

LEACHING OF 2,4-D AND DICAMBA FROM HOME LAWNS

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Abstract. Leaching of the broadleaf herbicides 2,4-D and dicamba from home lawns was monitored with ceramic extraction plates placed at a 0.2 m depth beneath undisturbed sod. The site was located on a Merrimac sandy loam. Four treatments, consisting of two rates of herbicide applications coupled with two irrigation regimes, were evaluated on 12 plots. The low herbicide rate consisted of 1.1 and 0.1 kg ha⁻¹ yr⁻¹ of 2,4-D and dicamba, respectively. The high rate used was 3.3 and 0.33 kg ha⁻¹ yr⁻¹ of 2,4-D and dicamba applied in three equal applications. Irrigation treatments were (1) minimal irrigation to avoid drought stress and percolation from the root zone and (2) overwatering at 37.5 mm week⁻¹. Geometric mean concentrations of 2,4-D ranged from 0.55 to 0.87 µg L⁻¹ compared to 0.26 to 0.55 µg L⁻¹ for dicamba. The low application-minimum irrigation treatment generated significantly higher concentrations than the other treatments for both herbicides. The low concentrations observed for both herbicides suggest that excellent degradation conditions exist in the root zone of turfgrass during the summer months when application occurs.

1. Introduction

Two of the most common herbicides used on home lawns are the phenoxy herbicide 2,4-D (2,4-dichloro-phenoxyacetic acid) and the benzoic acid herbicide dicamba (2-methoxy-3, 6-dichlorobenzoic acid). These herbicides are surface applied by homeowners and commercial lawn care companies to control broadleaf weeds such as dandelions (*Taraxacum officinale*) and plantain (*Plantago rugelii*). 2,4-D and dicamba are considered to be among the most mobile pesticides in soil (Helling and Turning, 1968). They have been found to leach in sandy soils and in soils low in organic matter (Bailey and White, 1970; Harris and Warren, 1964; Ogle and Warren, 1954; Weise and Davis, 1964). Miller *et al.* (1974) in their study of groundwater contamination in the Northeastern States, stressed the need for long term studies to determine if home lawn agrichemicals have penetrated the soil zone and entered the groundwater system. The Federal drinking water standard for 2,4-D is 0.1 mg L⁻¹ (EPA, 1976). The EPA recommended maximum advisable level for dicamba in drinking supplies is 0.0125 mg L⁻¹ (Baker, 1985).

White *et al.* (1976) reported little movement of 2,4-D in either subsurface or surface water flow with approximately 100 cm of simulated rainfall per year. Rapid decomposition could explain the low concentrations observed. During the growing season 2,4-D in the soil is usually broken down within 4 to 6 weeks. Dicamba is more persistent in the soil with an active life of 3 to 6 mo; however, degradation begins immediately and soil levels have been found to decrease markedly within the first month (Friesen, 1965).

Any management practice that enhances the probability of water loss immediately after herbicide application could promote off-site contamination. Home lawns are

typically watered without regard for soil moisture status or the water holding capacity of the soil. Excessive watering will increase antecedent soil moisture, thereby promoting leaching and surface water runoff from natural storm events or from the supplemental water alone.

Reapplication of a herbicide during the growing season may maintain high concentrations of the herbicides in the soil that can be transported with water leaching from the site. Nicholaichuk and Grover (1983) found fall applications can result in marked increases in off-site losses of 2,4-D since the rate of microbial degradation slows in cooler weather. The specific objective of this study was to determine the effect of multiple application rates and overirrigation on soil water percolate losses of 2,4-D and dicamba from the root zone of home lawns.

2. Materials and Methods

2.1. SITE DESCRIPTION

Twelve hydrologically isolated plots (2.1×15.2 m) were established at the University of Rhode Island to monitor surface and subsurface water loss from turfgrass. Soil type at the site was a Merrimac sandy loam (sandy, mixed, mesic Typic Dystrochrept). The organic matter content in the upper 20 cm was 2%. Slope on the plots was 2 to 3% with no cross slope.

A mixture of bluegrass and fescue was planted on the site during Fall 1980. The sod was greater than 90% Kentucky Bluegrass (*Poa pratensis* L.) at the onset of the study. To simulate home lawn management, a complete fertilizer was routinely applied. The turfgrass was maintained at a 5.0 to 7.5 cm height, and the clippings were left on the plots. Throughout the study a continuous layer of dead thatch 1.0 to 2.0 cm thick blanketed the surface soil.

A combination of two rates of herbicide application and two irrigation regimes was monitored. Herbicide application began in June 1984 and continued through 1986. Monitoring and analysis were conducted from July 1985 through November 1986 to avoid any anomalies that may have arisen during the first season of application.

2.2. HERBICIDE APPLICATION

The herbicides 2,4-D and dicamba were applied in a manufactured mixture of Trimec[®] (marketed by PPI Gordon, Kansas City, MO) as a liquid mix at a spray rate of 0.12 L m^{-1} . Two application rates of herbicides were compared. The low rate consisted of a single application in June of 1.1 kg ha^{-1} 2,4-D and 0.1 kg ha^{-1} of dicamba. This treatment simulates the standard practice of commercial lawn care companies. The high rate consisted of $3.3 \text{ kg ha}^{-1} \text{ yr}^{-1}$ and $0.33 \text{ kg ha}^{-1} \text{ yr}^{-1}$ for 2,4-D and dicamba, respectively. The high rate resulted from 3 applications per year occurring in April, June, and September. The quantity of herbicide used during each application was 1.1 kg ha^{-1} 2,4-D and 0.1 kg ha^{-1} dicamba. Both herbicides were applied in the amine salt form.

