 a	1183 a	2806	2261	1699 b	2177	478	2739

[z]Mean ratings within columns followed by the same letter are not significantly different at the 0.05 with significance levels adjusted by Sidaks inequality.

[y]All hollies were trimmed July 15, 1986.

[x]Non-significant.