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Nontarget Herbicide Losses from Application of Granular Ronstar to Container Nurseries[1]

C.H. Gilliam, D.C. Fare, and A. Beasley[2]
Department of Horticulture
Alabama Agricultural Experiment Station
Auburn University, AL 36849

Abstract

With empty containers, nontarget herbicide loss was 23 percent when the containers were spaced container to container. Spacing the containers on 20 (8 in) and 30 cm (12 in) centers resulted in nontarget losses of 51 and 80 percent loss respectively. Nontarget losses were similar when a dense canopy plant (*Rhododendron* × 'Trouper') and an open canopy plant (*Berberis thunbergii* 'Crimson Pygmy') were spaced container to container or on 20 (8 in) or 30 cm (12 in) spacings.

Index words: herbicide application, weed control, granular herbicides, container-grown, nursery runoff, water quality, oxadiazon

Species used in this study: Trouper azalea (*Rhododendron* × 'Trouper'); Crimson pygmy barberry (*Berberis thunbergii* DC. var. *atropurpurea* 'Crimson Pygmy').

Significance to the Nursery Industry

Topical application of granular herbicides to container grown plants results in a significant portion of the applied herbicide falling between the containers. From a practical nursery practice, herbicide applications should be made prior to spacing of containers if possible. Furthermore, this work points out the need to develop more refined techniques to apply herbicides to container grown nursery crops.

Introduction

Container production of landscape plants is common throughout the United States. Weed control is essential in container production due to reduced plant growth from weed competition (1, 2, 7) and reduced aesthetic value. Increased concerns about water quality dictate that future use of herbicides be environmentally safe. Three main concerns regarding herbicides in nursery runoff water are the location of container nurseries in relation to surface water, potential plant injury from recycled runoff water, and possible ground water contamination.

Granular herbicides are normally used to control weeds in container production. These herbicides are usually broadcast using a cyclone-type spreader with up to five applications of granular herbicides annually (3). When applied to round nursery containers a portion of the herbicide falls directly to the ground between the containers. Horowitz and Elmore (5) reported that this fraction falling directly on the ground may be 20% or more.

A previous study using a bioassay with oxyfluorfen has shown that 20 ppmw incorporated into the top of a peat-containing potting media has a low risk of leaching out of the container (4). Moles and Whitcomb (6) using a wheat bioassay, reported oxadiazon was not leached through the container medium with the normal use rate. These studies would suggest the greatest potential for water contamination from granular herbicide application to container grown plants is from nontarget losses. The objective of our study was to quantify nontarget herbicide losses as influenced by container spacing and plant species.

Materials and Methods

A rectangular frame (2.3 m × 1.27 m) was constructed and covered with a plastic sheet to allow recovery of the applied herbicide. Ronstar 2G (3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one) was applied at the manufacturer's suggested rate of 224 kg/ha (200 lb/A). A hand-held shaker can was used to apply the herbicide to 2.8 l (3 quart) containers. Three spacings evaluated were container to container, containers spaced on 20 and 30 cm (8 and 12 in) centers (4.0 and 13.0 cm (1.5 and 5 in) between containers, respectively). Each empty container was lined with a plastic freezer bag to collect the herbicide going into the container. Herbicide falling inside the containers was pooled and weighed, and the herbicide falling on the plastic sheet under the containers was weighed. The experiment was repeated twice (3 times total). An analysis of variance ($P = 0.05$) was done and Fisher's Protected LSD (0.05) was used for mean separation.

The test was repeated as previously described with containers of Trouper azalea (*Rhododendron* × 'Trouper') representing a dense canopy plant and Crimson Pygmy barberry (*Berberis thunbergii* 'Crimson Pygmy'), representing an open canopy plant. Trouper azaleas averaged 41.8 cm (16.4 in) in height and 39.3 cm (15.5 in) in width. Barberry averaged 24.6 cm (9.7 in) in height and 37.8 cm (14.9 in) in width. These container grown plants were placed in a plastic bag to cover the outside of the container and prevent container media from falling onto the plastic sheet. Container size, container spacing and replications were similar to the empty container test.

Results and Discussion

With the empty containers (Table 1), nontarget herbicide loss was 23% when the containers were spaced container to container and increased to 51 and 80% at 20 and 30 cm (8 and 12 in) spacing respectively. When plants were evaluated for the canopy influence on nontarget herbicide loss,

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[2]Professor, Research Associate, and undergraduate student, respectively.

Table 1. Nontarget loss of Ronstar 2G herbicide with broadcast applications as affected by pot spacing and plant canopy.

Container	Spacing	Herbicide loss (%)
Empty	pot to pot	23.0
	20 cm	51.0
	30 cm	80.0
LSD (.05)		1.3
Azalea	pot to pot	30.0
	20 cm	55.0
	30 cm	79.0
LSD (.05)		1.5
Barberry	pot to pot	27.0
	20 cm	54.0
	30 cm	80.0
LSD (.05)		2.0

there was almost no difference between the open canopy barberry and the dense canopy azalea. Although no statistical comparisons were made between empty containers and containers with plants, nontarget herbicide losses appeared similar. When spaced container to container the nontarget losses were 23, 30, and 27% for the empty containers, azalea and barberry respectively. The range in losses for the containers spaced on 20 cm (8 in) spacing was 51–55% and 79–80% for the containers spaced on 30 cm (12 in) centers.

This study reveals that nontarget granular herbicide loss from broadcast application ranges from 23–30% when 2.8 l (3 quart) containers are spaced container to container. This agrees with the reported 20% or more of the applied herbicide falling to the ground even in densely spaced containers (Horowitz and Elmore, 1991). Increasing plant spacing results in progressively greater nontarget herbicide loss. This work combined with reports of minimal herbicide leaching from the container media (4, 6) would indicate that most herbicides in nursery runoff waters are from nontarget herbicide losses. From a practical nursery practice, herbicide applications should be made prior to spacing of containers if possible. Furthermore, this work points out the need to develop more refined granular herbicide application techniques to prevent nontarget herbicide loss.

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