Movement, Dissipation, and Impacts of Isoxaben (Snapshot TG) in Nursery Runoff Water

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Granular preemergent herbicide formulations are preferred by the nursery industry because they are easy to apply. These materials are broadcast applied over the top of containerized crops and then activated by irrigation. Much of the applied herbicide may land on the surface surrounding the target pots where it is available to move offsite in runoff water and into containment ponds used for water recycling (Gilliam et al.,1992).

Concern over the fate of herbicides in the environment and their potential for accumulation, especially in surface andgroundwater supplies, is justified (Mahnken et al, 1992; Keese et al., 1991, 1992; Mangus et al., 1985). This issue is particularly important in nurseries that recycle their irrigation water.

The objectives of this study were to determine the movement of isoxaben from Snapshot TG formulation (DowElanco) in irrigation runoff water and to monitor its dissipation in the containment-pond water. The influence of residual concentrations of isoxaben in irrigation water on container-grown plants was also evaluated.

MATERIALS AND METHODS

Runoff Events. A 5-acre (2 ha) container nursery production area containing a diversity of plant species was treated with Snapshot TG (0.5% isoxaben + 2.0% trifluralin) at 100 lbs product/acre in August 1992 and May 1993. The area drains into a 1.25 acre (0.5 ha) containment pond through a single storm drain. Overhead irrigation (0.5 in.) was applied following herbicide application, and water samples were collected from the runoff water before it entered the collection pond. Runoff sample collection times were 0.25, 0.5, 1.5, 2.5, and 3.5 h after water began to enter the pond and also 2 and 5 days after treatment. Pond water samples were also collected near runoff entry point and the point of water exit before herbicide application, after the first runoff event, and at 2, 5, 8, 14, 21, 29, and 60 days after treatment in order to monitor isoxaben dissipation.

Irrigation Experiment. Spring-rooted liners of snow azalea (*Rhododendron* 'Snow'), buccaneer azalea (*R.* 'Buccaneer'), and Heller's Japanese holly (*Ilex crenata* Thumb. 'Helleri') were potted in 4.5-inch plastic containers, and freshly harvested root divisions of daylily (*Hemerocallis* 'Hyperion') and dwarf gardenia (*Gardenia jasminoides* 'Nana') liners were potted in one-gal containers using 100% fine pine bark. Fountain grass (*Pennisetum rupelli*) was seeded into the same medium. Potted liners were fertilized twice after potting with 16-4-8 fertilizer and placed in a glasshouse for the duration of the experiment.

Plants in 4.5-in. containers received 120 ml and plants in 1-gal containers received 240 ml of isoxaben-fortified irrigation water 2 to 3 times per week as needed. These quantities approximately equal 0.5 in. irrigation water. The treatments included 1.0 ppm and 10.0 ppm isoxaben in irrigation water obtained from Gallery 75 DF. Experiments continued for 6 weeks beginning the fourth week

of March. However, daylilies were irrigated for an total of 11 weeks. Active ingredient received varied by species as shown in Table 1. All experiments were in randomized complete block design with six replications. Data were processed using analysis of variance and means separated using a protected least significant difference at p=0.05.

Table 1. Amount of isoxaben received by each plant species for the experiment duration.

Species	No. irrigations/time (no./weeks)	Total ai applied (mg)	
		1 ppm	10 ppm
Daylily	19/11	4.56	45.6
Dwarf gardenia	9/6	2.16	21.6
Fountain grass	12/6	1.44	14.4
Heller's Japanese holly	9/6	1.08	10.8
Buccaneer azalea	14/6	1.68	16.8
Snow azalea	14/6	1.68	16.8

RESULTS AND DISCUSSION

Runoff Events. Runoff studies indicated that 7.4% of the applied isoxaben was lost in the irrigation runoff water during the first runoff event. Nearly 3.0% was lost 2 days after treatment (DAT), and 0.9% was lost 5 DAT.

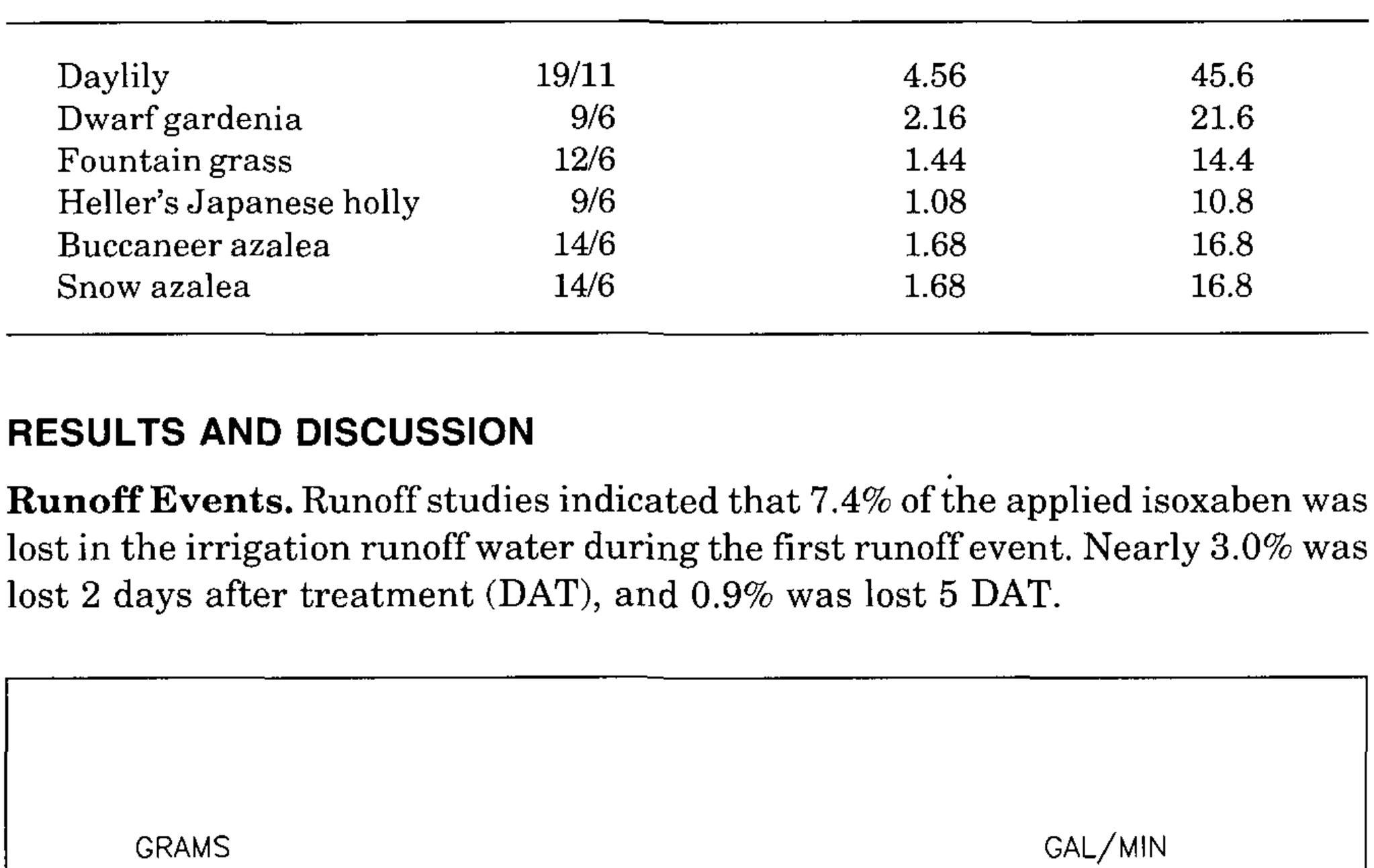

Figure 1. Isoxaben lost during first runoff event.

Approximately 38 g of isoxaben was detected during the first 1.5 h following herbicide application. Minimum quantities of 2.9 and 0.26 g were lost at the 0.25 and 3.5 h sampling periods (Fig. 1). These data correspond to results for agricultural and grass studies reported in the literature (Caro and Taylor, 1971; Bovey et al., 1978).

Isoxaben concentrations in the containment pond were much lower in 1992 than in 1993. However, the reverse was true at the site where water exits the pond. (Fig. 2).

Irrigation Experiment. Isoxaben-fortified irrigation water did not affect the growth index of dwarf gardenia, Heller's holly, or buccaneer azalea (Table 2) but reduced the growth index of snow azalea at both 1 and 10 ppm.

Table 2. Growth parameters measured for each species. Growth index = (height + 2 perpendicular widths)/3.

	Growth index (cm)				Shoot fresh weight (g)			
Species	0 ppm	1 ppm	10 ppm	LSD	0 ppm	1 ppm	10 ppm	LSD
Daylily	142.1	131.1	130.5	9.6	59.3	57.7	55.5	ns
Dwarf Gardenia	134.5	132.2	130.0	ns	0.52	0.54	0.45	ns
Fountain Grass	260.2	268.8	244.2	ns	10.6	9.1	8.6	1.3
Heller's Holly	122.1	123.8	124.7	ns	12.2	12.3	11.8	ns
Bucaneer Azalea	120.3	119.6	121.8	ns	24.7	24.6	25.5	ns
Snow Azalea	117.7	109.9	112.4	4.3	17.7	18.4	17.7	ns

ns = not significant at p = 0.5

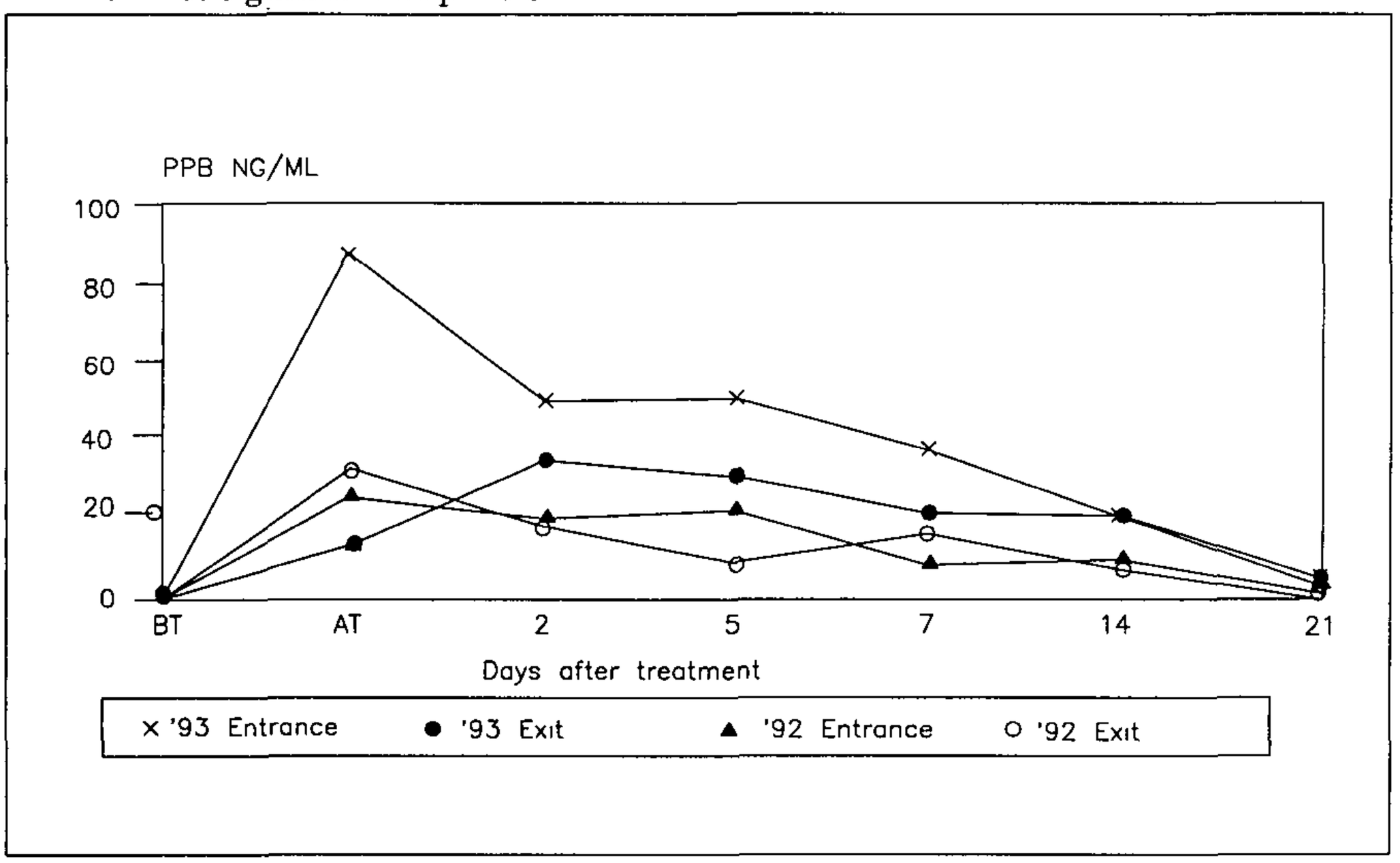

Figure 2. Isoxaben concentration in containment pond water near entry and exit points.

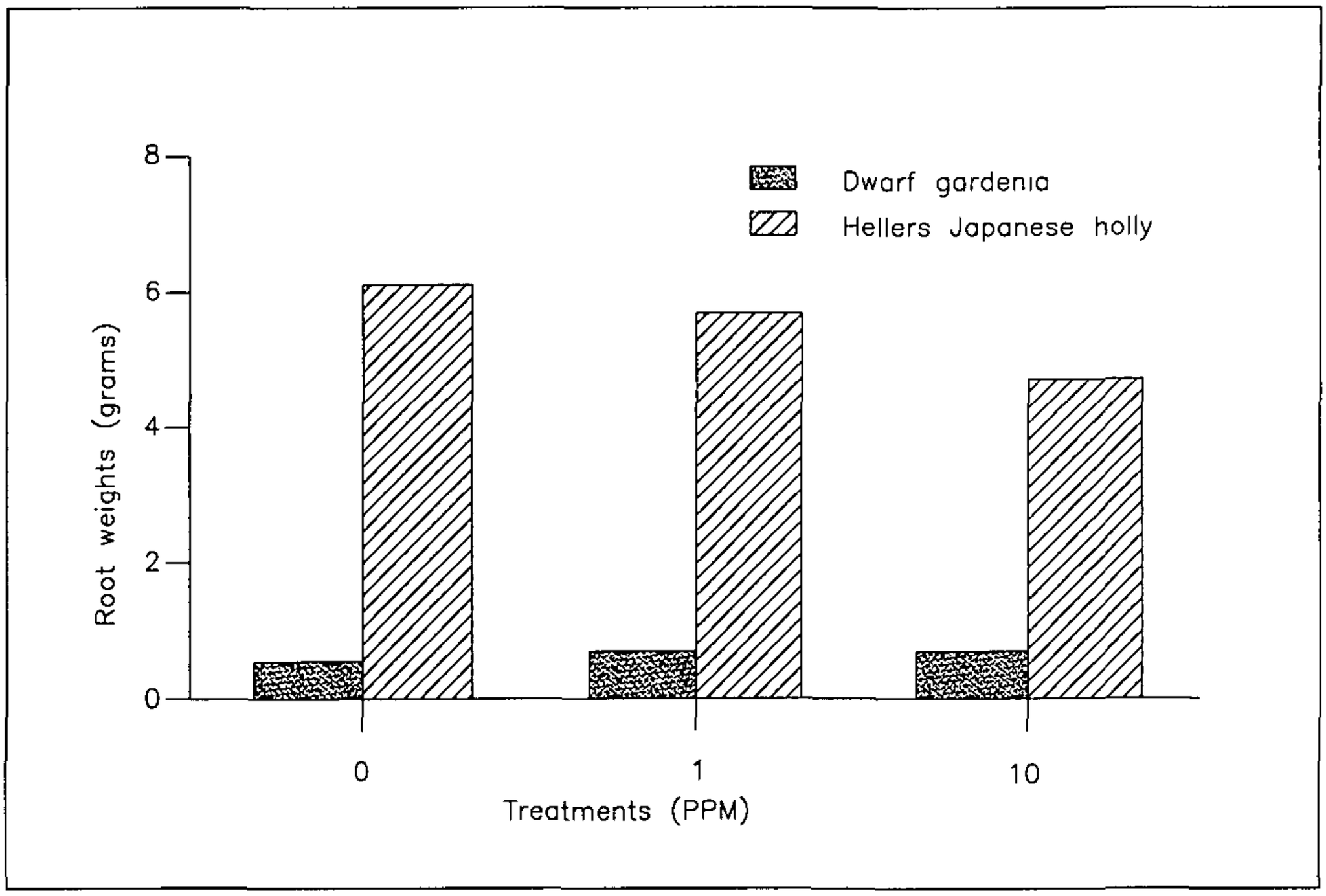

Figure 3. Root weights.

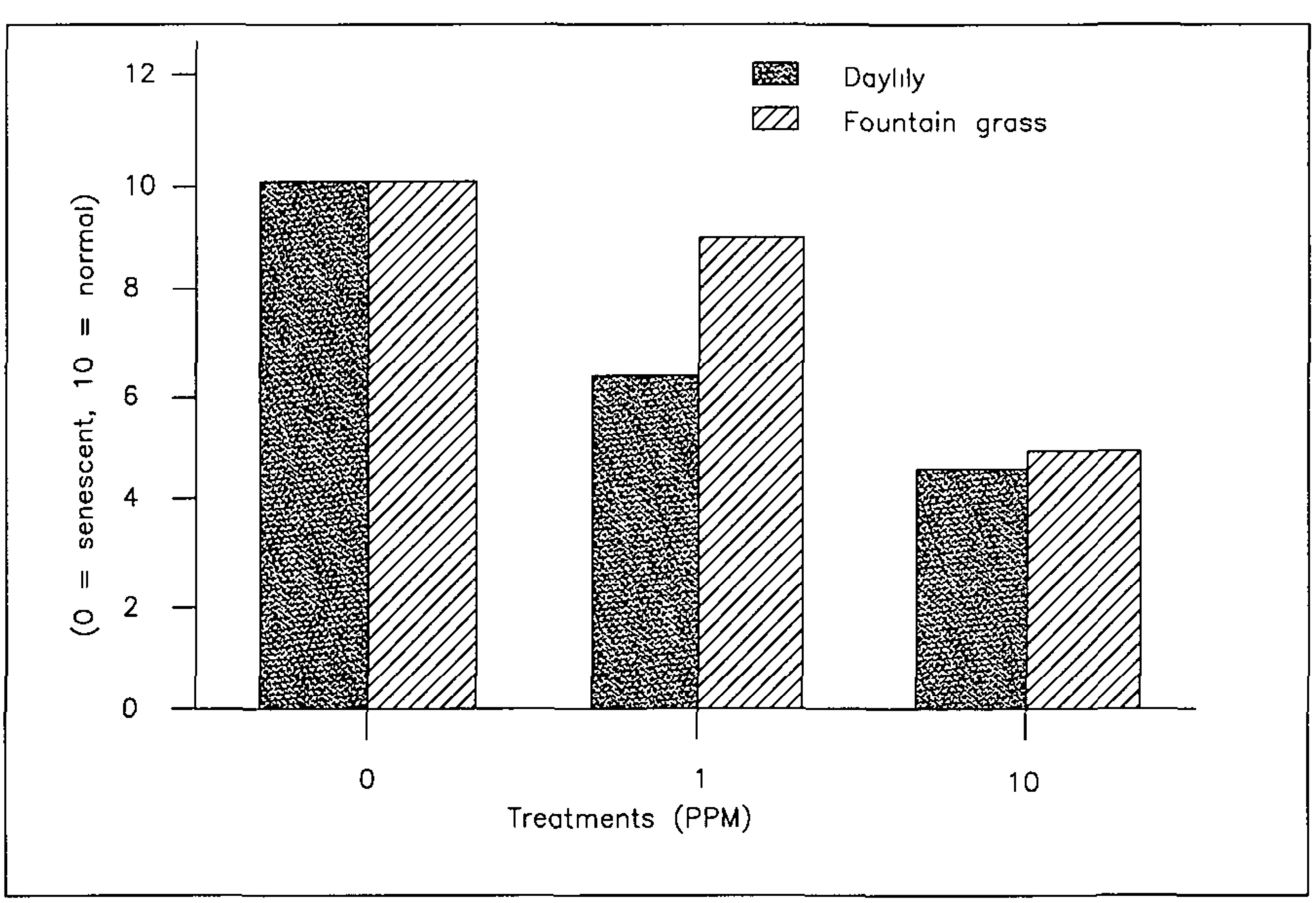

Figure 4. Root quality ratings.

No differences were observed in shoot growth index for Heller's holly, dwarf gardenia, or buccaneer azalea (Table 2). However, the 1.0 and 10.0 ppm reduced the shoot fresh weights of fountain grass. Isoxaben-fortified irrigation water produced no observable reductions in root fresh weight for dwarf gardenia but did reduce the root fresh weight of Heller's holly (Fig. 3). Root quality of both daylily and fountain grass was reduced by the 1.0 and 10.0 ppm treatment levels (Fig. 4).

This study shows that isoxaben moves from the application site in runoff water shortly after application and that it does not accumulate in the containment pond. However, some ornamental species may be injured by isoxaben residues in irrigation water. Growers can reduce the risk of plant damage from irrigation water by holding water for a period of time in a containment pond.

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