ABSTRACT

CUMMINGS, HENNEN DOCK. Pesticide Downward Movement in a Bermudagrass System Compared with Movement in a Fallow System. (Under the direction of Dr. Fred H. Yelverton and Dr. Jerome Weber.)

Pesticide regulations based on pesticide mobility data derived from row crop systems may not appropriate for bermudagrass systems since organic matter binds pesticides and bermudagrass systems can have a thatch layer at the soil surface which is rich with organic matter. Downward mobility of pesticides in a fallow soil system was compared with movement in a bermudagrass system under field conditions when the bermudagrass was actively growing and dormant in a Candor sand. Soil column lysimeters (15 cm in diameter x 91 cm in length) were removed from the field after 140 days of summer or winter and analyzed by depth for either fipronil, fipronil metabolites (fipronil sulfone, fipronil sulfide, fipronil amide, desulfinylfipronil), imazaquin, prodiamine, pronamide, or simazine parent material using gas chromatography. In general, greater pesticide concentrations were reported for winter treatments. Pesticides tended to not move beyond the thatch layer of the bermudagrass system but were distributed more uniformly from 0 to 15 cm in the fallow soil system. The thatch layer of the bermudagrass system contained 300% more organic matter than the 0-4 cm depth of the fallow soil system which provided a greater potential to bind pesticides.

In a second study, ^{14}C-labeled simazine was applied to dormant bermudagrass and fallow soil in short lysimeters stored in a cold growth chamber and to actively growing bermudagrass and fallow soil in lysimeters kept in a greenhouse in late April. Following each clipping collection, lysimeters were irrigated with 5 cm of water every three to four

days and leachate was collected 4 hours later. After 25 days, lysimeters were removed and divided into specific depth increments. Due to evapotranspiration, actively growing bermudagrass and warm fallow soil lysimeters yielded significantly less leachate than dormant bermudagrass and cold fallow soil lysimeters indicating less moisture was available for downward movement during summer. Simazine quantities in dormant bermudagrass leachate increased quickly indicating movement by channeling whereas simazine quantities in cold fallow soil leachate increased gradually over time indicative of herbicide front movement. There were no significant differences in the quantities of simazine in the roots or verdure of actively growing and dormant turf except for the 0-2 cm increment where dormant bermudagrass roots contained more simazine. The amount of simazine translocated in actively growing bermudagrass clippings increased from 14,377 disintegrations per minute (DPM) to a maximum of 62,003 DPM and then decreased to 21,314 DPM over a 21 day period. After the addition of 31 cm of irrigation (25% mean annual rain fall in NC), the greatest quantities of simazine were detected in the 0-2 cm increment of all treatments and concentrations decreased with depth. Although the greatest quantities of simazine in leachate were reported in dormant bermudagrass, the mobility index for simazine was greatest for cold fallow soil. Therefore, simazine is least mobile during periods of high evapotranspiration rates like summer.

In a third experiment beginning in May 2003, fipronil was applied at the label rate to bermudagrass in pots in a greenhouse 120, 90, 60, 30, and 0 days before adding one tawny mole cricket nymph to each of 11 replicates in September 2003. The experiment was conducted twice. In Run 1, 10 days after adding nymphs and 4 days after adding nymphs in Run 2, cricket status was recorded as dead, absent, or alive. Run 1 included 11 non-treated containers, and Run 2 included 26 non-treated containers. Soil in the 0-4 cm increment was analyzed for fipronil and four fipronil metabolite residue concentrations. Fipronil residue concentrations (µg per g) decreased with time ($0.00002x^2 – 0.005x + 0.3675$ where x =days after treatment, $R^2 = 0.9998$). Two metabolites (fipronil sulfone and fipronil sulfide) concentrations increased as fipronil residues decreased. Each treatment's effect on the nymph was significantly different from the non-treated; however, there were no significant differences in nymph status among fipronil treated pots. Therefore, fipronil residues 120 days after application (0.047 µg per g) were high enough to affect mole crickets to the same extent as the 0 day treatment (0.368 µg per g). There was significant repellency with fipronil as the majority of nymphs evacuated the treated pots, but 35 out of 37 nymphs were found alive in the non-treated pots.

PESTICIDE DOWNWARD MOVEMENT IN A BERMUDAGRASS SYSTEM COMPARED WITH MOVEMENT IN A FALLOW SYSTEM

by

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“I am glad to see you.”

Hennen Cummings

BIOGRAPHY

Hennen Dock Cummings is thirty-eight years old and grew up in Asheville, NC. He is the fourth child of Jeanne L. and Charles E. Cummings. He graduated in 1985 from Asheville Country Day School which is now called Carolina Day.

Hennen attended UNC-Chapel Hill from 1985 to 1989 and received a Bachelor of Science degree in Public Health while studying Environmental Science. From 1990 to 1995 he was employed by Geraghty & Miller (Arcadis), an international, full service, environmental consulting firm. As a project manager, he evaluated the potential for adverse health effects of humans exposed to toxic chemicals released from industrial facilities, underground storage tanks, landfills, and lagoons into soil, sediment, groundwater, and surface water.

Hennen returned to college in 1996 to study turfgrass management at North Carolina State University (NCSU). He earned a BS in Agronomy in December 1997 and graduated Summa Cum Laude, ranked number one in the senior class of 6,451 students. Hennen earned a MS in Crop Science from NCSU in 2001. Under the direction of Dr. Fred Yelverton, he studied rooting and lateral recovery of creeping bentgrass in response to plant growth regulators, preemergence herbicides, and soil temperature.

While at NCSU, Hennen earned several awards and honors: TCNC Eagle Scholarship, Northeast Weed Science Society First Place Paper Award, Crop Science Society of America Third Place Paper Award, Gamma Sigma Delta Honor Society of Agriculture, Outstanding Teacher Assistant Award, Preparing for the Professoriate Program, First Place Team Member in 2002 and 2003 at Northeast Weed Science Society Collegiate Weed Science Contest, Golf Course Superintendents Association of America Watson Graduate

Fellowship Award, and Weed Science Society of North Carolina Outstanding Ph.D. Graduate Student.

He has been married for 10 years to the lovely Kim Carter Cummings of Pinehurst who was a Human Resource Specialist at Wake Med Hospital. Hennen lived in a little "fixerupper" for 12 years on an acre of land north of Raleigh. A black super dog named Willy lives with them.

Currently, Hennen is the Director of the Turfgrass and Golf Course Management Program at Tarleton State University in Stephenville, TX.

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CHAPTER 1

Downward Pesticide Movement in a Bermudagrass System Compared with a Fallow Soil System

Abstract. Downward mobility of pesticides in a fallow soil system was compared to movement in a bermudagrass (*Cynodon dactylon*) system under field conditions when the bermudagrass was actively-growing and dormant in a Candor sand. Soil column lysimeters (15 cm in diameter x 91 cm in length) were removed from the field after 140 days of summer or winter duration and analyzed for fipronil, imazaquin, prodiamine, pronamide, and simazine parent material and four fipronil metabolites (fipronil sulfone, fipronil sulfide, fipronil amide, desulfinylfipronil) using gas chromatography. In general, greater pesticide concentrations were reported for winter treatments. Pesticides tended to not move beyond the thatch layer of the bermudagrass system but were distributed more uniformly from 0 to 15 cm in the fallow soil system. The thatch layer of the bermudagrass system contained 300% more organic matter than the 0-4 cm depth of the fallow soil system which provided a greater potential to bind pesticides in the bermudagrass system.

List of abbreviations: ANOVA = analysis of variance, CEC = cation exchange capacity, D = depth, DAT = days after treatment, DI = deionized, DNA = dinitroaniline, F = fraction of pesticide present, EPA = Environmental Protection Agency, FFDCA = Federal Food, Drug, and Cosmetic Act, FIFRA = Federal Insecticide, Fungicide, and Rodenticide Act, FQPA = Food Quality Protection Act, GC = gas chromatograph, HM = humic matter, OC = organic carbon, OM = organic matter, MI = mobility index, PLP = pesticide leaching potential, ppb = parts per billion, Rf = reached factor, RTP = Research Triangle Park.

INTRODUCTION

Recent detections of pesticides in our nation's groundwater have increased the public's interest in the fate and transport of these compounds in soil. In response, the Food Quality Protection Act (FQPA) of 1996 will limit or restrict certain turfgrass pesticide use (Public Law 104-170-Aug. 3, 1996). The FQPA amended the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (Public Law 92-516-Oct. 21, 1972) and the Federal Food, Drug, and Cosmetic Act (FFDCA) (21 U.S.C. 301 et seq. 1938). These amendments fundamentally changed the way the US Environmental Protection Agency (EPA) regulates pesticides. The FQPA requires currently registered pesticides to be reevaluated every fifteen years. As a result of being reevaluated, several broad-spectrum insecticides are no longer registered for use in turfgrass. In addition, the rate of development of new herbicide chemistry has slowed in recent years following the widespread usage of glyphosate-resistant crops. Thus, fewer new herbicides are introduced to the market each year, but current herbicides may continue to be removed from the market. A thorough understanding of pesticide mobility in turf is needed because more pesticides will be closely scrutinized under this legislation.

Pesticide regulations based on pesticide mobility data derived from row crop systems may not be appropriate for turf systems. In turf, pesticides are rarely applied to bare soil; a lower fraction of pesticides reaches the soil in actively-growing turf systems as the turf canopy intercepts a large portion of the pesticide. The intercepted pesticide is more exposed to wind and sunlight which encourages volatilization and photolysis; thus, lower concentrations reach the thatch layer which also covers the soil surface.

In both systems, organic matter (OM) can bind pesticides, and pH can influence pesticide movement (Gardner and Branham, 2001; Weber and Keller, 1994). However, managed turf systems are stratified by pH as lime is added to the surface and cannot be incorporated mechanically. In NC, the pH of soil beneath the thatch layer decreases from approximately pH 6.0 to 4.0 as depth increases. For pesticides that ionize, soil pH will determine if a pesticide molecule has a positive, negative, or neutral charge. Soil particles have negative charge and bind molecules with positive charge. Molecules with negative charge are repelled and are more mobile in soil. In addition, soil pH will influence the protonation state of organic acids in OM. The protonation state of the organic acids will determine the charge of the functional group. Organic matter with more charged functional groups can bind more pesticides molecules with the opposite charge.

As a bermudagrass (*Cynodon dactylon* L.) turf system ages, the thatch layer at the surface of the bermudagrass system thickens, and the lower portion of the thatch layer and soil below increase in OM content. Although OM accounts for only a small portion of soil, it has a large effect on both soil biological and chemical properties. The effect of soil OM on reducing herbicide activity through adsorption has been reported by many investigators (Gardner and Branham, 2001; Warren and Weber, 1994, Weber, 1994). In the case of applying an insecticide to control soil dwelling insects, the thatch layer can be a barrier that is difficult to penetrate. In addition, the thatch layer in a turf system contains diverse populations of microorganisms which can degrade pesticides and can utilize root exudates and regular applications of fertilizer and irrigation for growth and metabolism (Gardner and Branham, 2001).

Some pesticides are primarily root absorbed by actively-growing turf species and metabolized into benign organic chemicals; however, in winter when bermudagrass is dormant and not utilizing all of the available water and when microbial activity is reduced, there may be downward pesticide movement. In addition, the turf canopy is thinner in winter, and more pesticide will contact the thatch layer. Thus, timing of application can influence the fate of pesticides applied to turf. By understanding the fate and behavior of commonly used turfgrass products, management plans can be implemented that may increase their environmental safety and help preserve their use. In addition, turf is grown in parks, recreational areas, roadsides, residences, and businesses where people conduct their daily lives and depend on groundwater for public water supplies. Knowing if dormant or actively-growing turf increases or decreases the downward mobility of turf pesticides is very important.

For the protection of groundwater, pesticide-leaching studies have been conducted using soil column lysimeters (Flury, 1996; Führ et al., 1998; Keller and Weber, 1995). With lysimeters, there is no horizontal flow; thus, more downward movement occurs providing a worst-case scenario. Although expensive and labor intensive, field lysimeters provide for containment of the soil and pesticides and approximate field conditions under which pesticides are used. However, researchers have reported that plants, surface covers, and surface management can affect water infiltration, retention, and loss (Gardner and Branham, 2001; Weber and Keller, 1994; Winton and Weber, 1996). Surface mulches maintain higher soil moisture levels than bare ground, and plants consume soil moisture which may cause capillary transport of pesticides to the soil surface (Weber et al., 1999; Winton and Weber, 1996). The resulting differences in water balance dynamics create different leaching potentials for pesticides in the two systems as more water is retained near the surface in the actively-growing bermudagrass system (Helling et al., 1988; Weber and Lowder, 1985). Gardner and Branham (2001) compared the movement of ethofumesate (K_s 50 mg/L) and halofenozide (K_s 12 mg/L) in creeping bentgrass (*Agrostis palustris* Huds.), tall fescue (*Festuca arundinaceae* Schreb.), and bare soil. They reported that ethofumesate leaching in turfgrass was reduced by at least 95% compared to leaching in bare soil and that the half life was 3 days in turf and 51 days in bare soil. However, halofenozide showed similar leaching properties with and without turfgrass.

The fate and behavior of pesticides in soil are dependent on many factors like soil texture, pH, OM content, timing, intensity and duration of rainfall, temperature, humidity, cropping system, properties of the pesticide, use rate, microbial populations etc. In addition to the cropping system, the leaching potential of a pesticide primarily depends on soil type, texture (clay content), pH, and OM content of the soil system and the pesticide's sorption affinity, persistence, and solubility in water. Leaching is the primary concern in course-textured soils (Warren and Weber, 1994; Weber and Keller, 1994).

Fipronil (5-amino-1-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4-[(trifluoromethyl)sulfinyl]-1H-pyrazole-3-carbonitrile) is a new turf insecticide, registered for use in the US in 1996 (Federal Register, 1996). Prior to 2004, the fipronil granule formulation was required by the label to be knifed into the thatch layer by a custom applicator and not applied to the surface in a broadcast fashion. Based on the application requirement, the lack of information on the fate of fipronil in turf, and its physical and chemical properties, it was included in this study. On North Carolina golf courses where warm-season and cool-season grasses are grown adjacently, turf injury can occur if herbicides move on the surface from tolerant warm-season species to susceptible down-gradient cool-season species (Dernoeden, 1995). Imazaquin (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-quinolinecarboxylic acid), pronamide (3,5-dichloro-N-[1,1-dimethylpropynyl] benzamide), and simazine (6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine) have been observed to cause injury to down-gradient cool-season species like creeping bentgrass if a heavy rain follows pesticide application (personal communication, F. Yelverton [NCSU], 6/15/04). Based on the observed mobility of these pesticides in surface-water runoff and their physical and chemical properties, their downward movement in turf and fallow soil was evaluated in this study. Unlike the previous compounds, prodiamine (2,4-dinitro-N^3,N^3-dipropyl-6-[trifluoromethyl]-1,3-benzenediamine) is highly water insoluble and binds tightly to proteinaceous substances commonly found in OM. Prodiamine is not expected to move downwardly but was included for comparison purposes.

Simazine costs approximately $5 per acre whereas alternatives cost as much as $100 per acre, making it highly desirable if environmentally safe. Because lawn care professionals, athletic field managers, and golf course superintendents commonly use simazine and other triazine herbicides, the financial impact from the loss of these products would be substantial. Similarly, prodiamine and other dinitroaniline (DNA) herbicides are also much cheaper than their alternatives. DNA costs range from $30 to $40 per acre; whereas, the alternatives are approximately $125 per acre.

Physicochemical and biological properties of the pesticides studied are shown in Table 1. Because all compounds except pronamide ionize with changes in pH typically found in soil, the mobilites of the ionizable compounds are influenced by pH. The thatch layer of the bermudagrass system has a higher pH than the underlying turf (Figure 1). Fipronil is used to control red fire ants (*Solenopsis invicta* Buren) and mole crickets (*Scapteriscus* species) in turf. On the soil surface, fipronil is subject to photolysis and microbial degradation; however, below the surface microbial break down is the principle degradation route. Oxidation, reduction, and hydrolysis are also important degradation mechanisms for fipronil (California Environmental Protection Agency [CEPA], 2001). Fipronil's very low water solubility and weakly basic properties probably cause it to be tightly bound and immobile in acidic soils. In turf, fipronil is applied as a granular product at very low use rates (g ai ha^{-1}). Imazaquin can be applied pre or post emergence and absorbed by foliage and roots with rapid uptake occurring via the roots. Imazaquin is a weak acid (pKa = 3.8) and is more mobile in its anionic form at higher pHs. Imazaquin has the highest water solubility (60-120 mg L^{-1}) and lowest binding affinity (K_{oc} = 20 mL g^{-1}); thus imazaquin is expected to be the most mobile of the compounds included in this study. However, imazaquin has a moderately short disappearance time (DT_{50} = 60 days). Imazaquin is primarily degraded by microbes (Ahrens, 1994). Pronamide can be applied pre or post emergence and is absorbed via the roots. This herbicide is non ionizable and adsorbs readily to organic material. Degradation of pronamide occurs via microbial and non-microbial pathways (Ahrens, 1994). Simazine is applied as a preemergence herbicide and is absorbed via the roots. It is a weak base (pKa = 1.62) and is more mobile at higher pHs when it is in its molecular form. In high pH soil, slower microbial degradation predominates; however, in low pH soil, degradation via non-microbial hydrolysis occurs at a faster rate (Ahrens, 1994). Prodiamine is applied preemergence and is root absorbed. This compound is nonionizable in soil, has extremely low solubility, and binds tightly to OM (K_{oc} = 13,000 mL g^{-1}) (Ahrens, 1994). Prodiamine is subject to photolysis on the soil surface, however, it has a long half life in soil (DT_{50} = 120 days) (Ahrens, 1994).

This study was performed to determine if the presence of dormant or actively-growing bermudagrass influences the downward movement of these pesticides compared to fallow soil.

MATERIALS AND METHODS

Field lysimeter installation. This study was conducted at the Sandhills Research Station, Jackson Springs, NC. The particle-size distribution for the Candor sand (sandy, siliceous, thermic, Arenic Paleudult) is given in Table 2. In May 2001, a 580-m^2 area of a larger block of 'Tifway' hybrid bermudagrass established five years prior was sprayed with glyphosate (N-[phosphonomethyl]glycine). After two weeks, the dead sod was removed with a sod cutter, and the area was tilled. Then, the area was fumigated with methyl bromide (bromomethane) 89.5% and chloropicrin (trichloronitromethane) 10.5% applied at 448 kg ha^{-1} to set up a split-plot design (fallow soil vs. bermudagrass). The area was kept free of vegetation with glyphosate as needed for the two-year experiment and is referred to as fallow soil. Using a tractor-mounted inverted post-hole driver on June 10, 2001, August 6, 2001, and May 25, 2002, a total of 40 soil column field lysimeters made from 18-gauge cold-rolled steel (15.2 cm in diameter x 91.4 cm in length) were driven into both bermudagrass and fallow soil until 2 cm of the column remained above the soil surface. The lysimeters were installed in the center of 1.52 m x 1.52 m plots; the turf plots were separated by 30.5-cm trenches cut with a sod cutter. In addition, there was no slope making runoff losses/additions unlikely. The bermudagrass plots were maintained twice weekly at 1.9 cm by a reel mower, and clippings were returned. The fallow soil plots received the same irrigation and fertilization as the turf plots.

Herbicide treatments. One insecticide, fipronil (Chipco Choice 0.1 G [Aventis, Research Triangle Park (RTP), NC]), and four herbicides: imazaquin (Image LC 1.5 SL [BASF, RTP, NC]), pronamide (Kerb 50 WP [Rohm and Haas Company, Philadelphia, PA]), simazine (Princep 4F [Syngenta, Greensboro, NC]), and prodiamine (Barricade 65 WDG [Syngenta, Greensboro, NC]), were applied to unique plots with two replicates in the fallow soil and bermudagrass areas July 6, 2001 and July 2, 2002 when the turf was actively-growing and November 22, 2001 and November 29, 2002 when the turf was dormant. The first treatment application occurred six weeks after fumigation to allow the microorganism populations time to recover. The herbicides were applied using a two-wheeled, mounted, CO_2-pressurized boom with four TEEJET 8003XR (Spraying Systems Co., Wheaton, IL) flat-fan nozzles calibrated to deliver 467 L ha^{-1} at 207 kPa. Fipronil granules were applied using a saltshaker. Application rates are listed in Table 1; imazaquin was applied with X-77 (Valent, Libertyville, IL), a non-ionic surfactant, at 0.25% v/v. Treatments were watered in with one cm of irrigation immediately following application to set up a worst case-leaching scenario by reducing photolysis and volatilization. A light irrigation after application which is sufficient to move the product into the soil but not produce run off will result in a lower potential for run off during an intense rain storm.

Water input levels. Weather was recorded at the research station by the North Carolina Agricultural Research Services. The duration and frequency of irrigation events were recorded. Seven irrigation events were collected next to each lysimeter to determine the uniformity of the irrigation and to approximate the volume of irrigation applied to the lysimeters. Irrigation was applied to both fallow soil and bermudagrass plots simultaneously from July to September as necessary to avoid wilt of the turfgrass.

Sampling and analysis of pesticides. After approximately 140 days of summer or winter on November 27, 2001 and November 19, 2002, and April 10, 2002 and April 15, 2003, respectively, lysimeters were extracted. The lysimeters were cut lengthwise with a reciprocating saw, spread apart, and divided by depth into 0-2, 2-4, 4-8, 8-15, 15-30, 30-45, 45-60, and 60-91 cm increments starting at the bottom of the column. The thatch layer was approximately 0-4 cm thick and was separated into the 0-2 and 2-4 cm increments with a hacksaw. All soil increments were bagged in polyethylene bags, weighed, and stored at -18^{o}C. All increments from the two lysimeters in both fallow soil and bermudagrass systems were simultaneously thawed for each pesticide, sub sampled to determine percent moisture by weight, and set out in aluminum pans for two days to air dry at room temperature. Then, the soil increments were sieved through a 1.4-mm sieve and sub sampled. Aboveground and belowground bermudagrass tissues also were collected.

Fipronil, pronamide, simazine, and prodiamine were extracted by sonication (EPA Method 525.2 modified as described below). Ten grams of soil and 150 mL of acetone and n-hexane (1:1) were placed in a 250-mL beaker and sonicated (Branson® Sonifier 450 [Branson Ultrasonics, Danbury, CT]) for 5 minutes at 450 watts and 40 duty cycle. The supernatant was filtered through glass wool and anhydrous sodium sulfate into a 500-mL boiling flask. Another 150 mL of extraction solvent were added to the beaker and sonicated for three minutes. The supernatant was filtered into the same boiling flask. The volume was reduced to 2 mL by rotary evaporation under vacuum at 35^{o}C; then transferred quantitatively to a 10-mL syringe and filtered using a 0.2-µm nylon membrane filter (Gelman Science, Ann Arbor, MI). The rinsate was reduced to one mL with dry nitrogen and transferred to a 2-mL auto sampler vial and analyzed by gas chromatography (GC) (Varian Star 3400CX, Palo Alto, CA). The GC column was a DB-5 (JW Scientific, Folsom, CA), 30 m x 0.53 mm (0.5µm). The injection parameters were as follows: volume 1.0 µL, temperature 200 ^{o}C, helium was the carrier gas at a mean flow rate of 4.5 mL min^{-1}, and make up at 26 mL min^{-1}. The oven was initially held at 160^{o}C for two minutes, ramped to 299^{o}C at 30^{o}C min^{-1} with a final hold time of eight minutes. The thermonic specific detector (TSD) temperature was 300 ^{o}C. Hydrogen and high purity compressed air flow rates to the detector were 4.5 and 185 mL min^{-1}, respectively. Calibration standards at concentrations of 100, 10, and 5 µg mL^{-1} were used for quantitation.

Imazaquin was extracted by utilizing its affinity for polar surfaces (EPA Method 430198-01 modified as described). Ten grams of soil were added to a wide mouth jar with screw on lid with 30 mL of 0.5 N sodium hydroxide and placed on a platform shaker for one hour at 100 rpm. The solution was vacuum-filtered through Whatman 934-AH and # 4 filters covered with three g of celite. The filtrate was adjusted to pH 2.0. A precipitate was allowed to form following the addition and mixing of four g of sodium chloride. The solution was vacuum-filtered using a 934-AH filter. The filtrate was immediately partitioned to a C-18 Sep-Pac Plus cartridge (Waters, Milford, MA) prepared with 10 mL of methanol followed by 10 mL of deionized (DI) water. The imazaquin was removed from the cartridge using 20 mL of methanol and DI water (1:1). The solution pH was adjusted to 2.0 and transferred to a separatory funnel. The pesticide was partitioned twice into 25 mL of dichloromethane. The effluent was filtered through glass wool and sodium sulfate into a boiling flask. The volume was reduced to two mL by rotoevaporation under vacuum at 35°C. Then, the solution was transferred quantitatively to a test tube and reduced to 0.5 mL using a stream of dry nitrogen. The acid form of imazaquin was esterified using a Diazald® (Aldrich Chemical Co, Milwaukee, WI) generator for analysis by GC.

All pesticide residues were quantified by peak area measurements in comparison with 10 $\mu g\ mL^{-1}$ external standards. The limit of detection was 5.0 $\mu g\ kg^{-1}$. Calibration standards were included after approximately every four to eight samples. Extraction efficiencies were determined each time samples were extracted by adding one mL of pesticide standard (100 or 10 $\mu g\ mL^{-1}$) to 10 grams of the check soil and allowing two hours for the solvent to evaporate. Then the recovery was analyzed with the other samples as well as a background sample. The amount of pesticide remaining in each soil increment was reported.

A 5.0 g air-dried sample of vegetative tissues from the increment reporting the greatest residue for each pesticide was analyzed for that pesticide. If the pesticide was not detected, no further vegetative samples were analyzed for that pesticide. If the pesticide were detected, a 5.0 g air-dried sample of vegetative tissue from the increment reporting the next greatest residue was analyzed. Vegetative structures were soaked in DI water prior to analysis to aid in removing soil.

Soil analysis for physical and chemical properties. Percent moisture was determined gravimetrically by placing 15 grams of soil in a drying oven at 105 °C for 24 hours. Particle size analyses were performed using the hydrometer method (Gee and Bauder, 1986). Soil samples were sent to the North Carolina State Department of Agriculture Plant/Soil Laboratory in Raleigh, NC to be analyzed for cation-exchange capacity (CEC), humic matter (HM) content, and pH. HM was determined by the NaOH/DTPA-alcohol extraction method

(Mehlich, 1984a). Soil pH (1:1 soil:water) was measured using a glass electrode pH meter and standards. CEC (milliequivalents/100 grams [meq/100g]) of soil was determined by summing the quantity of base cation determined using the Mehlich-3 extractant and the quantity of exchangeable acidity determined using the Mehlich buffer method (Mehlich, 1984b). OM was determined by the combustion method by placing a known mass of oven-dry soil in a muffle furnace at 500 ^{o}C for 12 hours and subtracting the resulting mineral matter from the oven-dry soil weight (Nelson and Sommers, 1982).

Experimental design and data analysis. Pesticide treatments were arranged in a partly systematic spilt-plot design with separate turf and fallow soil system plots, with seasons assigned to subplots within systems, and with pesticide treatments allocated randomly to replications within each subplot. The experiment was run once in each of two years. Unique subplots were selected in each system for the two seasons in each of two years. The data were log transformed to determine significant differences and subjected to analysis of variance (ANOVA) contrasting system, season, replication, and year effects (SAS institute, 2001). Analysis of variance was conducted to determine whether there were significant differences due to systems, seasons, and years for each pesticide and depth increment from 0-15 cm. Additional analyses were carried out to compare depths for each pesticide in each season and year. There were many more instances when a pesticide was not detected than detected. To accommodate this distribution, one half the detection limit (2.5 parts per billion [ppb]) was used as a surrogate value for nondetects when the pesticide was detected in shallower samples but not in deeper samples. Samples in the 0-2, 2-4, 4-8, and 8-15 cm increments were always analyzed. Deeper samples (15-30, 30-45, 45-60, and 60-91 cm) were analyzed iteratively from shallow to deep until two consecutive nondetects were reported; then deeper samples were not routinely analyzed as there was no reason to believe the pesticide would be present in these soil samples due to the high sand content and low potential to bind pesticides. Simazine was the only pesticide detected in a sample below 15 cm. Simazine was detected in the 15-30 cm increment in the fallow soil system at 47- and 9- $\mu g\ kg^{-1}$ in winter 2001 (replicate 2 only) and 2002 (replicate 1 only), respectively.

Pesticide distribution in the soil normalized to 100 % recovered was used to calculate mobility indices (MI) and reached factor (R_f) indices as described by Weber et al. (1999) using MI = Σ D X F, where D = mean depth in cm and F = normalized fraction of chemical present, and $R_f = MI/MI_{max}$. The MI_{max} was 75.5 cm which is the midpoint of the lowest increment (60-91 cm). The greater the MI is, the greater the mobility of the pesticide. The range of possible MI values was 1.000 to 5.996 for the fallow soil system and 1.000 to 2.364 for the bermudagrass system if the pesticide were detected in at least one increment in one lysimeter for that season; otherwise, a MI and a R_f value could not be determined. The range of R_f values was 0.013 to 0.079 for the fallow soil system and 0.013 to 0.031 for the bermudagrass system where the higher number, the greater the mobility of the chemical.

RESULTS AND DISCUSSION

Soil properties. The native soil is classified as a Candor sand and was experimentally determined to have a mean texture of 84% sand, 11% silt, and 5% clay (loamy sand); the high sand and low clay native soil provides for a highly leachable soil for both systems (Figure 1, Table 2). The organic carbon content in the 0-4 cm depth is 2% for fallow soil and 6 % for bermudagrass. The greater the amount of OM is, the greater the potential to bind pesticides. The OM is distributed more uniformly in the fallow soil system in the plow layer

(0-30 cm), but in the turf system, the thatch layer at the surface contains a much greater amount of OM (Figure 1, Table 2). Below the thatch layer, the OM content of the two systems is comparable and decreases with depth especially below the plow layer. Likewise, the CEC is highest in the turf system thatch layer (Figure 1, Table 2). Below the thatch layer, CEC decreases with depth similarly in both systems as does OM content. The pH in the fallow soil system has a uniform distribution with depth; whereas in the turf system, pH decreases with depth which ranges from 6.5 to 5.5. Normally, pH in the fallow soil system is expected to decrease with depth in NC especially below the plow layer, but the low clay content of the Candor sand does not result in a large amount of reserve acidity.

The differences in pH between the two systems occur because lime can not be mechanically mixed in the turf system as it can be in the fallow soil system which was tilled six weeks prior to the first treatment (Figure 1). Except for pH, the differences in the soil properties between the two systems are attributable to the thatch layer in the turf system. Having more OM will influence water infiltration and retention of water and pesticides. The thatch layer moisture content will influence infiltration. Extremely wet and extremely dry thatch layers slow water infiltration compared to fallow soil and encourage runoff. The soil moisture profile shows that a majority of the water is retained in the thatch layer and not available for leaching. In summer, as water in the root zone is consumed by the turf, water from deeper in the profile may move upward by capillary action carrying pesticides with it (Weber et al., 1999).

The mean percent moisture by weight for each depth increment of all lysimeters has a similar distribution as the organic carbon profile in the two systems (Table 3). In both summer and winter, the percent moisture by weight has a uniform distribution in the fallow soil system. In the turf system, the moisture content is 200% higher in the thatch layer than in the soil below. Thus, a larger fraction of water is retained in the thatch layer and not available for leaching. In addition, increasing soil moisture content is known to increase the degree of mineralization of pesticides under aerobic conditions by stimulating microbial degradation (Graebing et al., 2003). Since pesticides in solution are more available for microbial degradation than when sorbed onto soil, soil moisture provides for greater interactivity of microorganisms (Graebing et al., 2003). Maturity of the turf can make a significant difference in the amount of leaching that occurs. A well established mature turf with more OM will reduce leaching of pesticides compared with a turf with lower OM content.

Climatic conditions. Lysimeters in summer, 2002 and winter, 2002 received more total moisture than lysimeters in summer, 2001 and winter, 2001. Precipitation totals were 31 and 29 cm for summer and winter, 2001, respectively, and 48 and 59 cm for summer and winter, 2002, respectively. However, 19 cm and 32 cm of irrigation were applied in summer, 2001 and 2002, respectively; whereas only one cm of irrigation was applied in winter of each year (immediately after treatments were applied). More irrigation was applied during the wetter summer (2002) because a drought limited the amount of available irrigation water during summer, 2001. The resulting total water inputs were 50, 30, 80, and 60 cm for summer and winter, 2001 and summer and winter, 2002, respectively.

Occurrence of pesticides in soil. In general, pesticides tended to stay in the thatch layer (0-4 cm) of the turf system and distribute more uniformly in the fallow system (0-15 cm) (Table 4). Generally, more movement and higher concentrations were reported in winter. There was never more movement in turf than fallow soil for any treatment applied to either dormant or actively-growing turf except for a minor amount (9.0 μg kg^{-1}) of prodiamine in summer 2001. In this study, there was no attempt to reduce losses due to volatilization or mineralization, nor were these processes measured. However, pesticides in this study are not considered to be very volatile.

Fipronil residues in the turf thatch layer were significantly greater than in the soil below in both summer and winter (Table 4). In the fallow soil system, fipronil distributed uniformly in summer, and concentrations decreased with depth in winter. Concentrations between winter and summer and between systems were not significantly different. However, fipronil was detected down to the 8-15 cm increment in the fallow soil system in winter and was detected only in the 0-2 cm increment in the turf system.

Imazaquin residues in the turf thatch were significantly greater than in the soil below in winter, and imazaquin was not detected in any turf system samples in summer (Table 4). However, the lysimeter total imazaquin residue concentration in winter for the dormant turf system (358.7 μg kg^{-1}) was significantly greater than both the fallow soil system in winter (9.7 μg kg^{-1}) and the actively-growing turf system in summer (not detected in any samples). However, the lysimeter total imazaquin residue concentration in winter for the dormant turf system (358.7 μg kg^{-1}) was not significantly different from the fallow soil system in summer (72.2 μg kg^{-1}). Imazaquin is root absorbed and was likely not detected in summer in the turf system due to plant metabolism and microbial degradation. In winter, bermudagrass is dormant and does not absorb water or pesticides. Perhaps imazaquin concentrations were greater in the turf system in winter because the rate of microbial degradation was greater in the fallow soil system. The fallow soil system had less free carbon available for microorganisms to use as a substrate but received the same fertilization and irrigation. In this environment, microorganisms could use pesticides as a carbon source more readily than microorganisms in the turf system which has an abundant amount of carbon that is replenished annually, and temperatures may have been higher in the fallow soil system which encourages great microbial growth. Gardner and Branham (2001) concluded that pesticides inside living plant roots are not available for microbial degradation which may also explain why imazaquin concentrations were greater in dormant turf. Volatilization rates for pesticide in fallow soil also may be greater than those for bermudagrass.

Pronamide was detected at higher concentration in the dormant turf system in the 0-2 cm increment (102.2 $\mu g\ kg^{-1}$) than in the lower increment (0.8 $\mu g\ kg^{-1}$) (Table 4). In the fallow soil system in winter, pronamide was detected at similar concentrations down to the 8-15 cm increment. In summer, pronamide was detected at similar concentrations in only the 0-2 and 2-4 cm increments in both the turf and fallow soil systems. These data show that lysimeter total concentrations were similar between systems and seasons, but more downward movement occurred in the fallow soil in winter. Lysimeter total concentrations tended to be greater in winter than summer, but the differences were not significant at the 0.05 % level.

Simazine tended to stay in the thatch layer of the active turf system; however, simazine tended to distribute more or less uniformly in the dormant turf system in winter and in the fallow soil system in summer and winter (Table 4). In summer, simazine did not move beyond the thatch in the turf system but moved to the 8-15 cm increment in the fallow soil system. In winter, simazine distributed uniformly in the fallow soil system, but concentrations decreased with depth in the turf system in winter. Simazine is more mobile and degrades at slower rates in high pHs compared to low pHs (Ahrens, 1994). It was the only compound detected in the 15-30 cm increment which occurred in the fallow soil system in winter, 2001 and 2002. Lysimeter total concentrations were greater in winter than summer for both systems.

Prodiamine was detected in the 0-2 cm increment at concentrations that were significantly greater than the concentrations below in both systems, and concentrations decreased with depth (Table 4). Concentrations were similar between the two systems and between seasons indicating that prodiamine movement was not influenced by soil cover or season.

Mobility. The R_f values for each pesticide tended to be greater in winter than summer although there were no statistically significant different R_f values between system and season for each compound (Table 4). Based solely on pH, imazaquin and simazine were expected to be more mobile in the turf thatch which had the highest pH. Under these conditions, imazaquin is in its anionic form, and simazine is in its molecular form. It is probable that these compounds were either absorbed by the turf or bound by the OM and did not experience increased mobility in the thatch layer. Using its K_{oc} and solubility, imazaquin was predicted to be the most mobile compound. However, imazaquin has a short half life (60 days) and was detected infrequently and only in the upper increments following 140 days of summer or winter application. Thus, imazaquin reported some of the lowest R_f values. However, when soil samples were collected with a golf cup cutter three days after treatment (DAT) in summer and winter and divided in 0-2, 2-4, 4-8 cm increments, imazaquin was the only pesticide to move to the 4-8 cm increment with the addition of only one cm of irrigation, and the movement occurred in both summer and winter (data not shown). The greatest R_f values were reported in winter in fallow soil for pronamide (0.077) and simazine (0.064).

Using the maximum R_f value as the sole predictor, the ranking of mobility of the pesticides from least to most mobile is prodiamine < imazaquin < fipronil < simazine < pronamide. Using mean R_f values, the ranking of least to most mobile is imazaquin < prodiamine < fipronil < pronamide < simazine. Using Pesticide Leaching Potential (PLP) values, the ranking of least to most mobile is fipronil < prodiamine < imazaquin < pronamide < simazine. In all rankings, pronamide and simazine are among the most mobile (North Carolina Agricultural Chemicals Manual, 2004).

Occurrence of pesticides in turf vegetative structure. Prodiamine was the only compound detected in turf tissues 140 DAT (Data not shown). Prodiamine was detected in two root samples (1.1 and 0.96 μg/g) from the 0-2 increment from lysimeters treated in winter 2001 which reported the greatest prodiamine soil concentrations. Prodiamine binds strongly to soil and proteinaceous compounds. Great care was taken to remove soil from the crown of the bermudagrass; yet, not all soil could be removed without damaging the integrity of the sample. In winter, the bermudagrass is dormant and not absorbing prodiamine. For these reasons and the fact that prodiamine binds tightly to proteins, whether prodiamine was sorbed to the outside of the vegetative structures or inside could not be determined. Prodiamine was likely the only compound detected in/on vegetative structures due to its affinity for proteins and long half life.

Conclusions. More downward movement and greater pesticide concentrations typically were reported in winter than summer for both systems. There tended to be greater downward movement in the fallow soil system than the bermudagrass system in summer and winter except for a minor amount of prodiamine. Therefore, a bermudagrass system should reduce the downward movement of some pesticides applied in times of rapid growth. In times of winter dormancy, the bermudagrass system may allow greater residue concentrations to remain in the thatch layer. Therefore, if simazine were applied in September when the turf is actively-growing rather than November, less downward movement would be expected, and weed control would remain the same. This is one example of a management plan that minimizes downward pesticide movement. The turf community has the responsibility to ensure that when a pesticide is deliberately introduced into the environment, the estimated risks to groundwater are not unreasonable, but they are balanced with the benefits from their use.

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Table 1. Pesticide physicochemical and biological properties (20-25 °C) and rates applied to fallow and bermudagrass lysimeters.

Property	Fipronil	Imazaquin	Pronamide	Simazine	Prodiamine
Chemical family†	Phenylpyrazol	Imidazolinone	Amide	Triazine	Dinitroaniline
Application rate (kg ai ha^{-1}) †	0.014	0.56	1.7	2.2	0.56
Molecular weight (g mol^{-1}) ‡	437	311	256†	202	350
Vapor pressure (mm Hg) †	2.8×10^{-9} #	<2 $\times 10^{-8}$ (45 ^{0}C)	8.5×10^{-5}	2.2×10^{-8}	2.5×10^{-8}
Water solubility (K_s) (mg L^{-1}) ‡	1.9 (pH 5)	60 – 120	15 †	6.2 @	0.013
Ionizability (pKa) ‡	6 weak acid and 2 weak base	3.8 weak acid	None	1.62 weak base	2.5 @ weak base
K_d (mL g^{-1}) @	4 -12	0.2	0.04 – 72.2	0.37 – 4.66	19.5 s 398 sl 120 l
K_{oc} (mL g^{-1}) ‡	427 – 1248 @	20	800 †	103 – 277@	13,000
DT_{50} (days) ‡	28	60	30 – 180@	27 – 102@	69 @
PLP_i ††	9 (very low)	44 (low)	48 (low)	62 (medium)	23 (very low)

† Ahrens, 1994.

‡ USDA-ARS Pesticide Properties Database, 1995. http://www.arsusda.gov/acsl/services/ppdb/listall.html.

@ Tomlin, 2000.

CEPA, 2001 http://www.pw.ucr.edu/textfiles/fipronil.pdf.

†† Pesticide Leaching Potential (PLP). North Carolina Agricultural Chemicals Manual, 2004.

Table 2. Particle-size distribution of sand, silt, and clay for each depth from treated field soil column lysimeters in a Candor sand (sandy, siliceous, thermic, Arenic Paleudult). †

Soil Depth (cm)	Mean HM ‡ (%)	Organic Matter @ (%)	Organic Matter £ (%)	Sand # (%)	Silt # (%)	Clay # (%)	Mean CEC ‡ (meq/100 g soil)	Mean pH ‡	Bulk Density †† (g/cm^3)
Fallow System									
0-2	0.72	2.04	- -	85.4	10.5	4.1	2.77	5.7	1.45
2-4	0.68	1.89	- -	83.7	11.9	4.4	2.75	5.5	1.42
4-8	0.72	1.94	- -	84.3	11.5	4.1	2.67	5.3	1.25
8-15	0.70	1.89	- -	82.2	13.6	4.2	2.77	5.5	1.35
15-30	0.61	1.68	- -	84.9	10.8	4.3	2.65	5.7	1.49
30-45	0.15	1.21	- -	82.9	10.8	6.3	1.80	5.6	1.60
45-60	0.07	1.20	- -	82.5	11.0	6.5	1.67	5.5	1.52
60-91	0.03	0.99	- -	81.8	11.7	6.6	1.62	5.8	1.36
Turf System									
0-2	0.51	6.13	2.9	87.7	9.4	2.9	8.15	6.5	1.00
2-4	0.64	5.87	1.4	80.6	16.4	3.0	6.65	6.5	1.12
4-8	0.79	2.08	1.8	85.3	11.4	3.2	4.20	6.1	1.17
8-15	0.71	1.98	1.3	88.4	8.5	3.0	3.75	6.1	1.28
15-30	0.57	1.84	0.7	87.1	8.6	4.4	2.82	5.7	1.58
30-45	0.35	1.04	0.7	85.7	8.7	5.6	2.55	5.6	1.59
45-60	0.10	1.13	0.7	83.8	9.5	6.8	1.92	5.5	1.54
60-91	0.10	0.97	- -	83.2	9.6	7.2	1.80	5.5	1.42

Table 2. (continued).

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† Soil Survey Geologic, Montgomery County.

‡ Mean of four samples, North Carolina State Department of Agriculture, Raleigh, NC 27606.

@ Mean of six samples determined using a muffle furnace set at 500 ^{o}C for 24 hours.

£ Mean of two samples, A&L Analytical laboratories, Inc., Memphis TN, 38105.

Mean of two samples determined using the hydrometer method.

†† Mean of 47 lysimeters calculated from the soil dry weight of each increment and lysimeter dimensions.

- - No data.

Table 3. Mean percent moisture by weight (dry weight basis) of each depth from treated field soil column lysimeters in a Candor sand as influenced by interaction effects of system and season in summer and winter of 2001 and 2002.

Depth	Summer		Winter	
	Fallow Soil	Active Turf	Fallow Soil	Dormant Turf
(cm)	(% moisture by dry wt)			
0 - 2	10. 76 a [†]	25. 94 a	8. 65 d	32. 45 a
2 – 4	9. 57 bc	26. 18 a	9. 15 c	18. 47 b
4 – 8	10. 00 ab	11. 00 b	9. 92 b	10. 08 c
8 – 15	10. 67 ab	8. 47 b	10. 28 ab	7. 97 c
15 – 30	10. 12 ab	9. 41 b	10. 35 a	9. 21 c
30 – 45	8. 76 cd	8. 48 b	8. 92 cd	8. 43 c
45 – 60	8. 52 cd	8. 67 b	8. 79 cd	8. 75 c
60 – 91	8. 02 d	8. 44 b	8. 06 e	8. 06 c
Mean	9. 55	13. 22	9. 26	13. 18
LSD	1. 16	2. 66	0. 40	4. 91

† Means within columns followed by the same lower case letter are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (SAS, 1998).

LSD Least significant difference (α = 0.05).

wt Weight.

Table 4. Mean pesticide residue concentrations and computed mobility (R_f) values from treated field soil column lysimeters in a Candor sand as influenced by interaction effects of system and season at 140 days after treatment in summer and winter of 2001 and 2002.

Fipronil	Summer		Winter	
Depth (cm)	Fallow Soil (µg kg^{-1})	Active Turf (µg kg^{-1})	Fallow Soil (µg kg^{-1})	Dormant Turf (µg kg^{-1})
0 – 2	18. 7 † a ‡	43. 5 a	29. 5 a	12. 8 a
2 – 4	6. 0 a	77. 5 a	14. 7 ab	< 5 b
4 – 8	3. 0 a	2. 1 b	7. 2 bc	< 5 b
8 – 15	< 5 a	< 5 b	1. 5 c	< 5 b
Depth LSD	NS $p < 0.57$	58. 8	17. 3	11. 2
Surface Soil (0-4 cm)#	24. 7 A @	121. 0 A	44. 2 A	12. 8 A
Subsoil (4-15 cm)	3. 0 A	2. 1 A	8. 7 A	< 5 A
Lysimeter Total	27. 7 A	123. 0 A	53. 0 A	12. 8 A
Mobility Rf ††	0. 022 A	0. 030 A	0. 032 A	0. 013 A

Imazaquin	Summer		Winter	
Depth (cm)	Fallow Soil (µg kg^{-1})	Active Turf (µg kg^{-1})	Fallow Soil (µg kg^{-1})	Dormant Turf (µg kg^{-1})
0 – 2	50. 5 a	< 5 a	9. 7 a	358. 7 a
2 – 4	12. 2 ab	< 5 a	< 5 a	< 5 b
4 – 8	9. 5 ab	< 5 a	< 5 a	< 5 b
8 – 15	< 5 b	< 5 a	< 5 a	< 5 b
Depth LSD	NS $p < 0.102$	NA	NS $p < 0.455$	414. 6
Surface Soil (0-4 cm)#	62. 7 AB	< 5 B	9. 7 B	358. 7 A
Subsoil (4-15 cm)	9. 5 A	< 5 A	< 5 A	< 5 A
Lysimeter Total	72. 2 AB	< 5 B	9. 7 B	358. 7 A
Mobility Rf ††	0. 021 A	NA	0. 013 A	0. 013 A

Table 4. (continued).

Pronamide	Summer		Winter	
Depth (cm)	Fallow Soil ($\mu g\ kg^{-1}$)	Active Turf ($\mu g\ kg^{-1}$)	Fallow Soil ($\mu g\ kg^{-1}$)	Dormant Turf ($\mu g\ kg^{-1}$)
0 – 2	47. 7 a	58. 0 a	96. 0 a	102. 2 a
2 – 4	10. 0 a	67. 7 a	106. 7 a	0. 8 b
4 – 8	< 5 a	< 5 a	111. 2 a	< 5 b
8 – 15	< 5 a	< 5 a	109. 0 a	< 5 b
Depth LSD	NS $p < 0.455$	NS $p < 0.455$	NS $p < 0.662$	83. 0
Surface Soil (0-4 cm)[#]	57. 7 A	128. 7 A	202. 7 A	103. 1 A
Subsoil (4-15 cm)	< 5 A	< 5 A	220. 2 A	< 5 A
Lysimeter Total	57. 7 A	125. 7 A	423. 0 A	1. 332 A
Mobility Rf [††]	0. 018 A	0. 027 A	0. 077 A	103. 1 A

Simazine	Summer		Winter	
Depth (cm)	Fallow Soil ($\mu g\ kg^{-1}$)	Active Turf ($\mu g\ kg^{-1}$)	Fallow Soil ($\mu g\ kg^{-1}$)	Dormant Turf ($\mu g\ kg^{-1}$)
0 – 2	11. 5 ab	16. 5 a	150. 2 a	644. 7 a
2 – 4	48. 2 a	1. 7 a	77. 0 a	203. 2 ab
4 – 8	5. 7 ab	< 5 a	171. 0 a	50. 5 bc
8 - 15	1. 6 ab	< 5 a	45. 0 a	15. 7 c
15 – 30	< 5 b	< 5 a	18. 7 a	< 5 c
Depth LSD	71. 2	NS $p < 0.125$	NS $p < 0.488$	258. 7
Surface Soil (0-4 cm)[#]	59. 7 A	18. 2 A	227. 2 A	848. 0 A
Subsoil (4-30 cm)	7. 3 A	< 5 A	230. 0 A	66. 2 A
Lysimeter Total	67. 1 B	18. 2 B	457. 2 A	914. 2 A
Mobility Rf [††]	0. 045 A	0. 019 A	0. 064 A	0. 023 A

Table 4. (continued).

Prodiamine Depth (cm)	Summer Fallow Soil (µg kg^{-1})	Summer Active Turf (µg kg^{-1})	Winter Fallow Soil (µg kg^{-1})	Winter Dormant Turf (µg kg^{-1})
0 – 2	721. 5 a	431. 2 a	849. 7 a	1087. 5 a
2 – 4	44. 2 b	55. 2 b	101. 2 b	89. 7 b
4 – 8	8. 0 bc	2. 3 c	13. 5 c	7. 0 c
8 – 15	< 5 c	4. 2 c	< 5 c	< 5 c
Depth LSD	606. 8	266. 7	360. 2	221. 9
Surface Soil (0-4 cm)#	765. 7 A	486. 5 A	951. 0 A	1177. 2 A
Subsoil (4-15 cm)	8. 0 A	6. 5 A	13. 5 A	7. 0 A
Lysimeter Total	773. 7 A	493. 0 A	964. 5 A	1184. 2 A
Mobility Rf ††	0. 017 A	0. 019 A	0. 017 A	0. 016 A

† Means calculated for two lysimeters in 2001 and 2002 using half the detection limit (5.0 µg kg^{-1}) for nondetects.

‡ Means within columns followed by the same lower case letter are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (LSD) when using log transformed data.

@ Means within rows followed by the same upper case letter are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (LSD) when using log transformed data.

Surface soil is 0-4 cm which is the thickness of the thatch layer in the turf system.

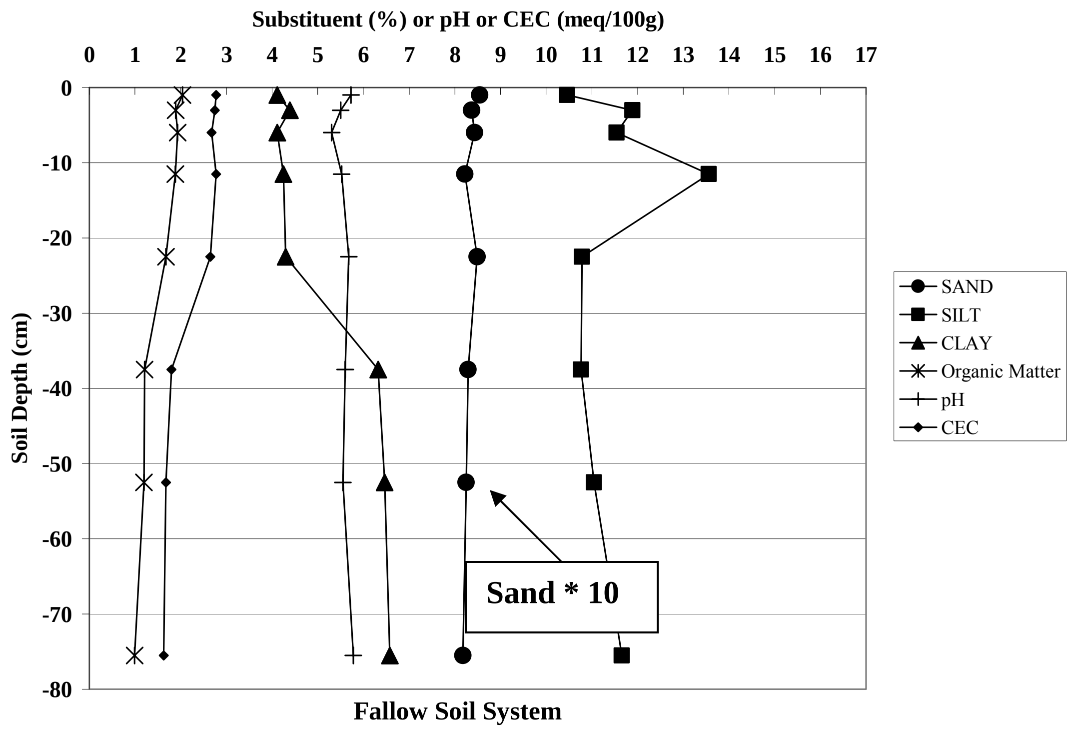
†† Reached factor (Rf) (unitless value).

LSD Least significant difference.

NA Not available.

ND Not detected (limit of detection = 5.0 µg kg^{-1}).

NS Not significant. p value for the log transformed data shown.



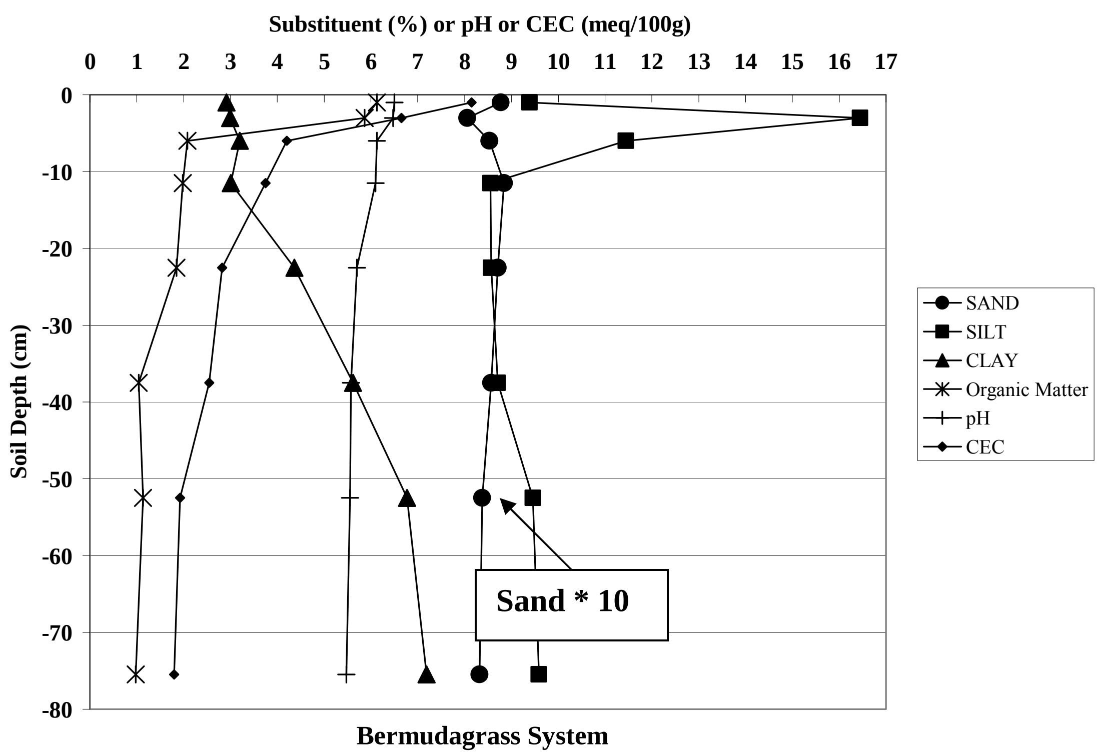


Figure 1. Percent sand, silt, clay, and organic matter (OM) or pH or Cation Exchange Capacity (CEC) (meq/100g) for fallow and bermudagrass system soil profiles.

CHAPTER 2

Downward Mobility of ^{14}C-Labeled Simazine in a Bermudagrass System Compared with a Fallow Soil System

Abstract. ^{14}C-labeled simazine was applied to dormant bermudagrass (*Cynodon dactylon*) and fallow soil in lysimeters stored in a cold growth chamber (5 ^{o}C) and to actively-growing bermudagrass and fallow soil in lysimeters kept in a greenhouse (25 ^{o}C). Following each clipping collection, lysimeters were irrigated with five cm of water every three to four days, and leachate was collected four hours later. After 25 days, lysimeters were divided into the following depth increments: 0-2, 2-4, 4-6, 6-8, 8-10, 10-15, 15-20, 20-25, 25-30 cm. Due to evapotranspiration, actively-growing bermudagrass and warm fallow soil lysimeters yielded significantly less leachate than dormant bermudagrass and cold fallow soil lysimeters indicating less moisture was available for downward movement during summer. The amount of simazine translocated in actively-growing bermudagrass clippings increased from 14,377 disintegrations per minute (DPM) to a maximum of 62,003 DPM and then decreased to 21,314 DPM over a 21 day period. After the addition of 31 cm of irrigation, the greatest quantities of simazine were detected in the 0-2 cm increment of all treatments and quantities decreased with depth. Although the greatest quantities of simazine in leachate were reported in dormant bermudagrass, the reached factor (R_f) calculated for simazine distribution in the soil profile was greatest for cold fallow soil (0.20), followed by dormant bermudagrass (0.17), followed by warm fallow soil (0.16) followed by actively-growing bermudagrass (0.14). Therefore, simazine is least mobile in bermudagrass in during periods of high evapotranspiration rates as in summer.

List of abbreviations: ANOVA = analysis of variance, D = depth, DAT = days after treatment, DPM = disintegrations per minute, F = fraction of pesticide present, LSA = liquid scintillation analyzer, MI = mobility index, PAR = photosynthetically active radiation.

Key words: Channeling; leachate; actively-growing; dormant; thatch*; Cynodon dactylon*

INTRODUCTION

Pesticide regulations based on data derived from pesticide mobility in row crop systems may not be appropriate for turf systems. In turf, pesticides are rarely applied to bare soil because the turf canopy intercepts a large portion of the pesticide, and less pesticide reaches the soil in actively-growing turf systems. Some pesticides are absorbed by actively-growing turf species and metabolized into benign organic chemicals; however, in winter when bermudagrass (*Cynodon dactylon* L.) is dormant and not utilizing all of the available water and when microbial activity is reduced, there may be downward pesticide movement. In addition, the turf canopy is thinner in winter, and more pesticide will contact the thatch layer. Thus, timing of application can influence the fate of pesticides applied to turf.

In both systems, organic matter (OM) can bind pesticides (Gardner and Branham, 2001; Weber and Keller, 1994). Although OM accounts for only a small portion of soil, it has a large effect on both its biological and chemical properties. As a bermudagrass turf system ages, the thatch layer at the surface of the bermudagrass system thickens, and the lower portion of the thatch layer and soil below increases in OM content. In addition, the thatch layer in a turf system contains diverse populations of microorganisms which can degrade pesticides and can utilize root exudates, regular applications of fertilizer and irrigation for growth and metabolism

(Gardner and Branham, 2001). Whereas in a fallow row crop system, OM is distributed uniformly in the plow layer (15-30 cm).

By understanding the fate and behavior of commonly used turfgrass products, management plans, that may increase environmental safety and help preserve their use, can be implemented. The Food Quality Protection Act (FQPA) of 1996 will limit or restrict certain turfgrass pesticide use (Public Law 104-107-Aug. 3, 1996). The FQPA requires currently registered pesticides to be reevaluated every fifteen years. A thorough understanding of pesticide mobility in turf is needed because more pesticides will be closely scrutinized under this legislation. Sorption and degradation are the main processes that affect the fate of pesticides in soil; these processes help determine the pesticide's persistence and distribution in the environment.

Simazine (6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine) costs approximately \$5 per acre whereas alternatives cost as much as \$100 per acre, making it highly desirable if environmentally safe. Because lawn care professionals, athletic field managers, and golf course superintendents commonly use simazine and other triazine herbicides, the financial impact from the loss of these products would be substantial. Simazine is a preemergence herbicide and is absorbed via the roots. Simazine is a weak base with a pK_a of 1.62, a moderate affinity for adsorption to OM (Koc 10-277 mL/g), a moderate water solubility of 6.2 mg/L at pH 7.0 and 20^oC, a low vapor pressure of 2.2×10^{-8} mm Hg at 20^oC, and a moderate to long disappearance time (DT_{50}) of 27-102 days (Ahrens 1994; Tomlin 2000). Because simazine ionizes with changes in pH levels typically found in soil, the mobility of simazine is influenced by soil pH. The thatch layer of the bermudagrass system has a higher pH than the underlying turf in NC where lime is routinely applied. Since simazine is a weak base, it is more mobile at higher pHs when it is in its molecular form. Sorption of s-triazines to OM in governed by H bonding and proton transfer between s-triazines and acid groups of humic substances especially in a hydrophobic environment where H bonds with water molecules are not dominant (Martin-Neto et al., 1994). In high pH soil, slower microbial degradation predominates; however, in low pH soil, degradation via non-microbial hydrolysis occurs at a faster rate (Ahrens, 1994). Chemical hydrolysis at the 2-position of the s-triazine ring yields 2-hydroxy-s-triazine (Armstrong and Chesters, 1968). Because simazine is moderately water solubility and has low volatility and moderate to long soil half life (DT_{50}) of 27-102 days, simazine may leach to groundwater (Ahrens, 1994; Tomlin, 2000). The major microbial transformation of s-triazine herbicides in soil is N-dealkylation (Scribner et al., 1992). Stearman et al. (2003) demonstrated that wetland cells with plants removed 77.1% of the simazine applied, and cells without plants removed 64.3%. Therefore, actively-growing bermudagrass may reduce simazine leaching to groundwater.

This study was performed to determine if the presence of dormant or actively-growing bermudagrass influences the downward movement of simazine compared with movement in fallow soil and to determine the influence of temperature on simazine mobility.

MATERIALS AND METHODS

Lysimeter installation. In May 2001, a 580 m^2 area of a larger block of 'Tifway' hybrid bermudagrass established five years prior at the Sandhills Research Station, Jackson Springs, NC where the native soil is a Candor sand (sandy, siliceous, thermic, Arenic Paleudult) was sprayed with glyphosate (N-[phosphonomethyl]glycine). The properties of the Candor sand are shown in Table 1. After two weeks, the dead sod was removed with a sod cutter, and the area tilled.

Then, the area was fumigated with methyl bromide (bromomethane) 89.5% and chloropicrin (trichloronitromethane) 10.5% applied at 448 kg ha^{-1}. This area was kept bare for three years with glyphosate and is referred to as fallow soil. On February 19, 2004, seven soil column lysimeters made from 18 gauge cold-rolled steel (15.2 cm in diameter x 30 cm in length) were covered with a metal plate and driven with a sledge hammer into both bermudagrass and fallow soil until two cm of the column remained above the soil surface. The lysimeters were excavated. Three bermudagrass and three fallow soil lysimeters were placed in both a greenhouse at North Carolina State University (NCSU) with mean temperature of 23 ^{o}C and a growth chamber in the Southeastern Plant Environment Laboratories (Phytotron) at NCSU at a constant temperature of 5 ^{o}C to keep the dormant bermudagrass and microorganisms dormant. All lysimeters were fumigated on April 9, 2004 with bifenthrin (4.0%) (Attain TR [Whitmire Micro-Gen Research Laboratories, St. Louis, MO]) to control small insects as a requirement to enter the Phytotron.

Chemical preparation and application. On April 6, 2004, when the bermudagrass lysimeters in the greenhouse were actively-growing and no longer dormant, all lysimeters were saturated by placing them in 19-L containers which were then filled with water to within one cm of the rim of the lysimeter. After 18 hours, the water in the containers was vacuumed out, and the lysimeters were removed and weighed. Each lysimeter was placed in its own 3.8-L container to collected leachate. Free water was allowed to drain for 24 hours leaving the soil at field capacity, and the lysimeters were again weighed. On April 8, 2004, ^{14}C-ring-labled simazine plus Princep 4L supplied by Syngenta Crop Protection, Greensboro, NC were applied in 2.0 mL of water by pipette in a cross-hatch pattern to the surface of each lysimeter. The quantity of ^{14}C-labeled simazine applied to each lysimeter was 4.46 µCi (0.165 TBq g^{-1}) (specific activity =46.3 µCi mg^{-1}, 98.7%). Simazine applied was equivalent to 2.24 kg ai ha^{-1} using 1105 L ha^{-1} spray volume.

Immediately following application, one cm of water of water was applied with a hand held pump sprayer. After four hours, leachate from each lysimeter was transferred with a vacuum pump to a 950-mL glass jar with screw lid. Clippings were collected every three to four days. Following clipping collection, five cm of water was sprayed on each lysimeter over a 40 minute period, and leachate was collected from each lysimeter four hours later. Cold-climate fallow and dormant bermudagrass lysimeters were irrigated with cold water stored in the growth chamber (constant 4^{o}C).

Lysimeter processing. On May 3, 2004, 25 days after treatment (DAT) and the addition of 31 cm of irrigation (25% of mean annual rainfall in NC), lysimeters were cut lengthwise with a reciprocating saw, spread apart, and divided by depth into 0-2, 2-4, 4-6, 6-8, 8-10, 10-15, 15-20, 20-25, and 25-30 cm increments starting at the bottom of the lysimeter. The thatch layer was approximately 0-4 cm thick and was separated into the 0-2 and 2-4 cm increments with a hacksaw. Bermudagrass roots were stored with their respective soil increment. Verdure was collected and stored separately. All soil increments were bagged in polyethylene bags, weighed, and stored at -18^{o}C.

^{14}C determination. For total ^{14}C recovered, four field moist 1-g samples from each soil section were combusted in a biological oxidizer (Model OX-300, R.J. Harvey Instrument Corp., Hillside, NJ) for four minutes at 880 ^{o}C until the coefficient of variation was <20% among subsamples. The $^{14}CO_2$ evolved was trapped in 15 mL of Harvey ^{14}C Scintillation Cocktail and subsequently quantified in a liquid scintillation analyzer (LSA) (Packard Model 2000 Ca, Packard Instrument Co., Dowers Grove, IL) for 20 minutes in disintegrations per minute (DPM) mode. Biological oxidizer efficiency was >94%. ^{14}C-simazine application solution and efficiency of the analytical procedures were verified by using the same rate of the same ^{14}C-simazine applied to 2.0 cm of field moist Candor sand inside duplicate polyethylene bags inside a metal cylinder (15.2 cm in diameter x 15.2 cm in length) on the same day lysimeters were treated. After this application, the bag was sealed and stored undisturbed at -18 ^{o}C. The amount of ^{14}C for each soil increment was converted to percent of applied ^{14}C. Following soil analysis, soil and roots from bermudagrass lysimeters was set out on aluminum pans for two days to air dry at room temperature to facilitate removing soil from roots. Increments were sieved through a 1.4 mm sieve, and roots were collected. Soil was washed from the roots using a squirt bottle with deionized water. The roots were air dried for 24 hours and weighed. Four 0.1 g root subsamples from each increment were combusted for four minutes in the biological oxidizer and subsequently quantified using the LSA for 20 minutes in DPM mode. The amount of ^{14}C in a 1.0 mL subsample from each leachate collection also was determined using the LSA for 40 minutes in DPM mode. All ^{14}C wastes were disposed of by NCSU Life Safety Services following proper procedures (Manual for Chemical Waste Management, 1991).

Experimental design and data analysis. Three replicates were assigned to treatments at random, and the experiment was conducted once. Simazine concentrations in roots by depth, verdures, clippings by date, and leachates by date were analyzed separately. Analysis of variance (ANOVA) was conducted on leachate volumes and simazine DPM in leachate to compare treatments. Based on the pattern of the plot of the DPM standard deviations, simazine DPMs in leachates were square-root transformed to determine significant differences. Similarly, simazine DPMs in roots were log (base 10) transformed and subjected to ANOVA with depth as a subfactor to test for treatment and depth main effects and interactions. For the actively-growing bermudagrass treatment, simazine DPM in clippings by date were log transformed and subjected to repeated measures ANOVA to determine significant differences in simazine DPM in clippings over time. In addition, analyses were performed on normalized percent of applied simazine calculated by summing the total simazine in the roots and soil of each increment (clipping DPM were added to the verdure DPM, and leachate DPM was added to the lowest soil increment DPM); then the total simazine DPM increment was divided by the lysimeter grand total simazine DPM applied. ANOVA was conducted to determine whether there were significant differences due to treatments and depth increment (SAS institute, 2001). Where appropriate means separation was carried out using Fisher's Protected LSD test at a significance level of 0.05.

Pesticide distribution in the soil normalized to 100 % applied was used to calculate mobility indices (MI) as described by Weber et al. (1999) using $MI = \Sigma D X F$, where D = mean depth in cm and F = normalized fraction of chemical present and the larger the MI, the greater the mobility of the chemical where MI_{max}=27.5 cm. Reached factor chromatic distribution of chemicals was calculated by dividing the $MI_{observed}$ by MI_{max}; i.e., $R_f = MI_{obs}/MI_{max}$.

RESULTS AND DISCUSSION

Leachate volume. To obtain five cm of irrigation, 927 mL was added to each lysimeter. Because the experiment started at soil field capacity, more water was added to each lysimeter than the soil could store. Free water leached from the bottom of lysimeters into a larger vessel containing the lysimeter. Dormant bermudagrass and cold-climate fallow (cold-fallow) lysimeters leached significantly greater volumes of water than the actively-growing bermudagrass and warm-climate fallow (warm-fallow) lysimeters on all but one sampling date (April 15, 2004) (Figure 1). On April 15, 2004, the absence of significant difference can be attributed to climate. From April 11 through April 14, cloudy weather reduced the photosynthetically active radiation (PAR) for several days prior to this collection (Figure 2). Thus, humidity was higher, and temperature was lower than normal. The cloudy weather reduced the rate of evapotranspiration in the greenhouse; therefore, all lysimeters yielded similar amount of leachate. As illustrated on Figure 2, the reduction of water loss during lower solar radiation demonstrates the influence of evaporation on the proportion of water available to move pesticides downward during summer compared with winter. The temperature in the greenhouse ranged from 11.2 to 43.9 ^{o}C with a mean of 24.7 ^{o}C during the study. The amount of PAR in the growth chamber was a constant 320 µmol s^{-1} m^{-2} (12:12 hr, light:dark). The growth chamber was maintained at a constant temperature of (5 ^{o}C).

The leachate volumes from the lysimeters in the 5 ^{o}C growth chamber (dormant bermudagrass and cold-fallow) were greater and more uniform, and than those for the lysimeters in the greenhouse (actively-growing bermudagrass and warm-fallow). As expected, the actively-growing bermudagrass was consuming water for growth and metabolism (evapotranspiration). As a result of the water removal, soil in these lysimeters could store more water resulting in less leachate. Similarly, the warm-fallow lysimeters lost water due to evaporation and retained significantly more water than the dormant bermudagrass and fallow-cold lysimeters on all but one sampling date (April 15, 2004). The mean leachate volumes of the actively-growing and warm-fallow lysimeters were significantly different from each other on two sampling dates (April 12 and 22); but neither was consistently lower than the other.

Perhaps greater leachate volumes were realized in the dormant bermudagrass and cold-fallow lysimeters due to channeling and preferential flow. The root channels in the dormant bermudagrass lysimeters may not have been completely filled with swollen active roots which allowed space for macropore flow in high sand content soil. The roots may have given structure to the soil which allowed for voids that formed when the lysimeters were driven into the bermudagrass to remain near the soil-lysimeter interface. These voids may have resulted in preferential flow. In addition, the rate of infiltration into the bermudagrass lysimeters was two to three times faster than the fallow lysimeters; five cm of irrigation could be added in 10 to 20 minutes to the bermudagrass lysimeters (0.33 cm min^{-1} infiltration rate) whereas 30 to 40 minutes was required for the fallow lysimeters (0.14 cm min^{-1} infiltration rate). The rapid infiltration rate into dormant bermudagrass indicated channeling (macropore flow). The rapid infiltration rate coupled with the dormant bermudagrass lysimeters remaining at field capacity for the duration of the study yielded greater volumes of leachate.

While handling the lysimeters, cold-fallow lysimeters were observed to retain more soil structure than the warm-fallow lysimeters. Although the 92% sand texture does not allow for strong soil structure, the cold temperature and high moisture content seemed to make the soil in the columns more rigid allowing for channel flow where possible and preferred flow along the lysimeter-soil interface. In addition, bubbles were observed to appear during irrigation of the fallow lysimeters. The bubbles indicate the opening and closing of macropores as sediment is washed into any opening. Free sand that may have washed into the macropores in the bermudagrass system was not able to block the opening to the macropore.

The lower infiltration rate of the fallow lysimeters provides for more contact time for water molecules containing simazine with potential binding sites in the soil. Furthermore, with less channeling than the bermudagrass lysimeters, the molecules pass at a slower rate through a greater volume of soil (micropore flow) allowing the simazine molecules to find more potential binding sites while diffusing through the soil in the fallow lysimeters. Leachate color in all lysimeters ranged from cloudy to light brown which indicated the presence of organic compounds, colloidal sesquioxides, and very fine sediment.

^{14}C-labeled simazine in leachate. ^{14}C-simazine in leachate appeared to increase gradually as the edge of the sorbed herbicide front approached the bottom of all lysimeters. The mean amount of ^{14}C-simazine in the dormant bermudagrass leachate was significantly greater than all other treatments on April 12, 2004 (Figure 3). Dormant bermudagrass leachate consistently tended to yield greater amounts of ^{14}C-simazine although not significantly ($\alpha = 0.05$) greater than all treatments on every sampling date. The mean amount of ^{14}C-simazine in the cold-fallow lysimeters leachate was significantly greater than the actively-growing bermudagrass lysimeters on April 27, 2004 and tended to yield increasing amounts of ^{14}C-simazine over time (Figure 3). The amount of ^{14}C-simazine in the warm-fallow lysimeters leachate tended to increase over time but was never significantly different from the actively-growing bermudagrass leachate which appeared to be relatively constant with time.

Rapid increases in ^{14}C-simazine in leachate occurred due to channeling. A rapid increase was observed in the dormant bermudagrass, and a gradual increase was observed in the cold-fallow lysimeters (Figure 3). The infiltration rate for the fallow lysimeters indicates less macropores and results in a slower flow rate. A slower flow rate corresponds to a lower mass loading and a greater hydraulic retention time which allows for more simazine diffusion into the soil pores and binding (Stearman et al. 2003). Stearman et al. (2003) demonstrated that herbicides were removed at greater percentages at low flow velocities compared with high flow velocities. As flow increased, mass loading increased, retention times decreased, and percent herbicide removed decreased. Sorption of simazine requires only minutes to hours to occur (Stearman et al. 2003). The fallow lysimeters surface soil seemed to have some sealing by a weak surface crust and blockage of the macropores in which sediment may travel. Macropores in the dormant bermudagrass lysimeters may have allowed for movement of simazine sorbed to colloids. Although leaching sediment may fill macropores in fallow systems, bermudagrass systems may have large macropores supported by the root system of the bermudagrass and are not plugged as easily as with fallow systems. A Japanese beetle grub *(Popillia japonica* Newman) was found in one dormant bermudagrass lysimeters during processing. Sediment could flow in channels made by soil invertebrates. The fact that sediment could originate at the surface is important because most simazine residues are in the top few centimeters of soil (Worrall et al. 1999).

^{14}C-labeled simazine in roots. The mean amount of ^{14}C-simazine was significantly greater in dormant bermudagrass roots than actively-growing bermudagrass roots after 25 DAT in only the shallowest increment (0-2 cm) (Figure 4). There were no other significant differences in the amount of ^{14}C-simazine in roots between the two bermudagrass treatments. The amount of simazine was expected to be greater in the actively-growing bermudagrass which would have been absorbing and metabolizing simazine. Dormant bermudagrass was not expected to absorb simazine. The measured amount of simazine in the dormant bermudagrass may have been adsorbed to the outside of the root and not inside the cells. The concentration of ^{14}C-simazine in roots decreased with soil depth. Being root absorbed, simazine is translocated acropetally mainly in the xylem and was expected to decrease with depth. In addition, decreasing quantities of ^{14}C-simazine in roots with increasing depth is reasonable since ^{14}C-simazine in soil decreased with depth.

^{14}C-labeled simazine in clippings. The mean amount of ^{14}C-simazine in clippings increased over time and then decreased (Figure 5). On the first clipping date four DAT (April 12, 2004),

^{14}C-simazine was detected at high quantities as expected (Figure 5.) These samples likely contained simazine residue on the shoots' surface that was not washed off during the initial irrigation (1.0 cm). Davis et al. (1959) reported that almost no simazine absorption occurred through intact leaves of cotton, corn, and cucumber; however, simazine did enter when the cuticle was broken. The actively-growing bermudagrass was cut three hours before simazine application which may have allowed simazine to enter the shoots. By the second clippings sampling date seven DAT (April 15, 2004), the majority of the ^{14}C-simazine residue on the shoots' surface was removed following the first clippings collection and addition of 5 cm of irrigation; therefore, the ^{14}C-simazine measured in clippings at this time was translocated simazine.

Leaves and shoots are the primary sinks for simazine; however, root, rhizome, and stem concentrations may remain constant (Knuteson et al., 2002). The quantity of ^{14}C-simazine in clippings was lowest on April 15 due to cloudy weather for three days prior to collection which reduced PAR and subsequently reduced evapotranspiration and simazine transport (Figure 2). Simazine uptake in plants and movement within the transpiration stream is largely a passive process closely associated with movement of water (Shone and Wood, 1972; Wilson et al., 1999). The amount of translocated ^{14}C-simazine is best described by the quadratic equation $-429.8X^2 + 13{,}738X – 57{,}144$ where X =days after treatment ($R^2 = 0.6429$) (Figure 5). Simazine was absorbed and readily translocated until approximately 19 DAT (April 28, 2004) when the amount of ^{14}C-simazine in clippings began to decrease probably due to a reduction in bioavailability as the chemical became sorbed to the soil colloids.

^{14}C-labeled simazine in verdure. There were no significant differences in the amount of ^{14}C-simazine in the verdure of dormant bermudagrass and actively-growing bermudagrass 25 DAT

(Figure 6, depth =0 cm). Actively-growing bermudagrass verdure was expected to contain more ^{14}C-simazine due to translocation from the roots. Translocation was not expected to occur in dormant bermudagrass. When simazine was applied to the bermudagrass, the droplets were clearly visible resting on top of the waxy canopy of the actively-growing bermudagrass until irrigation was applied. When simazine was applied to the dormant bermudagrass, the droplets ran down the foliage into the thatch immediately. Dormant bermudagrass does not have a waxy leaf. The absence of wax reduces surface tension and increases leaf-herbicide contact area which increases the potential for sorption. To the contrary, droplet formation reduces herbicide-leaf contact area and reduces the potential for sorption. However, simazine is mainly root adsorbed.

Percent of applied simazine remaining at 25 DAT. Percent of applied simazine remaining includes the amount of ^{14}C-labeled and unlabeled simazine in soil and leachate in all treatments as well as in roots, clippings, and verdure for the bermudagrass treatments (Figure 6). In general, the majority of simazine was measured in the 0-2 cm increment in all treatments and decreased with depth. The mean percent of applied simazine in the cold-fallow lysimeters (7.6 %) was significantly greater in the 6-8 cm increment than all other treatments, and the mean percent simazine in the warm-fallow lysimeters (4.6 %) was significantly greater than the mean percent in the dormant bermudagrass lysimeters (2.4 %) at this same depth (6-8 cm). The mean percent of simazine in leachate was significantly greater in the dormant bermudagrass (3.9%) than other treatments (Figure 6, depth = 30 cm). The mean percent of simazine in leachate was 1.5, 1.2, and 1.0 % for cold fallow, warm fallow, and actively-growing lysimeters, respectively. There were no other significant differences at the α=0.05 level.

Simazine was expected to be detected at lower quantities in the actively-growing turf lysimeters since bermudagrass absorbs and metabolizes simazine (biological degradation). In addition, the amount of simazine in the clippings began to decrease at the end of the experiment. The reduction in clippings was presumed to indicate a reduction of bioavailable simazine in the root zone. Sorption of “aged” simazine to soil colloids and its diffusion into micropores reduces bioavailable simazine. Scribner et al. (1992) demonstrated that recently added simazine desorbed rapidly and was degraded by indigenous microbes and was available for plant uptake; however, overtime, the desorption of simazine becomes increasingly slower resulting in higher ratios of soil-bound to aqueous phase simazine concentrations than predicted by laboratory determined sorption coefficients. Scribner et al. (1992) concluded that the potential for pesticide leaching is greatest at or near the time of application because of the greater mass of pesticide present and the higher aqueous-phase pesticide concentration relative to its soil concentration. Immediately after ^{14}C-simazine application, one cm of water was applied to all lysimeter. Soil bound organic contaminates are unavailable for biological degradation (plant uptake) which suggests that desorption into the aqueous phase may be prerequisite for biodegradation (Scribner et al., 1992). The volume of leachate recovered from each treatment indicated that some water was available for downward movement even during warm weather. However, during warm weather, there may be capillary movement of water and pesticides toward the surface as water is removed from shallow soil by evapotranspiration processes, as was observed by Weber et al. (1999).

Mobility indices. The greater the MI is, the greater the potential for simazine movement in soil. The mean MI for the cold-fallow lysimeters (5.4) was significantly greater than the mean MIs for warm-fallow and actively-growing lysimeters (4.4 and 3.9, respectively) (Table 2). The mean MI (4.6) for dormant bermudagrass was not significantly different from any treatment MI. Although the mean amount of ^{14}C-simazine was greatest in the leachate of dormant bermudagrass (Figure 3), the mean percent of applied simazine was greater in 4-6, 6-8, 8-10, 10-15, and 15-20 increments of the cold-fallow lysimeters (Figure 6). Therefore, the order of mobility for simazine from greatest to lowest is: cold-fallow > dormant bermudagrass > warm-fallow > actively-growing bermudagrass.

Conclusions. More water is available to move pesticides downward in winter than summer when evapotranspiration rates are lower. During summer, bermudagrass utilizes available moisture in the root zone and additional water is lost through evaporation. Capillary action may bring moisture and pesticides from deeper in the soil profile toward the drying soil near the surface. Channels may form in the root zone of dormant bermudagrass which may lead to rapid leaching of simazine. Gradual downward movement of simazine is more likely in fallow soil in winter compared to fallow soil in summer and actively-growing bermudagrass. Simazine was measured at similar quantities in dormant and actively-growing root and verdure samples. Simazine was either adsorbed to the outside of the root or shoot surfaces or absorbed by the dormant bermudagrass. Translocated simazine was detected at increasing and then decreasing quantities in clippings which indicated a reduction in bioavailable simazine with time. Simazine quantities in clippings were not expected to decrease unless quantities of simazine in the root zone decreased. Simazine is predicted to be most mobile in fallow-cold soil, followed by, dormant bermudagrass, followed by fallow-warm soil followed by actively-growing bermudagrass.

Therefore, if simazine were applied to bermudagrass in September when the turf is actively growing rather than November, less downward movement would be expected, and weed control would remain the same. This is one example of a management plan that minimizes downward pesticide movement.

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Table 1. Particle-size distribution of sand, silt, and clay from treated soil column lysimeters in a Candor sand (Sandy, Siliceous, Thermic, Arenic Paleudult). †

Soil Depth (cm)	Mean HM ‡ (%)	Organic Matter @ (%)	Sand # (%)	Silt # (%)	Clay # (%)	Mean CEC ‡ (meq/100 g soil)	Mean pH ‡
Fallow System							
0-2	0.72	2.04	85.4	10.4	4.1	2.77	5.7
2-4	0.68	1.89	83.7	11.9	4.4	2.75	5.5
4-8	0.72	1.94	84.3	11.5	4.1	2.67	5.3
8-15	0.70	1.89	82.2	13.6	4.2	2.77	5.5
15-30	0.61	1.68	84.9	10.8	4.3	2.65	5.7
Turf System							
0-2	0.51	6.13	87.7	9.4	2.9	8.15	6.5
2-4	0.64	5.87	80.6	16.4	3.0	6.65	6.5
4-8	0.79	2.08	85.3	11.4	3.2	4.20	6.1
8-15	0.71	1.98	88.4	8.5	3.0	3.75	6.1
15-30	0.57	1.84	87.1	8.6	4.4	2.82	5.7

† Soil Survey Geologic, Montgomery County.

‡ North Carolina State Department of Agriculture, Raleigh, NC 27606.

@ Mean of six samples determined using a muffle furnace set at 500 ^oC for 24 hours.

Mean of two samples determined using the hydrometer method.

Table 2. Mean mobility indices and computed mobility (R_f) values for simazine in actively-growing and dormant bermudagrass and in warm- and cold-climate fallow lysimeters.

Treatment	Mobility Index		R_f	
Active bermudagrass	3.9	B	0.14	B
Dormant bermudagrass	4.6	AB	0.17	AB
Warm fallow	4.4	B	0.16	B
Cold fallow	5.4	A	0.20	A
MI_{max} = 27.5 cm				

Data points with the same letter at each sampling depth are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (LSD).

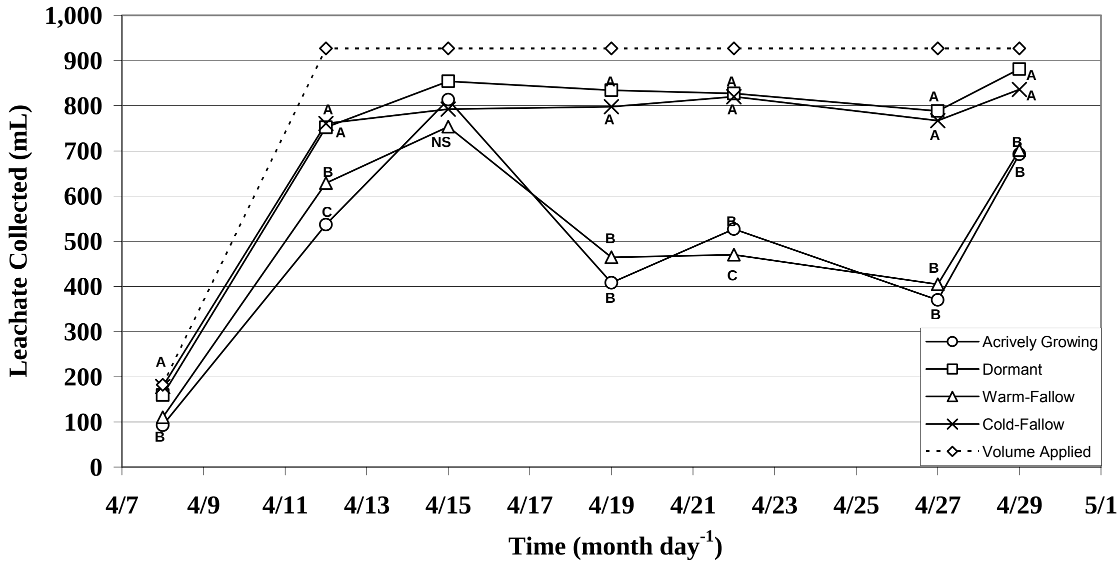

Figure 1. The effect of treatments on volume of leachate collected when five cm of water was applied every three to four days.

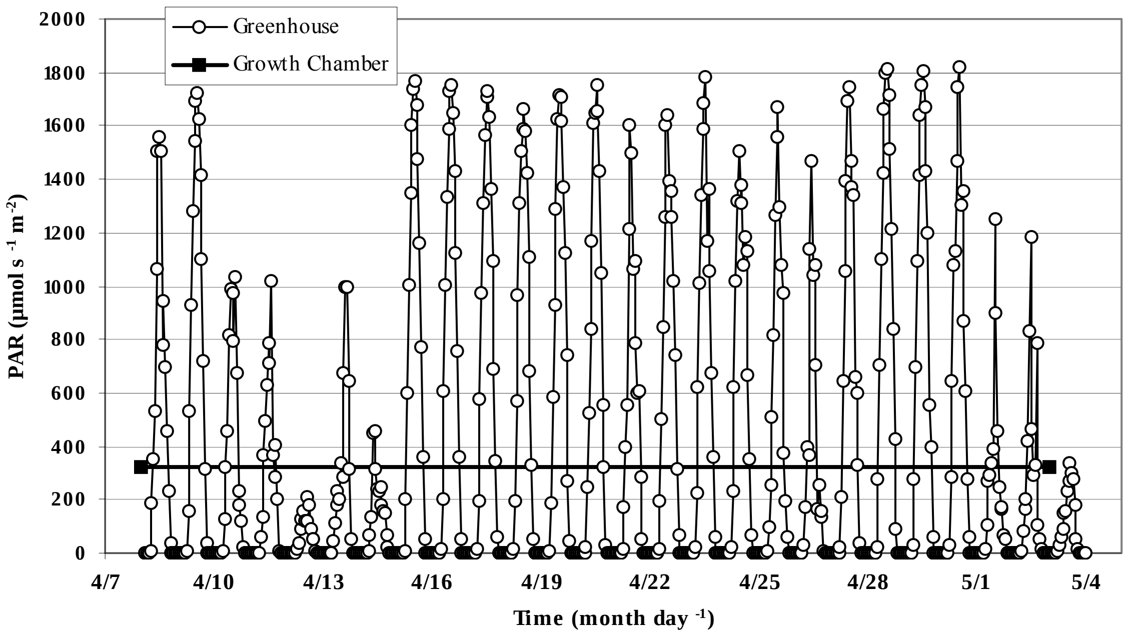

Figure 2. Hourly photosynthetically active radiation (PAR) in the greenhouse and growth chamber during the study.

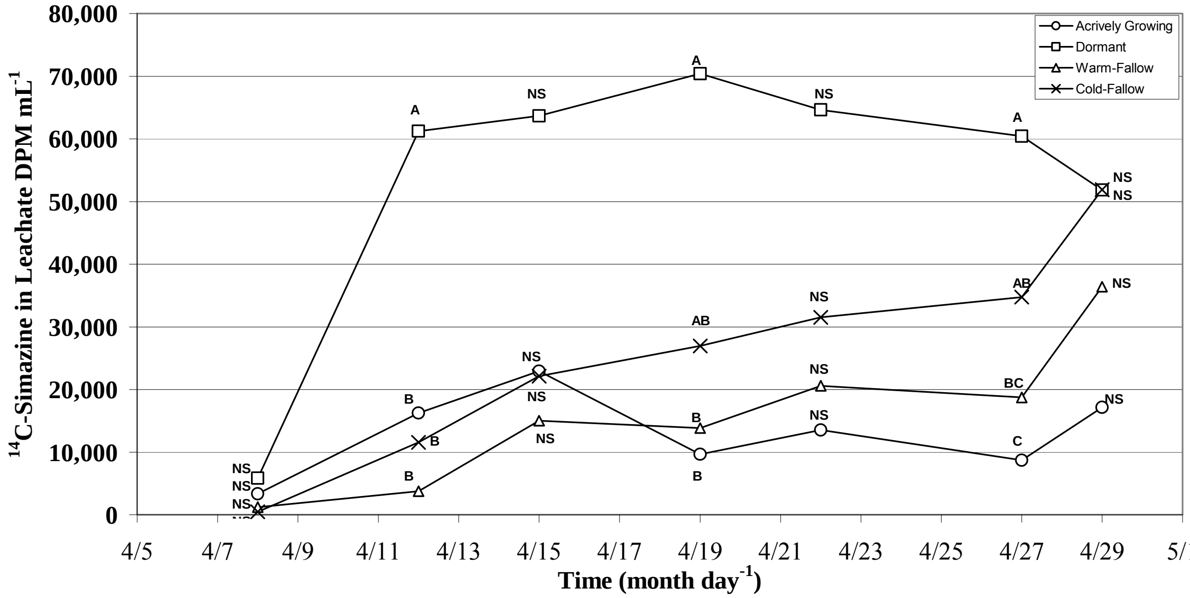

Figure 3. Effect of treatments on amount of ^{14}C-labeled simazine in leachate (DPM mL^{-1}) over time.

Data points with the same letter at each sampling date are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (LSD). LSDs were determined using a square root transformation of the raw data. "NS" indicates no significant differences among all treatments at the sampling date.

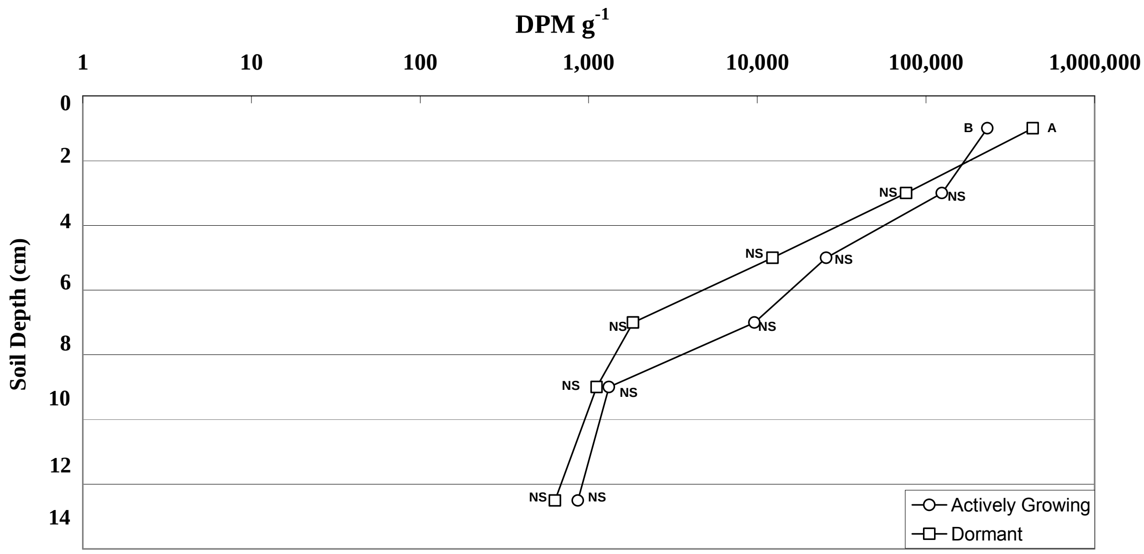

Figure 4. Amount of [14]C-labeled simazine in roots 25 days after treatment (DAT) at each soil depth as affected by treatment.

Data points with the same letter at each sampling depth are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (LSD). LSDs were determined using a log transformation of the raw data. “NS” indicates no significant differences among treatments at the sampling depth.

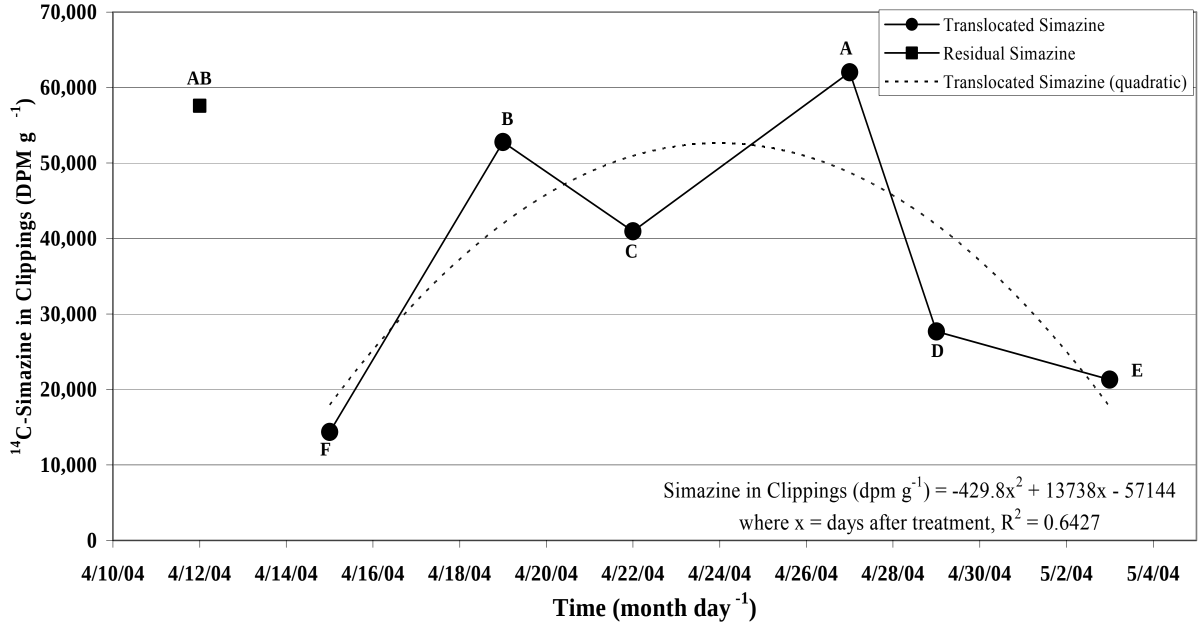

Figure 5. Amount of ^{14}C-labeled simazine in clippings over time for bermudagrass treatments.

Simazine was applied on 4/8/04. Data points with the same letter at each sampling date are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (LSD). LSDs were determined using a log transformation of the raw data.

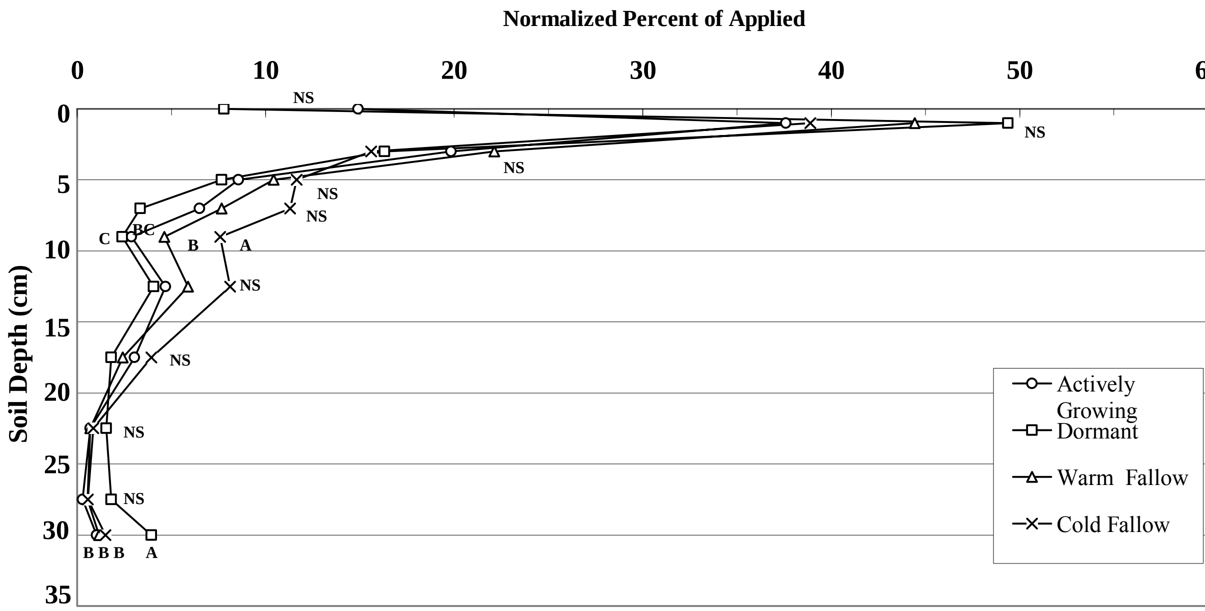

Figure 6. Normalized percent of applied ^{14}C-labeled simazine at each soil depth, leachate (depth = 30), and verdure (depth = 0) as affected by treatment 25 days after treatment (DAT).

Data points with the same letter at each sampling depth are not significantly different at the 5% level of significance according to Fisher Protected Least Significant Difference (LSD). LSDs were determined using a log transformation of the raw data. “NS” indicates no significant differences among treatments at the sampling depth.

CHAPTER 3

Impact of Fipronil Residues on Mole Cricket (Orthoptera; Gryllotalpidae) Behavior and Mortality in Bermudagrass

Abstract

In a greenhouse experiment initiated in May 2003, fipronil was applied at the label rate to bermudagrass (*Cynodon dactylon*) in pots at 120, 90, 60, 30, and 0 days before adding one tawny mole cricket nymph (*Scapteriscus vicinus*) to each of 11 replicates in September 2003. The experiment was conducted twice. Run-1 included 11 non-treated pots, and Run-2 included 26 non-treated pots. Soil in the pots was divided into 0-4, 4-8, and 8-18 cm depth increments 10 days after adding nymphs in Run-1 and four days after adding nymphs in Run-2. Cricket status was recorded as dead, absent, or alive. Soil in the 0-4 cm increment was analyzed for fipronil and four fipronil metabolite residues. Fipronil residue concentrations decreased with time ($C=0.00002x^2 - 0.005x + 0.3675$, $R^2 = 0.9998$ where C= fipronil concentration ($\mu g\ g^{-1}$) and x=days after treatment). Two metabolites (fipronil sulfone and fipronil sulfide) concentrations increased as fipronil residues decreased. Each treatment's effect on the late instar mole cricket was significantly different from the non-treated; however, there were no significant differences in nymph status among fipronil treated pots. Total fipronil and/or its metabolites residues 120 days after application (0.047 µg per g) were high enough to affect mole crickets to the same extent as the zero day treatment (0.368 µg per g). There was significant repellency with fipronil and/or its metabolites as the majority

of nymphs evacuated the treated pots, but 35 out of 37 nymphs were found alive in the non-treated pots; i.e., the crickets served as sentinels of fipronil and fipronil metabolites.

Key Words: Fipronil, fipronil metabolite, fipronil sulfide, fipronil sulfone, repellency, avoidance, mole cricket, *Scapteriscus vicinus*.

INTRODUCTION

Mole crickets (order Orthoptera, family Gryllotalpidae) are one of the most devastating pests in bermudagrass (*Cynodon dactylon* L.), zoysiagrass (*Zoysia japonica* Stend.), centipede (*Eremochloa ophiuroides* [Munro] Hack.), St. Augustine (*Stenotaphrum secundatum* [Walt.] Kuntze), bahiagrass (*Paspalum notatum* Fluegge), and pasture grasses on the Coastal Plain regions of the US from North Carolina to Texas due to the extent of the injury to the turf and high cost of control and turf recovery (Frank & Parkman 1999). These subterranean pests have muscular, shovel-like forelegs that enable them to burrow in sandy and friable soil (Frank & Parkman 1999). Mole cricket nymphs resemble adults in shape, but nymphs are flightless and slightly smaller. Mole crickets spend most of their lives tunneling through soil to feed on roots and soil organisms and uproot turf plants which dry out and die (Leslie 1994). The consumption of turf roots and stems can cause significant turf desiccation (Matheny 1981). Turf quality can be further reduced by the presence of acoustic calling chambers (mounded soil) built by male mole crickets to attract females for mating in spring. The disturbed soil can disrupt play on golf tees and putting greens, damage mowing equipment, cause unstable footing on athletic fields, and ruin the appearance of what would otherwise be considered well-maintained turf (Hertl & Brandenburg 2002). Very severe turf damage may require reseeding or resodding, with reinfestation still a possibility (Frank & Parkman 1999). One large nymph can form several meters of galleries in a single evening; thus, there may be a zero tolerance of mole crickets on a golf course putting green because raised tunnels interfere with ball roll and are skimmed off by greens mowers (Frank & Parkman 1999). Additionally, the turf may be further damaged by large predators trying to dig up the mole crickets (Frank & Parkman 1999). Furthermore, thinned turf may be colonized by opportunistic weeds (Frank & Parkman 1999). Therefore, these pests account for hundreds of millions of dollars in damage and control cost every year (Potter 1998).

The two most destructive species in the southern US are the introduced southern mole cricket (*Scapteriscus borellii* Giglio-Tos [known until recently as *Scapteriscus acletus* Rehn & Hebard]) and the tawny mole cricket (*Scapteriscus vicinus* Scudder). Southern mole crickets feed on a variety of soil arthropods and occasionally on turf roots and stems. They cause turf damage mainly by surface tunneling (Matheny 1981). In addition to surface tunneling, herbivorous tawny mole crickets feed on turf roots and stems at night in the upper two cm of soil which can result in severe turf loss in late summer and fall (Ulagaraj 1975, Taylor 1979, Matheny 1981). There is one generation of mole crickets a year, but egg laying and hatching may be spread out over several weeks during May and June (Potter 1989). There is variability in the number and duration of instars for the two species, but in general, tawny and the southern mole crickets will complete 8-9 and 7-10 instars, respectively (Braman 1993).

Young nymphs are difficult to monitor because of their subterranean nature; thus, mole crickets are among the most difficult to control turfgrass insects (Potter 1989).

Managing these pests requires a systematic annual plan. Once the surface signs of infestation are apparent, the nymphs are large and more difficult to control, and chemical applications in late summer are not as effective as those made earlier to smaller nymphs (Potter 1989). Because the turf may not be visibly damaged in June and July, nymph populations should be sampled. Nymphs can be brought to the surface by drenching a previously irrigated turf area with six L of water per m^2 with a 0.4% solution of dishwashing detergent. Then, monitor the area for five minutes (Short & Koehler 1979).

Although there may be little evidence of their presence, nymphs are likely to hatch where the mole crickets over wintered (Potter 1998). Mole crickets that over winter deep in the soil are active as early as March. Due to faster development and earlier flights and hatch of the tawny, a larger percentage of them become adults (85%) before winter. In comparison, southern mole crickets remain as large nymphs mainly over winter, and only about 25% become adults before winter (Potter 1989). Infestations tend to reoccur in the same location unless management practices or turf quality vary significantly. Thus, these "mapped" areas of infestation may require chemical treatment but not the entire turf facility. Therefore, mole crickets can be managed by scouting and mapping to properly target insecticide and biocontrol agent applications.

Fipronil (5-amino-3-cyano-1-[2,6-dichloro-4-trifluoromethylphenyl]-4-tifluoromethylsulfinylpyrazole) is an insecticide that provides excellent mole cricket control. Fipronil is a member of the phenyl pyrazole class of pesticides and was discovered in 1987 by Rhone-Poulenc researchers in Ongar, England (Figure 1). It is a highly effective insecticide used on a wide range of crops, buildings, and domesticated animals and was registered for use in the US in 1996 (Federal Register, 1996). Fipronil and/or its metabolites effectively control home pests, termites, fire ants, mole crickets, water rice weevil, and field corn pest (USGS 2003). In turf, fipronil is applied as a granular product at very low use rates (µg ai [active ingredient] per ha)

Fipronil has four major metabolites: desulfinylfipronil (5-amino-3-cyano-1-[2,6-dichloro-4-trifluoromethylphenyl]-4-tifluoromethylpyrazole), fipronil amide (5-amino-3-carbamoyl-1-[2,6-dichloro-4-trifluoromethylphenyl]-4-tifluoromethylsulfinylpyrazole), fipronil sulfide (5-amino-3-cyano-1-[2,6-dichloro-4-trifluoromethylphenyl]-4-tifluoromethyl-thio-pyrazole), and fipronil sulfone (5-amino-3-cyano-1-[2,6-dichloro-4-trifluoromethylphenyl]-4-tifluoromethylsulfonylpyrazole). Desulfinylfipronil is formed through photodegradation in water and on soil. Fipronil amide is the product of alkaline hydrolysis in water and soil. Fipronil sulfide forms slowly during anaerobic metabolism. Fipronil sulfone is the product of oxidation in soil. Fipronil metabolites may be more toxic to non-target animals than fipronil (USGS 2003).

The objectives of this study were to determine the length of influence of fipronil and/or its metabolites on tawny mole cricket nymphs in bermudagrass and to measure degradation of fipronil and appearance of fipronil metabolites yielding the various levels of nymph responses.

MATERIALS AND METHODS

Bermudagrass cultivation.

Dormant ‘Tifway’ bermudagrass from the Sandhills Research Station, Jackson Springs, NC was sectioned with a shovel into semi-cube shapes 15-cm wide and 8-cm deep on 23 Mar., 2003. The bermudagrass cubes were placed in 150 containers (19 cm in diameter x 18 cm deep [Classic 400, Nursery Supplies, Inc., Chambersburg, PA]) whose bottom five cm was fitted with fiberglass screen (1.4 mm [New York Wire, Mt. Wolf, PA]) to prevent mole cricket nymph escape through the drain holes as nymphs have the ability to tunnel deep in the container. Villani et al. (2002) noted that nymphs avoided control agents in the treated layer at the surface by remaining deep in the soil; however, fipronil and/or its metabolites have not been documented to elicit repellent behavior in mole crickets. The native soil was a Candor sand (sandy, siliceous, thermic, Arenic Paleudult). Sufficient native top soil was added to the bottom of each container to ensure that the screen was correctly positioned over the drain holes and to make certain that when the bermudagrass cube was added, the surface of the cube would be 2.0 cm from the rim of the container. Thus, the bermudagrass could be easily maintained at 2.0 cm mowing height with battery-powered, reciprocating shears. Additional soil was added to fill the space between the cube and the circular wall of the container. The containers were placed in a greenhouse with a photoperiod of 14:10 (L:D). Peters ® 20-20-20 fertilizer was applied at 24 kg N per ha on 4 Apr., 30 Apr., 23 May, 25 Jun., and 18 Aug., 2003. Turf in the containers was cut twice weekly at 2.0 cm. Containers were twisted ¼ turn after each mowing and rotated across the bench once a week. Automatic overhead irrigation provided 0.6 cm water per day (2X annual mean).

Using a saltshaker, fipronil (Chipco Choice 0.1 granular (G) [Aventis, Research Triangle Park, NC]) was applied to the surface of the bermudagrass containers at 0.014 g ai per ha 120, 90, 60, 30, 0 days before adding one late-instar tawny mole cricket nymph to each container. Through natural degradation pathways, the fipronil concentration would be reduced over time and be measured at the end of the experiment. The six treatments and untreated checks were arranged in a randomized complete block with 11 replicates, and the experiment was conducted twice. Thus, for Run-1, fipronil was applied 7 May, 6 Jun., 8 Jul., 5 Aug., and 5 Sep., 2003 to bermudagrass in unique containers. For Run-2, fipronil was applied 21 May, 25 Jun., 22 Jul., 19 Aug., and 19 Sep., 2003. Immediately following application, 0.3 cm of irrigation was applied. Nymphs were introduced three hours after irrigation. Run-1 included 11 non-treated containers, and Run-2 included 26 non-treated containers (total of 147 containers with one mole cricket nymph in each).

Tawny mole cricket nymphs were collected from Brunswick County in southeastern NC on 14 Aug., 2003 from the Oyster Bay Golf Links (33^{o} 52.9' N 78^{o} 32.10' W) for Run-1 and on 22 Sep., 2003 from Sea Trails Golf Links for Run-2. Nymphs were brought to the soil surface by applying a 0.4% solution of lemon Joy® brand liquid dishwashing detergent in six L of water per m^2 of turf (Short & Koehler 1979). The collected nymphs were rinsed in lake water to remove the soapy residue and placed in a 19-L bucket half filled with moist soil from the surrounding area. The day after collection, each nymph was placed in a 473-mL plastic container half filled with moist soil and half an earthworm (*Lumbricus* ssp.) (as a food source). Air holes were placed in the container lids and sides. The status of the nymph, soil moisture, and worm were checked twice weekly for at least two weeks before they were added to the fipronil treated containers.

One nymph was placed in a 3-4 cm hole made by a rod into the thatch layer of the bermudagrass in each container on 5 and 19 Sep., 2003 for Runs-1 and -2, respectively. Nymphs were added in order of expected lowest fipronil concentration to highest (non-treated, 120, 90, 60, 30, 0 day). For Run-1, on 15 Sep., 2003, 10 days after adding the nymphs, the containers were divided into three sections (0-4, 4-8, 8-18 cm). The thatch layer was approximately 0-4 cm thick. The status of the nymphs was recorded as live, dead, or absent. Nymphs found alive were placed in individual 473-mL plastic container with moist soil and monitored for four days to ensure the recorded status was accurate since fipronil has been observed to require several days to control mole crickets in the field (personal communication with Dr. Rick Brandenburg [NCSU], 20 Jul., 2004). The depth increment where the nymph was located was noted. Because more nymphs were recorded as absent in Run-1 than expected, containers in Run-2 were processed four days after adding nymphs on 23 Sep., 2003. The decreased nymph residence time in the treated containers facilitated locating dead nymphs, which can disintegrate quickly in moist soil. In addition, the number of non-treated containers was increased from 11 to 26.

Sample preparation.

All soil increments were bagged in polyethylene bags, weighed, and stored at -18^{o}C. All increments from the containers treated with fipronil on the same day were simultaneously thawed for each pesticide, sub sampled to determine percent moisture by weight, and set out in aluminum pans for two days to air dry at room temperature. Then, the increments were sieved through a 1.4 mm sieve and sub sampled. In addition to preparing the soil for fipronil and/or its metabolites extraction, sieving was used to locate fragments of nymphs in Run-1.

Extraction procedure.

To determine if the concentrations of fipronil and fipronil metabolites were different in pots where nymphs were found absent or dead, soil samples from the 0-4 cm increment (thatch layer) from two replicates where the nymphs were reported as absent and from two replicates where the nymphs were reported as dead at the end of the experiment were randomly selected for analysis from each treatment in both Runs-1 and -2. Because only four nymphs were found live in all fipronil treated pots, only two samples (120 day and 0 day) from a fipronil treated pot containing a live nymph at the end of the experiment were analyzed.

Soil samples were extracted by sonication (EPA Method 525.2 modified as described below). Ten grams of soil and 150 mL of acetone and n-hexane (1:1) were placed in a 250-mL beaker and sonicated (Branson® Sonifier 450 [Branson Ultrasonics, Danbury, CT]) for five minutes at 450 watts and 40-duty cycle. The supernatant was filtered through glass wool and anhydrous sodium sulfate into a 500-mL boiling flask. Another 150 mL of extraction solvent were added to the beaker and sonicated for three minutes. The supernatant was filtered into the same boiling flask. The volume was reduced to 2.0 mL by rotary evaporation under vacuum at 35^{o}C; then transferred quantitatively to a 10-mL test tube using n-hexane for rinsing. In order to remove all the acetone from the solution, the rinsate was reduced to 0.5 mL with a stream of dry nitrogen and diluted to 8.0 mL with n-hexane. The volume was reduced to 0.2 mL with dry nitrogen, and then diluted to 3.0 mL with n-hexane. A florisil solid phase extraction (SPE) Sep-Pak cartridge (Waters, Milford, MA) was prepared with 10 mL of hexane. Then the fipronil in 3.0 mL of hexane was injected into the cartridge very slowly. The elutent was concentrated and analyzed to make certain all fipronil was retained in the cartridge. The fipronil and/or its metabolites were removed from the cartridge with 5.0 mL of acetone mixed with 5.0 mL of n-hexane. This elutent was reduced to 1.0 mL with dry nitrogen and transferred to a 2-mL GC auto sampler vial.

Samples were analyzed for fipronil, desulfinylfipronil (MB46513), fipronil amide (RPA200766), fipronil sulfide (MB45950), and fipronil sulfone (MB46136). Extracts were analyzed using an HP 6890 GC coupled to an HP 5973 MSD using a ZB 50 (Phenomenex, Torrance, CA) column (30 m x 0.32 mm x 0.25µm film thickness) with the following temperature program: Injection port: 175 °C, initial temp: 80 °C, initial hold: 1.0 min, ramp rate: 20 °C per min to 250 °C, ramp rate 6 °C per min to 287 °C and hold 1.0 min, ramp 25 °C per min to 300 °C and hold 5.0 min. One µL of sample was injected. The electron capture detector (ECD) temperature was 300 °C. Helium carrier gas at a mean flow of 1.0 mL per min. Nitrogen was used as the detector makeup gas. Calibration standards at concentrations of 100, 10, and 5.0 µg per mL were used for quantification. Matrix spike were run for every six samples. Every other sample was injected into a mass spectrometer to verify the concentration and molecule.

Data analysis.

The status of the nymphs were analyzed by Pearson Chi Square analysis and by logistic regression, fitting run and treatment effects, using the GENMOD procedure of SAS version 8.0 (SAS Institute 2001). GENMOD requires a binary response; thus to accommodate this procedure, numbers of absent and dead nymphs (impacted by fipronil or metabolite) were combined to compare against the number of live nymphs. Likelihood ratio chi square-tests ($P \leq 0.05$) were used to determine significant differences. The most appropriate degradation model for fipronil and fipronil metabolites residual concentrations was determined using SAS.

RESULTS AND DISCUSSION

Only four nymphs were recorded as alive in fipronil treated containers at the end of both runs of the experiment even after 120 days of summer degradation in a greenhouse. The number of dead and absent nymphs in the 110 fipronil treated containers were 51 and 55, respectively. The data suggest that fipronil and/or its metabolites modified the behavior of the nymphs which indicates repellency (Table 1). Out of 37 nymphs in the non-treated containers, 35 (94.6 %) were found alive; one was absent and one was dead. When fipronil concentrations were greatest (0 day treatment), the number of absent nymphs was greatest. As fipronil concentrations decreased and fipronil metabolite concentrations increased, nymph mortality also tended to increase. Therefore, fipronil or its metabolites were impacting the mole crickets by either causing mortality or avoidance behavior.

After noting the higher than expected number of nymphs reported as absent in Run-1, the nymph residence time in Run-2 was reduced from 10 to four days. Initially, the absence of a nymph in a container was attributed to quick death followed by rapid mole cricket decomposition. If nymphs were to detect the fipronil and/or its metabolites, they were not expected to pass through the treated layer at the surface and walk off the edge of the container, but rather tunnel deeper (Villani et al. 2002). However, Villani (et al. 2002) conducted experiments in containers with high side walls and lids where mole crickets could not leave the system; tunneling deeper was the only option for avoidance.

Tunneling behavior and depth is influenced by soil temperature, development stage, size of insect, and soil moisture (Hertl & Brandenburg 2002, Frank & Parkman 1999). Higher soil moisture at the surface increases nymph tunneling activity and a high water table forces them to the surface (Hertl & Brandenburg 2002, Frank & Parkman 1999). At harvest, the soil percent moisture on a dry weight basis ([initial wt – dry wt] per dry wt x 100) combining Runs-1 and -2 were 50%, 25%, and 20% for the 0-4, 4-8, 8-18 cm increments, respectively. Although these moisture levels are high, live mole crickets were collected from 94% of the non-treated containers. Therefore, the experimental apparatus was not inherently lethal or repellent to the nymphs. However, Hudson (1989) reported that nymphs are largely nomadic compared to adults who have a "home burrow"; thus, nymphs are more likely to seek escape on the surface. Therefore, some nymphs must have detected the fipronil and/or its metabolites and came to the surface as compared to the untreated containers.

Fipronil targets the γ-aminobutyric acid type A (GABA) receptor system which disrupts the nerve function of insects by blocking the voltage gated chlorine channels of neurons (California Environmental Protection Agency [CEPA] 2001). Thus at sufficient doses, fipronil causes excessive neuronal excitation. During harvest of Run-2, nymphs were observed to be supine with rapid movement of the legs followed by death. Therefore, based on observation of nymphs found during harvest and the mode of action of fipronil, it is likely that some of the nymphs reported as absent, received a high enough dose to be affected by fipronil and/or its metabolites. The affected nymphs may have walked over the edge of the container. Seven nymphs were found dead below the containers, but could not be assigned to a specific container. The nymphs that were absent, but not found, may have been consumed by predators known to inhabit the greenhouse.

When Runs-1 and -2 are combined, the number of nymphs recorded as absent is similar to the number of dead (Table 1). During the statistical analysis, the numbers of dead and absent nymphs (impacted nymphs) were combined for comparison against the number found live. All fipronil treatment timings were significantly different from the non-treated

(Chi-square <0.001). When the results of the non-treated containers were removed from the statistical analysis, there were no significant differences among fipronil treatment timings. Therefore, fipronil or its metabolites were present a concentrations which impacted the nymphs when applied at the labeled rate to bermudagrass containers 120 days before adding the nymphs during the summer in a greenhouse where two times the normal annual rainfall was applied. Fipronil was expected to be degraded more rapidly as its reported disappearance time in turf is 12-15 days vs. 33-75 days in bare soil (CEPA 2001). In this experiment, the half-life of fipronil was approximately 40 days.

The mean zero day treatment concentration for Runs-1 and -2 for fipronil in the soil in the 0-4 increment of the bermudagrass containers was 0.368 µg per g, and mean 120 day treatment concentration was 0.047 µg per g (Figure 2). The degradation of fipronil is best described by the quadratic equation $C = 0.00002x^2 - 0.0053x + 0.3672$, $R^2 = 0.9998$ where C=fipronil concentration (µg per g) and x = days after treatment. As the concentration of fipronil decreased, the concentrations of fipronil sulfone and fipronil sulfide increased. Fipronil sulfone is the major fipronil metabolite detected in this study. The appearance of fipronil sulfone is best described by the quadratic equation $C = -0.00003x^2 + 0.0039x + 0.1228$, $R^2 = 0.8629$ where C = fipronil sulfone concentration (µg per g) and x = days after treatment. The concentration of fipronil sulfone was greatest in the 60-day (applied in July) soil samples which indicates that this molecule is also degrading. Fipronil sulfone is formed through aerobic soil metabolism and was expected to be the major degradation product. Fipronil sulfide concentrations also increased as fipronil concentrations decreased with a maximum concentration reported in the 60-day samples. Fipronil sulfide is formed through degradation in soil and water under anaerobic conditions. There were no significant differences in fipronil concentrations in containers where nymphs were dead or absent at the end of the experiment. The same relationship is true for fipronil sulfone and fipronil sulfide.

The heavy irrigation rate and screen in front of the drain holes may have allowed anaerobic conditions to form temporarily. Desulfinylfipronil and fipronil amide were detected in all containers at minor concentrations (data not shown). These metabolite mean concentrations were similar across treatments and did not show a relation to fipronil residue concentrations. Desulfinylfipronil is formed during photolysis and was not expected to be present in high concentrations due to shading of the soil surface by the bermudagrass canopy. Fipronil amide is formed during alkaline hydrolysis; the conditions necessary for fipronil amide to be produced were not expected (USGS 2003). Metabolite residues were detected in the zero day samples because the containers were not harvested until 10 and four days after application for Runs-1 and -2, respectively.

The fipronil concentration in the 120 day sample where the nymph was alive was 0.034 µg per g (data not shown). This value is less than mean 120 day concentrations for containers where nymphs were dead or absent, 0.056 and 0.046 µg per g, respectively. Similarly, the fipronil sulfone concentration in the 120 day sample where the nymph was alive was 0.13 µg per g. This value is less than mean 120 day concentrations for containers where nymphs were dead or absent, 0.28 and 0.23 µg per g, respectively. In addition, the fipronil sulfide concentration in the 120 day sample where the nymph was alive was 0.039 µg per g. This value is less than mean 120 day concentrations for containers where nymphs were dead or absent, 0.067 and 0.059 µg per g, respectively. The fipronil, fipronil sulfide, and fipronil sulfone zero day concentrations where the nymphs were alive were also less by similar magnitudes than the mean concentrations for zero days samples were nymphs were dead or absent.

Conclusions.

Fipronil at a mean concentration of 0.047 µg per g in the 120 day treatment soil samples impacted tawny mole cricket nymphs as much as fipronil at a mean concentration of 0.368 µg per g in the zero day treatment soil samples (0-4 cm). Fipronil or fipronil metabolites impacted the nymphs by either causing death or repellent behavior. Fipronil was expected to be degraded more rapidly. As fipronil concentration decreased, fipronil sulfone and fipronil sulfide concentrations increased as expected. For instances where fipronil may have appeared to be slow acting in the field, fipronil may not have been rapidly transformed to its metabolites due to environmental conditions. Fipronil or its metabolites are highly effective tawny mole cricket nymph management tools and have the potential to provide season-long control or prevent reinvasion in the same season (120 days).

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Table 1. Tawny mole cricket nymph status at harvest combining Runs-1 and -2 when containers were treated with 0.014 g ai per ha fipronil either 0, 30, 60, 90, or 120 days before adding one nymph to each container (11 replicates, repeated, except not-treated which had 11 reps in Run-1 and 26 in Run-2). Nymphs served as a sentinel for fipronil.

Fipronil Application Time	Live (%)	Dead (%)	Absent (%)
0 Day	9.1	27.3	63.6
30 Day	4.5	54.5	40.9
60 Day	0	45.5	54.5
90 Day	4.5	45.5	50
120 Day	0	59.1	40.1
Not Treated	**94.6**	2.7	2.7

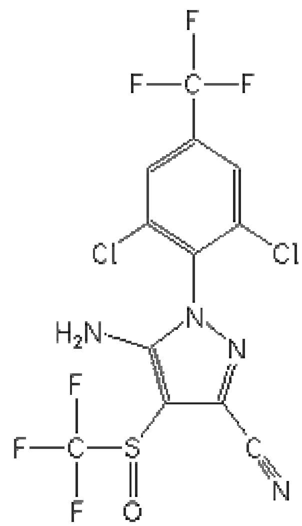

Figure 1. Fipronil molecule.

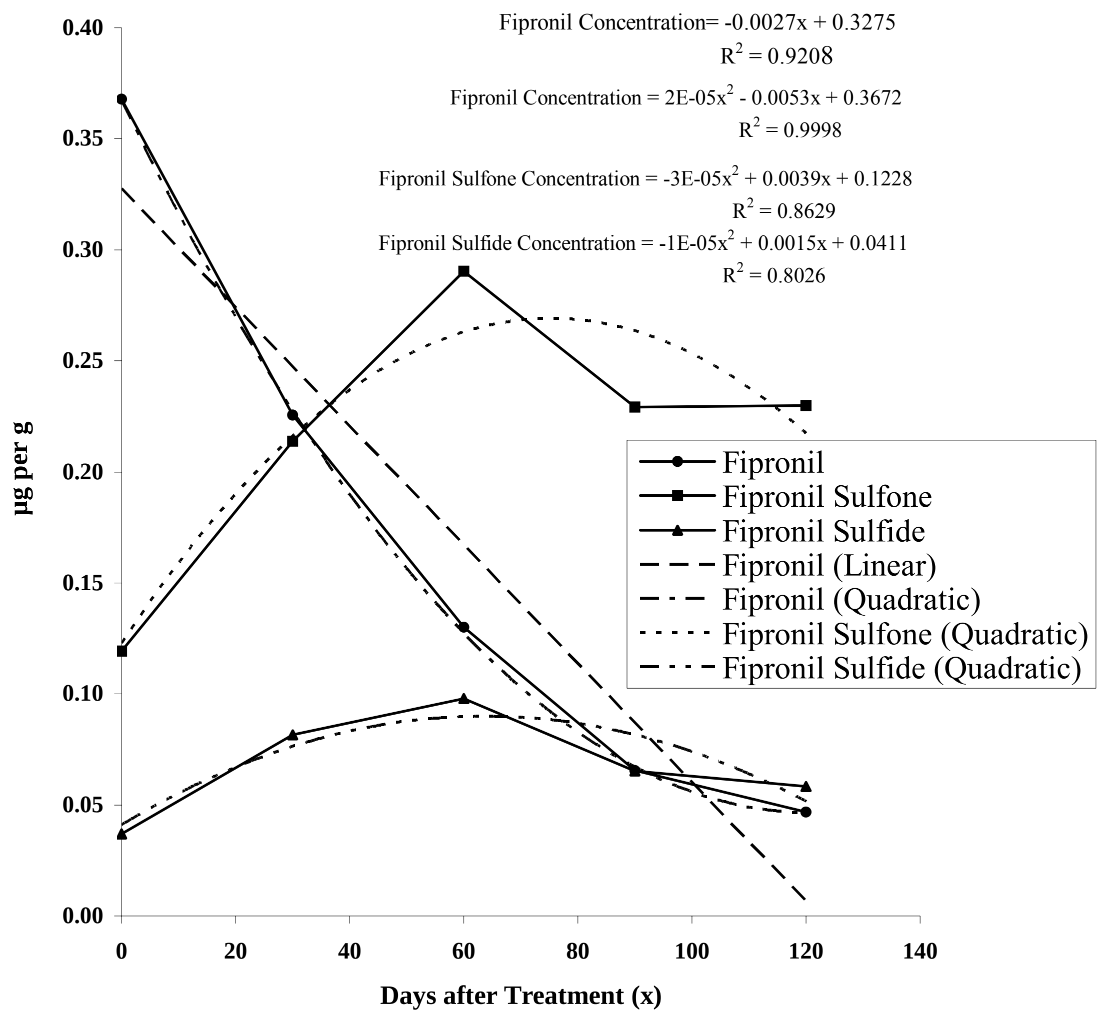

Figure 2. Mean fipronil, fipronil sulfide, and fipronil sulfone residue concentrations in soil (0-4 cm) in a bermudagrass system with time.

Degradation of parent material and appearance of metabolites with time.

Appendix A

Table 1A. Raw data and calculations used to determine the percent of applied ^{14}C labeled simazine applied to actively-growing bermudagrass (sample 101).

Sample #	Depth Code	Depth Range	Date	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Bag Roots + Soil Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Initial Concentration			05/27/04		1.60	17.54	16.11	15.94	14.51	765.5	14.42	751.1
Initial Concentration RERUN					1.60	17.54	16.11	15.94	14.51	765.5	14.4	751.1
Standard is 62825.1												
Actively Growing												
Treatment												
101	Verdure		5/25/04	1						23.3	1.31	22.0
101	A	0-2	5/25/04	1	1.55	17.88	15.21	16.33	13.66	494.5	1.31	493.2
101	B	2-4	5/25/04	3	1.55	17.04	14.45	15.49	12.90	394.3	1.31	393.0
101	C	4-6	5/25/04	5	1.54	17.55	15.27	16.01	13.73	576.3	1.31	575.0
101	D	6-8	5/25/04	7	1.55	17.28	15.48	15.73	13.93	700.2	1.31	698.9
101	E	8-10	5/25/04	9	1.57	17.15	15.49	15.58	13.92	496.8	6.22	490.6
101	F	10-15	5/25/04	12.5	1.57	17.53	15.63	15.96	14.06	1488.1	6.22	1481.9
101	G	15-20	5/25/04	17.5	1.57	17.76	15.55	16.19	13.98	1599.6	6.22	1593.4
101	H	20-25	5/25/04	22.5	1.56	17.36	15.01	15.80	13.45	1832.4	6.22	1826.2
101	I	25-30	5/25/04	27.5	1.56	17.06	14.90	15.50	13.34	1446	6.22	1439.8
101	Leachate			27.5								
101	I + Leachate			27.5								

Table 1A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 101) (Continued).

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Initial Concentration			1.27	1.21	1.18	1.27	8.88	9.86	0.91	684.41
Initial Concentration RERUN			1.25	1.07	1.29	1.29	8.88	9.86	0.91	684.41
Standard is 62825.1										
Actively Growing										
Treatment										
101	Verdure									
101	A	0-2	1.11	1.05	1.11	1.07	17.55	19.55	0.82	396.21
101	B	2-4	1.09	1.11	1.16	1.16	17.92	20.08	0.82	310.18
101	C	4-6	1.13	1.18	1.11	1.07	14.93	16.61	0.85	484.85
101	D	6-8	1.26	1.11	1.09	1.10	11.63	12.92	0.88	616.66
101	E	8-10	1.01	1.14	1.23	1.15	10.72	11.93	0.89	437.82
101	F	10-15	1.27	1.22	1.12	1.27	12.16	13.51	0.88	1301.53
101	G	15-20	1.23	1.09	1.18	1.22	14.21	15.81	0.86	1366.93
101	H	20-25	1.21	1.20	1.07	1.18	15.66	17.47	0.84	1540.27
101	I	25-30	1.21	1.13	1.14	1.20	14.50	16.19	0.86	1231.06
101	Leachate									
101	I + Leachate									

Table 1A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 101) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Initial Concentration			18415	17246	16159.1	17626.1	14,500	14,253	13,694	13,879	14,081
Initial Concentration RERUN			17556.9	14558.3	17839.5	17484.8	14,046	13,606	13,829	13,554	13,759
Standard is 62825.1											
Actively Growing											
Treatment											
101	Verdure										
101	A	0-2	10066.9	12080.5	8780.7	9829.9	9,069	11,505	7,911	9,187	9,418
101	B	2-4	3283.0	4297.8	3035.7	3572.3	3,012	3,872	2,617	3,080	3,145
101	C	4-6	2071.6	2386.2	2073.1	1983.9	1,833	2,022	1,868	1,854	1,894
101	D	6-8	1051.0	822.0	880.5	943.4	834	741	808	858	810
101	E	8-10	541.0	670.1	559.6	611.1	536	588	455	531	527
101	F	10-15	332.3	375.6	367.6	323.9	262	308	328	255	288
101	G	15-20	137.9	242.8	153.9	155.3	112	223	130	127	148
101	H	20-25	67.6	90.2	59.0	68.0	56	75	55	58	61
101	I	25-30	47.2	36.9	43.2	69.0	39	33	38	58	42
101	Leachate										
101	I + Leachate										

Table 1A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 101) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Initial Concentration			15,912	15,641	15,028	15,231	0.887	14,109	13,869	13,325	13,505
Initial Concentration RERUN			15,414	14,931	15,176	14,874	1.070	16,488	15,971	16,233	15,911
Standard is 62825.1											
Actively Growing											
Treatment											
101	Verdure										
101	A	0-2	11,000	13,955	9,595	11,143	0.995	10,946	13,885	9,547	11,087
101	B	2-4	3,670	4,717	3,188	3,752	0.995	3,651	4,694	3,173	3,733
101	C	4-6	2,155	2,377	2,195	2,180	0.995	2,144	2,365	2,185	2,169
101	D	6-8	944	838	914	970	1.035	977	868	946	1,005
101	E	8-10	600	658	510	595	1.035	621	682	528	616
101	F	10-15	298	350	374	290	1.035	308	363	387	301
101	G	15-20	131	260	152	148	1.016	133	264	154	151
101	H	20-25	66	89	65	68	1.016	67	91	66	69
101	I	25-30	46	38	44	67	1.016	46	39	45	68
101	Leachate										
101	I + Leachate										

Table 1A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 101) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Initial Concentration			34.85	14,074.2	13,833.8	13,290.1	13,469.8	13,667
Initial Concentration RERUN			47.7	16,439.8	15,923.7	16,185.7	15,863.0	16,103
Standard is 62825.1								
Actively Growing Treatment								
101	Verdure							
101	A	0-2	34.1	10,911.4	13,851.3	9,512.9	11,053.3	11,332
101	B	2-4	34.1	3,617.3	4,659.8	3,138.5	3,699.3	3,779
101	C	4-6	34.1	2,110.2	2,331.2	2,150.4	2,134.6	2,182
101	D	6-8	34.1	943.0	833.4	912.2	970.6	915
101	E	8-10	34.1	587.0	647.5	493.4	582.0	577
101	F	10-15	34.1	274.3	328.7	352.7	266.5	306
101	G	15-20	34.1	98.7	229.7	120.4	116.7	141
101	H	20-25	34.1	33.2	56.4	32.3	35.3	39
101	I	25-30	34.1	12.3	4.7	10.9	34.2	16
101	Leachate			.	.	.	.	
101	I + Leachate			.	.	.	.	

Table 1A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 101) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Initial Concentration			9,353,813	.	.	9,353,813	85.39	83.22	1.026	102.6	.	.
Initial Concentration RERUN			11,021,106	.	.	11,021,106	100.61	83.22	1.209	120.9	.	.
Standard is 62825.1												
Actively Growing												
Treatment												
101	Verdure		.	813,640	248,189	1,061,829	9.69	88.40	0.110	11.0	0.11	.
101	A	0-2	4,489,954	268,291	.	4,758,244	43.44	88.40	0.491	49.1	0.49	3.34
101	B	2-4	1,172,097	82,044	.	1,254,141	11.45	88.40	0.130	13.0	0.39	3.34
101	C	4-6	1,057,742	28,356	.	1,086,099	9.91	88.40	0.112	11.2	0.56	3.34
101	D	6-8	564,122	3,711	.	567,833	5.18	88.40	0.059	5.9	0.41	3.34
101	E	8-10	252,829	605	.	253,434	2.31	88.40	0.026	2.6	0.24	3.34
101	F	10-15	397,663	280	.	397,943	3.63	88.40	0.041	4.1	0.51	3.34
101	G	15-20	193,225	.	.	193,225	1.76	88.40	0.020	2.0	0.35	3.34
101	H	20-25	60,567	.	.	60,567	0.55	88.40	0.006	0.6	0.14	3.34
101	I	25-30	19,116	.	.	19,116	0.17	88.40	0.002	0.2	0.05	3.34
101	Leachate		30,642	.	.	30,642	0.28	88.40	0.003	0.3	0.09	3.34
101	I + Leachate		49,758	.	.	49,758	0.45	88.40	0.005	0.5	0.14	3.34
Actively Growing							88.40				3.34	

Table 1B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 102).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Actively Growing												
Treatment												
102	Verdure			1						34.37	1.31	33.1
102	A	0-2	5/27/04	1	1.55	17.83	15.00	16.28	13.45	448.8	1.31	447.5
102	B	2-4	5/27/04	3	1.55	17.32	14.42	15.77	12.87	592.8	1.31	591.5
102	C	4-6	5/27/04	5	1.54	17.24	14.96	15.70	13.42	482.7	1.31	481.4
102	D	6-8	5/27/04	7	1.55	17.04	15.18	15.49	13.63	528.3	1.31	527.0
102	E	8-10	5/27/04	9	1.57	17.87	16.04	16.30	14.47	480.3	6.22	474.1
102	F Big Bug Skeleton	10-15	5/27/04	12.5	1.57	16.99	15.21	15.42	13.64	1690.7	6.22	1684.5
102	G	15-20	5/27/04	17.5	1.56	17.82	15.72	16.26	14.16	1825	6.22	1818.8
102	H	20-25	5/27/04	22.5	1.56	17.43	15.28	15.87	13.72	1555.6	6.22	1549.4
102	I	25-30	5/27/04	27.5	1.56	17.22	15.03	15.66	13.47	1361.6	6.22	1355.4
102	Leachate			27.5								
102	I + Leachate			27.5								

Table 1B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 102) (Continued).

Sample #	Depth Code	Depth Range	4 min Combustion Cycle Sub Sample 1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Actively Growing Treatment										
102	Verdure									
102	A	0-2	1.25	1.13	1.27	1.26	18.87	21.04	0.81	354.08
102	B	2-4	1.23	1.18	1.11	1.15	20.11	22.53	0.80	462.18
102	C	4-6	1.28	1.29	1.28	1.18	15.24	16.99	0.85	405.96
102	D	6-8	1.23	1.25	1.26	1.16	12.25	13.65	0.88	461.60
102	E	8-10	1.24	1.28	1.14	1.28	11.41	12.65	0.89	419.40
102	F Big Bug Skeleton	10-15	1.26	1.17	1.13	1.11	11.70	13.05	0.88	1486.83
102	G	15-20	1.14	1.25	1.17	1.19	13.36	14.83	0.87	1575.81
102	H	20-25	1.20	1.24	1.18	1.18	14.07	15.67	0.86	1331.37
102	I	25-30	1.22	1.20	1.13	1.21	14.57	16.26	0.85	1157.89
102	Leachate									
102	I + Leachate									

Table 1B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 102) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Actively Growing											
Treatment											
102	Verdure										
102	A	0-2	9062.8	7504	8076.5	8672.6	7,250	6,641	6,359	6,883	6,783
102	B	2-4	4235.6	3808.2	3078.4	4141.1	3,444	3,227	2,773	3,601	3,261
102	C	4-6	1728.8	1455.4	1543.2	1461.2	1,351	1,128	1,206	1,238	1,231
102	D	6-8	917	858.6	845.2	805.6	746	687	671	694	699
102	E	8-10	687.5	689	661.6	636.5	554	538	580	497	543
102	F Big Bug Skeleton	10-15	247	316.4	295.5	252.8	196	270	262	228	239
102	G	15-20	308.2	231.6	247.2	264.8	270	185	211	223	222
102	H	20-25	118.9	104.8	120.7	117.4	99	85	102	99	96
102	I	25-30	120.9	59.7	64.9	83.8	99	50	57	69	69
102	Leachate										
102	I + Leachate										

Table 1B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 102) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Actively Growing											
Treatment											
102	Verdure										
102	A	0-2	8,936	8,185	7,838	8,484	0.91936	8,216	7,525	7,206	7,799
102	B	2-4	4,310	4,040	3,471	4,507	0.91936	3,963	3,714	3,192	4,144
102	C	4-6	1,593	1,331	1,422	1,461	0.91936	1,465	1,224	1,308	1,343
102	D	6-8	850	783	764	791	0.95471	811	747	730	756
102	E	8-10	626	608	655	561	0.95471	597	580	625	536
102	F Big Bug Skeleton	10-15	222	306	296	258	0.95471	212	292	283	246
102	G	15-20	312	214	244	257	0.98469	307	211	240	253
102	H	20-25	115	98	119	116	0.98469	114	97	117	114
102	I	25-30	116	58	67	81	0.98469	114	57	66	80
102	Leachate										
102	I + Leachate										

Table 1B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 102) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Actively Growing								
Treatment								
102	Verdure			.	.	.	.	
102	A	0-2	34.85	8,180.8	7,490.1	7,171.4	7,764.6	7,652
102	B	2-4	34.85	3,928.0	3,679.1	3,156.7	4,109.1	3,718
102	C	4-6	34.85	1,430.1	1,188.9	1,272.9	1,308.3	1,300
102	D	6-8	34.85	776.3	712.5	695.0	720.8	726
102	E	8-10	34.85	562.6	545.2	590.6	501.0	550
102	F Big Bug Skeleton	10-15	34.85	177.1	257.5	247.9	211.4	223
102	G	15-20	34.85	272.4	175.7	205.3	218.0	218
102	H	20-25	34.85	78.7	62.0	82.4	79.2	76
102	I	25-30	34.85	79.4	22.5	31.4	45.0	45
102	Leachate			.	.	.	.	
102	I + Leachate			.	.	.	.	

Table 1B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 102) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Actively Growing Treatment												
102	Verdure		.	1,328,734	306,496	1,635,230	14.93	77.85	0.192	19.2	0.19	.
102	A	0-2	2,709,321	206,365	.	2,915,686	26.62	77.85	0.342	34.2	0.34	4.19
102	B	2-4	1,718,482	151,499	.	1,869,981	17.07	77.85	0.219	21.9	0.66	4.19
102	C	4-6	527,764	12,716	.	540,481	4.93	77.85	0.063	6.3	0.32	4.19
102	D	6-8	335,184	3,275	.	338,459	3.09	77.85	0.040	4.0	0.28	4.19
102	E	8-10	230,613	1,652	.	232,265	2.12	77.85	0.027	2.7	0.25	4.19
102	F Big Bug Skeleton	10-15	332,292	1,197	.	333,488	3.04	77.85	0.039	3.9	0.49	4.19
102	G	15-20	343,314	.	.	343,314	3.13	77.85	0.040	4.0	0.70	4.19
102	H	20-25	100,591	.	.	100,591	0.92	77.85	0.012	1.2	0.27	4.19
102	I	25-30	51,583	.	.	51,583	0.47	77.85	0.006	0.6	0.17	4.19
102	Leachate		166,692	.	.	166,692	1.52	77.85	0.020	2.0	0.54	4.19
102	I + Leachate		218,275	.	.	218,275	1.99	77.85	0.026	2.6	0.70	4.19
Actively Growing							77.85				4.19	

Table 1C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 103).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Actively Growing												
Treatment												
103	Verdure		5/26/04	1						33.46	1.31	32.2
103	A	0-2	5/26/04	1	1.59	17.54	15.01	15.95	13.42	265.6	1.31	264.3
103	B	2-4	5/26/04	3	1.58	17.64	14.67	16.06	13.09	457.9	1.31	456.6
103	C	4-6	5/26/04	5	1.57	17.69	14.85	16.12	13.28	344.3	1.31	343.0
103	D	6-8	5/26/04	7	1.76	17.37	15.20	15.61	13.44	684	1.31	682.7
103	E	8-10	5/26/04	9	1.70	17.72	15.62	16.02	13.92	673	6.22	666.8
103	F	10-15	5/26/04	12.5	1.62	17.33	15.53	15.71	13.91	1796.2	6.22	1790.0
103	G	15-20	5/26/04	17.5	1.61	17.78	15.76	16.17	14.15	1873.3	6.22	1867.1
103	H	20-25	5/26/04	22.5	1.71	17.23	15.08	15.52	13.37	1419.2	6.22	1413.0
103	I	25-30	5/26/04	27.5	1.73	17.77	15.67	16.04	13.94	1655.1	6.22	1648.9
103	Leachate			27.5								
103	I + Leachate			27.5								

Table 1C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 103) (Continued).

			4 min Combustion Cycle								
			Sub Sample				Water Content				Soil-Roots Total
			1	2	3	4	% Moisture	% Moisture	Dry Soil		Section
Sample #	Depth Code	Depth Range	Burn Weight (g)	Burn Weight (g)	Burn Weight (g)	Burn Weight (g)	**Wet** Weight Basis	Dry Weight Basis	Fraction		Dry Weight (g)
Actively Growing Treatment											
103	Verdure		large volume of A require to get this weight								
103	A	0-2	1.14	1.18	1.12	1.17	16.86	18.85	0.83		214.93
103	B	2-4	1.22	1.11	1.14	1.12	20.25	22.69	0.80		356.37
103	C	4-6	1.17	1.24	1.15	1.20	19.12	21.39	0.81		272.18
103	D	6-8	1.17	1.15	1.12	1.08	14.28	16.15	0.86		583.07
103	E	8-10	1.12	1.13	1.18	1.25	13.44	15.09	0.87		576.60
103	F	10-15	1.24	1.13	1.23	1.18	11.59	12.94	0.88		1582.03
103	G	15-20	1.19	1.19	1.11	1.20	12.82	14.28	0.87		1627.77
103	H	20-25	1.27	1.14	1.15	1.13	14.26	16.08	0.86		1211.53
103	I	25-30	1.22	1.25	1.18	1.14	13.40	15.06	0.87		1427.91
103	Leachate										
103	I + Leachate										

Table 1C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 103) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Actively Growing											
Treatment											
103	Verdure										
103	A	0-2	14481	11259.1	10306.7	12966.6	12,703	9,542	9,202	11,083	10,632
103	B	2-4	6564	5413.6	6084.7	6084.7	5,380	4,877	5,337	5,433	5,257
103	C	4-6	2587.2	2946.8	3197.4	2479.8	2,211	2,376	2,780	2,067	2,359
103	D	6-8	1571.1	1731.6	1630.8	1406	1,343	1,506	1,456	1,302	1,402
103	E	8-10	596.7	602.7	635.9	613.2	533	533	539	491	524
103	F	10-15	488.6	436.5	453	378.9	394	386	368	321	367
103	G	15-20	200.2	296.6	193.3	220.2	168	249	174	184	194
103	H	20-25	45.6	60	65	62.9	36	53	57	56	50
103	I	25-30	44.9	42.6	41.5	39.5	37	34	35	35	35
103	Leachate										
103	I + Leachate										

Table 1C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 103) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Actively Growing											
Treatment											
103	Verdure										
103	A	0-2	15,278	11,476	11,068	13,329	0.9425	14,399	10,816	10,432	12,563
103	B	2-4	6,746	6,115	6,692	6,812	0.9425	6,358	5,764	6,308	6,420
103	C	4-6	2,734	2,938	3,438	2,555	0.9425	2,577	2,769	3,240	2,408
103	D	6-8	1,566	1,757	1,699	1,519	0.95971	1,503	1,686	1,630	1,457
103	E	8-10	616	616	623	567	0.95971	591	591	598	544
103	F	10-15	446	437	417	363	0.95971	428	419	400	349
103	G	15-20	193	286	200	210	0.98331	190	281	196	207
103	H	20-25	42	61	66	65	0.98331	41	60	65	64
103	I	25-30	42	39	41	40	0.98331	42	39	40	39
103	Leachate										
103	I + Leachate										

Table 1C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 103) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Actively Growing								
Treatment								
103	Verdure			.	.	.	.	
103	A	0-2	36.05	14,363.2	10,780.0	10,395.5	12,526.7	12,016
103	B	2-4	36.05	6,322.1	5,727.5	6,271.5	6,384.1	6,176
103	C	4-6	36.05	2,540.9	2,733.4	3,204.1	2,372.2	2,713
103	D	6-8	36.05	1,467.3	1,649.7	1,594.1	1,421.4	1,533
103	E	8-10	36.05	554.7	555.3	561.5	507.9	545
103	F	10-15	36.05	391.7	383.3	363.7	312.5	363
103	G	15-20	36.05	153.7	245.1	160.4	170.9	183
103	H	20-25	36.05	5.1	24.3	28.8	27.8	21
103	I	25-30	36.05	5.7	2.6	3.9	3.3	4
103	Leachate			.	.	.	.	
103	I + Leachate			.	.	.	.	

Table 1C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to the initial soil standard and to actively-growing bermudagrass (sample 103) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Actively Growing												
Treatment												
103	Verdure		.	1,113,134	275,378	1,388,512	12.68	86.90	0.146	14.6	0.15	.
103	A	0-2	2,582,717	220,072	.	2,802,789	25.59	86.90	0.294	29.4	0.29	4.16
103	B	2-4	2,201,032	140,131	.	2,341,162	21.37	86.90	0.246	24.6	0.74	4.16
103	C	4-6	738,317	35,755	.	774,072	7.07	86.90	0.081	8.1	0.41	4.16
103	D	6-8	893,914	21,826	.	915,740	8.36	86.90	0.096	9.6	0.67	4.16
103	E	8-10	314,150	1,693	.	315,843	2.88	86.90	0.033	3.3	0.30	4.16
103	F	10-15	573,965	1,111	.	575,077	5.25	86.90	0.060	6.0	0.76	4.16
103	G	15-20	297,084	.	.	297,084	2.71	86.90	0.031	3.1	0.55	4.16
103	H	20-25	26,045	.	.	26,045	0.24	86.90	0.003	0.3	0.06	4.16
103	I	25-30	5,556	.	.	5,556	0.05	86.90	0.001	0.1	0.02	4.16
103	Leachate		77,113	.	.	77,113	0.70	86.90	0.008	0.8	0.22	4.16
103	I + Leachate		82,669	.	.	82,669	0.75	86.90	0.009	0.9	0.24	4.16
							86.90				4.16	

Table 2A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 201).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Dormant												
201	Verdure		5/20/04	1						25.22	1.31	23.9
201	A	0-2	5/20/04	1	1.60	17.72	13.55	16.12	11.95	652.9	1.31	651.6
201	B	2-4	5/20/04	3	1.57	17.44	13.49	15.87	11.92	689.8	1.31	688.5
201	C	4-6	5/20/04	5	1.57	17.10	13.99	15.53	12.42	402	1.31	400.7
201	D	6-8	5/20/04	7	1.60	17.18	14.53	15.58	12.93	498.5	1.31	497.2
201	E	8-10	5/20/04	9	1.67	17.45	15.04	15.78	13.37	519.7	6.22	513.5
201	F	10-15	5/20/04	12.5	1.59	17.45	14.86	15.86	13.27	1565.6	6.22	1559.4
201	G	15-20	5/20/04	17.5	1.60	17.70	15.22	16.10	13.62	1694.1	6.22	1687.9
201	H	20-25	5/20/04	22.5	1.67	17.63	15.32	15.96	13.65	2236.4	6.22	2230.2
201	I	25-30	5/20/04	27.5	1.64	17.44	14.97	15.80	13.33	1331.9	6.22	1325.7
201	Leachate			27.5								
201	I + Leachate			27.5								

Table 2A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 201) (Continued).

Sample #	Depth Code	Depth Range	4 min Combustion Cycle Sub Sample 1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Dormant										
201	Verdure		large volume of A require to get this weight							
201	A	0-2	1.07	1.13	1.25	1.05	30.77	34.90	0.69	441.53
201	B	2-4	1.09	1.13	1.01	1.23	29.28	33.14	0.71	480.57
201	C	4-6	1.12	1.11	1.22	1.14	22.23	25.04	0.78	310.90
201	D	6-8	1.18	1.24	1.15	1.11	18.24	20.49	0.82	406.08
201	E	8-10	1.11	1.04	1.05	1.12	16.02	18.03	0.84	430.92
201	F	10-15	1.14	1.07	1.07	1.15	17.43	19.52	0.83	1287.33
201	G	15-20	1.20	1.03	1.06	1.09	16.29	18.21	0.84	1412.80
201	H	20-25	1.08	1.16	1.06	1.10	15.08	16.92	0.85	1893.91
201	I	25-30	1.04	1.13	1.05	1.17	16.50	18.53	0.84	1106.95
201	Leachate									
201	I + Leachate									

Table 2A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 201) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Dormant											
201	Verdure										
201	A	0-2	6782.2	5565.9	5147.4	5867.8	6,339	4,926	4,118	5,588	5,243
201	B	2-4	2146.9	3768.6	3607.7	2456.7	1,970	3,335	3,572	1,997	2,718
201	C	4-6	1789.3	1976	1998.6	1834.9	1,598	1,780	1,638	1,610	1,656
201	D	6-8	1398.6	1193.6	1192.3	1217.9	1,185	963	1,037	1,097	1,070
201	E	8-10	748.1	688.8	678.1	729.1	674	662	646	651	658
201	F	10-15	322	295.8	331	332.7	282	276	309	289	289
201	G	15-20	92.8	106.7	96.1	78.5	77	104	91	72	86
201	H	20-25	60.9	107.6	133.3	55.9	56	93	126	51	81
201	I	25-30	117.9	128.1	163.3	129	113	113	156	110	123
201	Leachate										
201	I + Leachate										

Table 2A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 201) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Dormant											
201	Verdure										
201	A	0-2	9,156	7,115	5,949	8,073	0.98364	9,007	6,999	5,851	7,941
201	B	2-4	2,785	4,716	5,051	2,824	0.98364	2,740	4,639	4,968	2,778
201	C	4-6	2,054	2,289	2,106	2,070	0.98364	2,021	2,252	2,072	2,036
201	D	6-8	1,450	1,177	1,268	1,342	0.98102	1,422	1,155	1,244	1,316
201	E	8-10	803	789	769	775	0.98102	787	774	754	760
201	F	10-15	342	335	375	350	0.98102	336	328	368	344
201	G	15-20	92	124	108	86	0.94489	87	117	102	81
201	H	20-25	66	109	148	60	0.94489	63	103	140	57
201	I	25-30	136	136	186	132	0.94489	128	128	176	125
201	Leachate										
201	I + Leachate										

Table 2A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 201) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Dormant								
201	Verdure			.	.	.	.	
201	A	0-2	32	8,974.5	6,966.9	5,819.2	7,908.7	7,417
201	B	2-4	32	2,707.6	4,606.7	4,936.3	2,746.1	3,749
201	C	4-6	32	1,988.6	2,219.6	2,040.0	2,003.8	2,063
201	D	6-8	32	1,390.1	1,123.0	1,212.0	1,284.5	1,252
201	E	8-10	32	755.3	741.7	722.4	728.5	737
201	F	10-15	32	303.6	296.4	335.5	311.7	312
201	G	15-20	32	55.3	84.9	70.3	49.3	65
201	H	20-25	32	30.7	71.2	107.9	24.5	59
201	I	25-30	32	96.3	96.3	144.0	92.8	107
201	Leachate			.	.	.	.	
201	I + Leachate			.	.	.	.	

Table 2A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 201) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Dormant												
201	Verdure		.	1,061,930	.	1,061,930	9.69	85.27	0.114	11.4	0.11	.
201	A	0-2	3,275,003	418,654	.	3,693,657	33.72	85.27	0.395	39.5	0.40	4.93
201	B	2-4	1,801,736	85,857	.	1,887,593	17.23	85.27	0.202	20.2	0.61	4.93
201	C	4-6	641,395	8,744	.	650,139	5.94	85.27	0.070	7.0	0.35	4.93
201	D	6-8	508,571	2,459	.	511,030	4.67	85.27	0.055	5.5	0.38	4.93
201	E	8-10	317,586	1,600	.	319,186	2.91	85.27	0.034	3.4	0.31	4.93
201	F	10-15	401,418	664	.	402,081	3.67	85.27	0.043	4.3	0.54	4.93
201	G	15-20	91,786	169	.	91,955	0.84	85.27	0.010	1.0	0.17	4.93
201	H	20-25	110,991	.	.	110,991	1.01	85.27	0.012	1.2	0.27	4.93
201	I	25-30	118,810	.	.	118,810	1.08	85.27	0.013	1.3	0.35	4.93
201	Leachate		493,684	.	.	493,684	4.51	85.27	0.053	5.3	1.45	4.93
201	I + Leachate		612,494	.	.	612,494	5.59	85.27	0.066	6.6	1.80	4.93
							85.27				4.93	

Table 2B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 202).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Dormant												
202	Verdure		5/21/04	1						36.1	1.31	34.8
202	A	0-2	5/21/04	1	1.59	17.32	13.49	15.73	11.90	753.8	1.31	752.5
202	B	2-4	5/21/04	3	1.58	17.12	13.80	15.54	12.22	573.6	1.31	572.3
202	C	4-6	5/21/04	5	1.58	17.43	14.57	15.85	12.99	553	1.31	551.7
202	D	6-8	5/21/04	7	1.75							
202	E	8-10	5/21/04	9	1.71							
202	D&Ecombined	6-10		8		17.03	14.57	17.03	14.57	760.8	1.31	759.5
202	F **GRUBc+3pupa**	10-15	5/21/04	12.5	1.61	17.18	14.81	15.57	13.20	1623.3	6.22	1617.1
202	G	15-20	5/21/04	17.5	1.62	17.52	15.08	15.90	13.46	1788.3	6.22	1782.1
202	H	20-25	5/21/04	22.5	1.74	17.52	15.14	15.78	13.40	1183.5	6.22	1177.3
202	I	25-30	5/21/04	27.5	1.71	17.62	15.17	15.91	13.46	2392.5	6.22	2386.3
202	Leachate			27.5								
202	I + Leachate			27.5								
202	A ReRUN		6/16/04	1.0	1.56	17.23	15.55	15.67	13.99	753.8	1.3	752.5
202	F RERUN		6/16/04	12.5	1.57	17.39	16.40	15.82	14.83	1623.3	6.2	1617.1

Table 2B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 202) (Continued).

Sample #	Depth Code	Depth Range	4 min Combustion Cycle Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Dormant										
202	Verdure		I							
202	A	0-2	1.22	1.06	1.22	1.14	28.39	32.18	0.72	521.26
202	B	2-4	1.04	1.16	1.12	1.05	24.06	27.17	0.76	429.28
202	C	4-6	1.08	1.12	1.21	1.14	19.63	22.02	0.80	442.62
202	D	6-8								315.41
202	E	8-10								315.41
202	D&Ecombined	6-10	1.28	1.22	1.11	1.21	16.88	16.88	0.83	630.81
202	F **GRUBc+3pupa**	10-15	1.04	1.12	1.18	1.09	16.00	17.95	0.84	1357.97
202	G	15-20	1.02	1.08	1.14	1.07	16.18	18.13	0.84	1493.73
202	H	20-25	1.22	1.10	1.14	1.13	15.72	17.76	0.84	992.21
202	I	25-30	1.15	1.13	1.16	1.13	16.15	18.20	0.84	2000.89
202	Leachate									
202	I + Leachate									
202	A ReRUN		1.10	1.13			10.80	12.01	0.89	671.19
202	F RERUN		1.01	1.16			6.04	6.68	0.94	1519.46

Table 2B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 202) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Dormant											
202	Verdure										
202	A	0-2	18057.2	8092.1	9269.2	8637.3	14,801	7,634	7,598	7,577	9,402
202	B	2-4	2725.9	3003.7	3099.8	2498	2,621	2,589	2,768	2,379	2,589
202	C	4-6	1023.8	1210.6	1181.8	1087.4	948	1,081	977	954	990
202	D	6-8									
202	E	8-10									
202	D&Ecombined	6-10	192.8	86.6	97.5	112.9	151	71	88	93	101
202	F **GRUBc+3pupa**	10-15	183	138.5	170	85	176	124	144	78	130
202	G	15-20	177	198.9	171.1	176.4	174	184	150	165	168
202	H	20-25	143.3	114.9	113.6	125.7	117	104	100	111	108
202	I	25-30	206.2	238.8	175.3	148.9	179	211	151	132	168
202	Leachate										
202	I + Leachate										
202	A ReRUN		9063.2	13766.2			8,239	12,182			10,211
202	F RERUN		325.1	375.9			322	324			323

Table 2B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 202) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Dormant											
202	Verdure										
202	A	0-2	20,669	10,661	10,610	10,581	0.95528	19,745	10,184	10,136	10,107
202	B	2-4	3,451	3,410	3,644	3,133	0.95528	3,297	3,257	3,481	2,993
202	C	4-6	1,179	1,345	1,215	1,187	0.98535	1,162	1,325	1,197	1,169
202	D	6-8									
202	E	8-10									
202	D&Ecombined	6-10	181	85	106	112	0.96282	174	82	102	108
202	F **GRUBc+3pupa**	10-15	209	147	172	93	0.96282	202	142	165	89
202	G	15-20	207	220	179	197	0.9413	195	207	169	185
202	H	20-25	139	124	118	132	0.9413	131	117	111	124
202	I	25-30	214	252	180	157	0.9413	201	237	170	148
202	Leachate										
202	I + Leachate										
202	A ReRUN		9,237	13,658			0.98845	9,131	13,500		
202	F RERUN		343	345			0.98845	339	341		

Table 2B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 202) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Dormant								
202	Verdure			.	.	.	.	
202	A	0-2	31.9	9,082.8	10,152.2	10,103.7	10,075.5	9,854
202	B	2-4	31.9	3,265.1	3,225.3	3,449.6	2,960.7	3,225
202	C	4-6	31.9	1,130.3	1,293.3	1,165.5	1,137.5	1,182
202	D	6-8		71.3	25.2	34.9	38.1	42
202	E	8-10		71.3	25.2	34.9	38.1	42
202	D&Ecombined	6-10	31.9	142.6	50.3	69.9	76.2	85
202	F **GRUBc+3pupa**	10-15	31.9	169.8	109.8	133.2	57.5	118
202	G	15-20	31.9	163.0	174.9	136.6	153.2	157
202	H	20-25	31.9	99.3	84.8	79.4	92.3	89
202	I	25-30	31.9	169.4	205.3	137.7	116.0	157
202	Leachate			.	.	.	.	
202	I + Leachate			.	.	.	.	
202	A ReRUN		47.7	9,082.8	13,452.6			11,268
202	F RERUN		47.7	290.9	293.2			292

Table 2B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 202) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Dormant												
202	Verdure		.	731,876	.	731,876	6.68	86.62	0.077	7.7	0.08	.
202	A	0-2	5,136,238	553,518	.	5,689,756	51.94	86.62	0.600	60.0	0.60	4.02
202	B	2-4	1,384,496	46,984	.	1,431,480	13.07	86.62	0.151	15.1	0.45	4.02
202	C	4-6	523,026	4,421	.	527,448	4.82	86.62	0.056	5.6	0.28	4.02
202	D	6-8	13,363	311	.	13,674	0.12	86.62	0.001	0.1	0.01	4.02
202	E	8-10	13,363	311	.	13,674	0.12	86.62	0.001	0.1	0.01	4.02
202	D&Ecombined	6-10	53,454	1,243	.	54,697	0.50	86.62	0.006	0.6	0.05	4.02
202	F **GRUBc+3pupa**	10-15	159,687	630	.	160,317	1.46	86.62	0.017	1.7	0.21	4.02
202	G	15-20	234,436	.	.	234,436	2.14	86.62	0.025	2.5	0.43	4.02
202	H	20-25	88,254	.	.	88,254	0.81	86.62	0.009	0.9	0.21	4.02
202	I	25-30	314,390	.	.	314,390	2.87	86.62	0.033	3.3	0.91	4.02
202	Leachate		283,587	.	.	283,587	2.59	86.62	0.030	3.0	0.82	4.02
202	I + Leachate		597,977	.	.	597,977	5.46	86.62	0.063	6.3	1.73	4.02
202	A ReRUN		7,562,792									
202	F RERUN		443,750									
							86.62				4.02	

Table 2C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 204).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Dormant												
204	Verdure		5/24/04	1						26.74	1.31	25.4
204	A	0-2	5/24/04	1	1.60	17.08	13.37	15.48	11.77	678.8	1.31	677.5
204	B	2-4	5/24/04	3	1.58	17.46	14.07	15.88	12.49	460.1	1.31	458.8
204	C	4-6	5/24/04	5	1.58	17.76	14.61	16.18	13.03	600.9	1.31	599.6
204	D	6-8	5/24/04	7	1.76	17.12	14.53	15.36	12.77	480.8	1.31	479.5
204	E	8-10	5/24/04	9	1.71	17.18	14.78	15.47	13.07	639.5	6.22	633.3
204	F	10-15	5/24/04	12.5	1.62	17.01	14.51	15.39	12.89	1718.9	6.22	1712.7
204	G	15-20	5/24/04	17.5	1.62	17.32	14.86	15.70	13.24	1852.3	6.22	1846.1
204	H	20-25	5/24/04	22.5	1.75	17.03	14.66	15.28	12.91	1455.9	6.22	1449.7
204	I	25-30	5/24/04	27.5	1.72	18.00	15.17	16.28	13.45	1677.1	6.22	1670.9
204	Leachate			27.5								
204	I + Leachate			27.5								
204	H Rerun		6/16/04		1.75	17.03	14.66	15.28	12.91	1455.9	6.2	1449.7

Table 2C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 204) (Continued).

Sample #	Depth Code	Depth Range	4 min Combustion Cycle Sub Sample 1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Dormant										
204	Verdure		large volume of A require to get this weight							
204	A	0-2	1.22	1.22	1.04	1.08	27.75	31.52	0.72	477.48
204	B	2-4	1.24	1.08	1.14	1.12	24.09	27.14	0.76	338.87
204	C	4-6	1.28	1.21	1.11	1.13	21.56	24.17	0.78	467.45
204	D	6-8	1.19	1.13	1.24	1.16	17.83	20.28	0.82	393.29
204	E	8-10	1.12	1.15	1.28	1.14	16.24	18.36	0.84	530.09
204	F	10-15	1.24	1.14	1.16	1.17	17.23	19.39	0.83	1417.30
204	G	15-20	1.22	1.12	1.21	1.08	16.55	18.58	0.83	1540.47
204	H	20-25	1.21	1.15	1.26	1.24	16.17	18.36	0.84	1215.32
204	I	25-30	1.06	1.06	1.12	1.18	18.66	21.04	0.81	1359.17
204	Leachate									
204	I + Leachate									
204	H Rerun		1.08	1.14			16.17	18.36	0.84	1215.32

Table 2C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 204) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Dormant											
204	Verdure										
204	A	0-2	7702.8	9101.1	7693	7763.3	6,314	7,460	7,397	7,188	7,090
204	B	2-4	3697.5	2952	3439.3	3411.5	2,982	2,733	3,017	3,046	2,945
204	C	4-6	2210.5	2048.7	2012.3	2238.6	1,727	1,693	1,813	1,981	1,804
204	D	6-8	1294.4	1103.3	1299	1181.8	1,088	976	1,048	1,019	1,033
204	E	8-10	923.5	709.7	813.1	634.4	825	617	635	556	658
204	F	10-15	621.9	685.1	365	349.4	502	601	315	299	429
204	G	15-20	168.7	189.2	208.9	209.4	138	169	173	194	168
204	H	20-25	208.4	324.5	131.3	856.2	172	282	104	690	312
204	I	25-30	81	79.2	114.3	174.6	76	75	102	148	100
204	Leachate										
204	I + Leachate										
204	H Rerun		258.3	255.0			239	224			231

Table 2C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 204) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Dormant											
204	Verdure										
204	A	0-2	8,739	10,325	10,238	9,949	0.98303	8,590	10,150	10,064	9,780
204	B	2-4	3,928	3,601	3,975	4,013	0.98303	3,862	3,540	3,907	3,945
204	C	4-6	2,202	2,159	2,311	2,526	0.98303	2,164	2,122	2,272	2,483
204	D	6-8	1,324	1,188	1,275	1,240	0.92749	1,228	1,102	1,182	1,150
204	E	8-10	984	737	758	664	0.92749	913	683	703	616
204	F	10-15	606	726	380	361	0.92749	562	673	353	335
204	G	15-20	166	202	207	232	0.85691	142	173	177	199
204	H	20-25	205	337	124	824	0.85691	176	288	107	706
204	I	25-30	94	92	125	182	0.85691	80	79	108	156
204	Leachate										
204	I + Leachate										
204	H Rerun		285	267			0.98845	282	264	0	0

Table 2C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 204) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Dormant								
204	Verdure			.	.	.	.	
204	A	0-2	42.8	8,547.6	10,107.0	10,021.5	9,737.3	9,603
204	B	2-4	42.8	3,818.9	3,497.0	3,864.3	3,901.9	3,771
204	C	4-6	42.8	2,121.5	2,079.1	2,229.2	2,439.9	2,217
204	D	6-8	42.8	1,184.9	1,059.2	1,139.6	1,107.1	1,123
204	E	8-10	42.8	870.2	640.5	660.6	573.4	686
204	F	10-15	42.8	519.2	630.6	309.8	291.8	438
204	G	15-20	42.8	99.2	130.7	134.5	156.3	130
204	H	20-25	42.8	133.2	245.6	234.3	216.0	207
204	I	25-30	42.8	37.7	35.9	64.7	113.1	63
204	Leachate			.	.	.	.	
204	I + Leachate			.	.	.	.	
204	H Rerun		47.7	234.3	216.0			225

Table 2C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to dormant bermudagrass (sample 204) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Dormant												
204	Verdure		.	429,508	.	429,508	3.92	92.14	0.043	4.3	0.04	.
204	A	0-2	4,585,424	319,363	.	4,904,787	44.78	92.14	0.486	48.6	0.49	4.98
204	B	2-4	1,277,731	95,915	.	1,373,646	12.54	92.14	0.136	13.6	0.41	4.98
204	C	4-6	1,036,526	23,722	.	1,060,248	9.68	92.14	0.105	10.5	0.53	4.98
204	D	6-8	441,539	2,722	.	444,262	4.06	92.14	0.044	4.4	0.31	4.98
204	E	8-10	363,741	1,437	.	365,177	3.33	92.14	0.036	3.6	0.33	4.98
204	F	10-15	620,573	602	.	621,174	5.67	92.14	0.062	6.2	0.77	4.98
204	G	15-20	200,521	.	.	200,521	1.83	92.14	0.020	2.0	0.35	4.98
204	H	20-25	251,936	.	.	251,936	2.30	92.14	0.025	2.5	0.56	4.98
204	I	25-30	85,420	.	.	85,420	0.78	92.14	0.008	0.8	0.23	4.98
204	Leachate		356,768	.	.	356,768	3.26	92.14	0.035	3.5	0.97	4.98
204	I + Leachate		442,188	.	.	442,188	4.04	92.14	0.044	4.4	1.20	4.98
204	H Rerun		273,646									
							92.14				4.98	

Table 3A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 303).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Warm Fallow Soil Treatment												
303	A	0-2	5/6/04	1	1.61	17.73	16.75	16.12	15.14	539.8	1.31	538.5
303	B	2-4	5/6/04	3	1.58	17.49	16.49	15.91	14.91	555.5	1.31	554.2
303	C	4-6	5/6/04	5	1.57	17.26	16.17	15.69	14.60	638.7	1.31	637.4
303	D	6-8	5/6/04	7	1.61	17.20	16.04	15.59	14.43	626.3	1.31	625.0
303	E	8-10	5/6/04	9	1.68	17.24	16.02	15.56	14.34	529.4	6.22	523.2
303	F	10-15	5/6/04	12.5	1.59	17.33	15.89	15.74	14.30	1564.8	6.22	1558.6
303	G	15-20	5/6/04	17.5	1.68	17.73	15.89	16.05	14.21	1828.8	6.22	1822.6
303	H	20-25	5/6/04	22.5				0.00	0.00			
303	I	25-30	5/6/04	27.5								
303	HandICombined	20-30		25	1.62	17.49	15.24	15.87	13.62	2864.7	6.22	2858.5
303	Leachate			27.5								
303	I + Leachate			27.5								

Table 3A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 303) (Continued).

Sample #	Depth Code	Depth Range	4 min Combustion Cycle Sub Sample 1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Warm Fallow Soil Treatment										
303	A	0-2	1.04	1.06	1.13	1.10	5.85	6.47	0.94	506.98
303	B	2-4	1.08	1.01	1.01	1.06	6.06	6.71	0.94	520.58
303	C	4-6	1.00	1.00	1.17	1.11	6.74	7.47	0.93	594.42
303	D	6-8	1.09	1.14	1.09	1.16	7.23	8.04	0.93	579.79
303	E	8-10	1.18	1.04	1.14	1.13	7.62	8.51	0.92	483.34
303	F	10-15	1.09	1.15	1.14	1.03	9.06	10.07	0.91	1417.34
303	G	15-20	0.99	1.06	1.17	1.09	11.58	12.95	0.88	1611.53
303	H	20-25								1218.23
303	I	25-30								1218.23
303	HandICombined	20-30	1.09	1.15	1.29	1.29	14.76	16.52	0.85	2436.46
303	Leachate									
303	I + Leachate									

Table 3A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 303) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Warm Fallow Soil Treatment											
303	A	0-2	5992.9	6438.4	6876.2	6730.1	5,762	6,074	6,085	6,118	6,010
303	B	2-4	5406.3	5067.5	4123.4	5275.6	5,006	5,017	4,083	4,977	4,771
303	C	4-6	2898.3	2554.6	3134.1	3002.7	2,898	2,555	2,679	2,705	2,709
303	D	6-8	1840.7	1833.1	1790.8	2005.3	1,689	1,608	1,643	1,729	1,667
303	E	8-10	1053.8	1084.4	854.3	1099.3	893	1,043	749	973	914
303	F	10-15	275.4	412.1	508.1	643.5	253	358	446	625	420
303	G	15-20	66.2	73.5	72.6	86.5	67	69	62	79	69
303	H	20-25									
303	I	25-30									
303	HandICombined	20-30	44.1	45.2	54.4	44.9	40	39	42	35	39
303	Leachate										
303	I + Leachate										

Table 3A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 303) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Warm Fallow Soil Treatment											
	303 A	0-2	6,120	6,451	6,463	6,498	0.9524	5,829	6,144	6,156	6,189
	303 B	2-4	5,329	5,341	4,346	5,298	0.9524	5,075	5,087	4,139	5,046
	303 C	4-6	3,108	2,739	2,872	2,901	0.9379	2,915	2,569	2,694	2,721
	303 D	6-8	1,820	1,733	1,771	1,863	0.9379	1,707	1,626	1,661	1,748
	303 E	8-10	967	1,129	811	1,053	0.9379	907	1,059	761	988
	303 F	10-15	278	394	490	687	0.8997	250	355	441	618
	303 G	15-20	76	78	70	90	0.8997	68	71	63	81
	303 H	20-25									
	303 I	25-30									
	303 HandICombined	20-30	47	46	49	41	0.8997	43	41	45	37
	303 Leachate										
	303 I + Leachate										

Table 3A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 303) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Warm Fallow Soil Treatment			AVERAGE(31.5,39.9)					
303	A	0-2	35.7	5,793.4	6,108.6	6,119.9	6,153.4	6,044
303	B	2-4	35.7	5,039.6	5,051.3	4,103.5	5,010.4	4,801
303	C	4-6	35.7	2,879.2	2,533.5	2,658.3	2,684.9	2,689
303	D	6-8	35.7	1,671.7	1,590.0	1,625.4	1,712.1	1,650
303	E	8-10	35.7	871.0	1,022.9	725.1	952.0	893
303	F	10-15	35.7	214.3	318.8	405.3	582.4	380
303	G	15-20	35.7	32.3	34.9	27.4	45.0	35
303	H	20-25		3.5	2.9	4.4	0.5	3
303	I	25-30		3.5	2.9	4.4	0.5	3
303	HandICombined	20-30	35.7	7.0	5.8	8.8	1.0	6
303	Leachate			.	.	.	.	
303	I + Leachate			.	.	.	.	

Table 3A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 303) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Warm Fallow Soil Treatment												
303	A	0-2	3,064,134	.	.	3064134	27.97	84.04	0.333	33.3	0.33	4.17
303	B	2-4	2,499,419	.	.	2499419	22.82	84.04	0.272	27.2	0.81	4.17
303	C	4-6	1,598,394	.	.	1598394	14.59	84.04	0.174	17.4	0.87	4.17
303	D	6-8	956,535	.	.	956535	8.73	84.04	0.104	10.4	0.73	4.17
303	E	8-10	431,488	.	.	431488	3.94	84.04	0.047	4.7	0.42	4.17
303	F	10-15	538,871	.	.	538871	4.92	84.04	0.059	5.9	0.73	4.17
303	G	15-20	56,278	.	.	56278	0.51	84.04	0.006	0.6	0.11	4.17
303	H	20-25	3,449	.	.	3449	0.03	84.04	0.000	0.0	0.01	4.17
303	I	25-30	3,449	.	.	3449	0.03	84.04	0.000	0.0	0.01	4.17
303	HandICombined	20-30	13,795	.	.	13795	0.13	84.04	0.001	0.1	0.04	4.17
303	Leachate		39,938	.	.	39938	0.36	84.04	0.004	0.4	0.12	4.17
303	I + Leachate		53,733	.	.	53733	0.49	84.04	0.006	0.6	0.16	4.17
							84.04				4.17	

Table 3B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 304).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Warm Fallow Soil Treatment												
304	A	0-2	5/4/04	1	1.61	16.98	15.94	15.37	14.33	655.6	1.31	654.3
304	B	2-4	5/4/04	3	1.58	16.69	15.86	15.11	14.28	433.6	1.31	432.3
304	C	4-6	5/4/04	5	1.57	17.13	15.99	15.56	14.42	487.3	1.31	486.0
304	D	6-8	5/4/04	7	1.61	16.96	15.77	15.35	14.16	729.5	1.31	728.2
304	E	8-10	5/4/04	9	1.68	17.16	15.88	15.48	14.20	681.1	6.22	674.9
304	F	10-15	5/4/04	12.5	1.58	17.22	15.71	15.64	14.13	1544.3	6.22	1538.1
304	G	15-20	5/4/04	17.5	1.61	17.17	15.23	15.56	13.62	1596.3	6.22	1590.1
304	H	20-25	5/4/04	22.5	1.69	17.35	15.36	15.66	13.67	1416.6	6.22	1410.4
304	I	25-30	5/4/04	27.5	1.63	17.31	15.04	15.68	13.41	1792.6	6.22	1786.4
304	Leachate			27.5								
304	I + Leachate			27.5								
304	D ReRUN				1.61	16.96	15.77	15.35	14.16	729.5	1.3	728.2
304	E ReRUN				1.68	17.16	15.88	15.48	14.20	681.1	6.2	674.9

Table 3B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 304) (Continued).

Sample #	Depth Code	Depth Range	4 min Combustion Cycle Sub Sample 1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Warm Fallow Soil Treatment										
304	A	0-2	1.15	1.06	1.09	1.05	6.52	7.26	0.93	611.60
304	B	2-4	1.03	1.00	1.05	0.97	5.23	5.81	0.95	409.67
304	C	4-6	1.14	1.02	1.04	1.07	7.13	7.91	0.93	451.34
304	D	6-8	1.11	1.01	1.08	1.12	7.55	8.40	0.92	673.24
304	E	8-10	1.03	1.01	1.06	1.04	8.06	9.01	0.92	620.48
304	F	10-15	0.98	0.96	1.02	1.19	9.61	10.69	0.90	1390.24
304	G	15-20	0.92	1.09	1.08	1.10	12.74	14.24	0.87	1387.54
304	H	20-25	1.18	0.92	0.94	1.02	12.96	14.56	0.87	1227.65
304	I	25-30	1.14	0.96	1.01	1.08	15.09	16.93	0.85	1516.76
304	Leachate									
304	I + Leachate									
304	D ReRUN		1.11	1.15			7.55	8.40	0.92	673.24
304	E ReRUN		1.26	1.06			8.06	9.01	0.92	620.48

Table 3B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 304) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Warm Fallow Soil Treatment											
304	A	0-2	7038.2	6474.2	7035.5	6859.6	6,120	6,108	6,455	6,533	6,304
304	B	2-4	2059.2	3825.4	3927.4	3686.9	1,999	3,825	3,740	3,801	3,341
304	C	4-6	1289.6	1679.2	1331.3	951.9	1,131	1,646	1,280	890	1,237
304	D	6-8	914.4	1004.1	938.9	1354.6	824	994	869	1,209	974
304	E	8-10	1067.1	550.7	578	737.8	1,036	545	545	709	709
304	F	10-15	556.8	389.8	336.2	559.6	568	406	330	470	444
304	G	15-20	269.6	341.5	474.8	172.1	293	313	440	156	301
304	H	20-25	118.6	89.7	121.6	115.4	101	98	129	113	110
304	I	25-30	80.7	78	79.2	105.8	71	81	78	98	82
304	Leachate										
304	I + Leachate										
304	D ReRUN		1250.6	1534.8			1,127	1,335			1,231
304	E ReRUN		1069.6	864.3			849	815			832

Table 3B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 304) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Warm Fallow Soil Treatment											
304	A	0-2	6,547	6,534	6,905	6,989	1.05234	6,890	6,876	7,266	7,355
304	B	2-4	2,110	4,037	3,947	4,011	1.05234	2,220	4,248	4,154	4,221
304	C	4-6	1,218	1,773	1,378	958	1.05234	1,282	1,865	1,451	1,008
304	D	6-8	891	1,075	940	1,308	1.05234	938	1,132	990	1,377
304	E	8-10	1,127	593	593	772	1.05234	1,186	624	624	812
304	F	10-15	629	449	365	520	1.05234	661	473	384	547
304	G	15-20	336	359	504	179	1.05234	353	378	530	189
304	H	20-25	115	112	149	130	1.05234	122	118	156	137
304	I	25-30	83	96	92	115	1.05234	88	101	97	121
304	Leachate										
304	I + Leachate										
304	D ReRUN		1,219	1,444			0.98845	1,205	1,427		
304	E ReRUN		923	887			0.98845	913	877		

Table 3B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 304) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Warm Fallow Soil								
Treatment			AVERAGE(52.4,32.6)					
304	A	0-2	42.5	6,847.5	6,833.5	7,224.0	7,312.2	7,054
304	B	2-4	42.5	2,177.5	4,205.4	4,111.0	4,178.2	3,668
304	C	4-6	42.5	1,239.3	1,822.9	1,408.0	965.6	1,359
304	D	6-8	42.5	1,156.8	1,089.1	947.0	1,334.1	1,132
304	E	8-10	42.5	828.9	581.6	581.6	769.5	690
304	F	10-15	42.5	619.0	430.2	341.2	505.0	474
304	G	15-20	42.5	310.9	335.3	487.7	146.2	320
304	H	20-25	42.5	79.0	75.4	113.9	94.3	91
304	I	25-30	42.5	45.2	58.2	54.7	78.9	59
304	Leachate			.	.	.	.	
304	I + Leachate			.	.	.	.	
304	D ReRUN		47.7	1,156.8	1,379.2			1,268
304	E ReRUN		47.7	864.9	828.9			847

Table 3B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 304) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Warm Fallow Soil Treatment												
304	A	0-2	4,314,426	.	.	4314426	39.39	83.22	0.473	47.3	0.47	5.19
304	B	2-4	1,502,678	.	.	1502678	13.72	83.22	0.165	16.5	0.49	5.19
304	C	4-6	613,352	.	.	613352	5.60	83.22	0.067	6.7	0.34	5.19
304	D	6-8	761,955	.	.	761955	6.96	83.22	0.084	8.4	0.59	5.19
304	E	8-10	428,386	.	.	428386	3.91	83.22	0.047	4.7	0.42	5.19
304	F	10-15	658,780	.	.	658780	6.01	83.22	0.072	7.2	0.90	5.19
304	G	15-20	444,036	.	.	444036	4.05	83.22	0.049	4.9	0.85	5.19
304	H	20-25	111,274	.	.	111274	1.02	83.22	0.012	1.2	0.27	5.19
304	I	25-30	89,884	.	.	89884	0.82	83.22	0.010	1.0	0.27	5.19
304	Leachate		190,852.1	.	.	190852	1.74	83.22	0.021	2.1	0.58	5.19
304	I + Leachate		280,736	.	.	280736	2.56	83.22	0.031	3.1	0.85	5.19
				92,817								
304	D ReRUN		853,671									
304	E ReRUN		525,505									
							83.22				5.19	

Table 3C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 307).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Warm Fallow Soil Treatment												
307	A	0-2	5/5/04	1	1.59	17.38	16.42	15.79	14.83	1022.3	1.31	1021.0
307	B	2-4	5/5/04	3	1.58	17.08	16.04	15.50	14.46	797.8	1.31	796.5
307	C	4-6	5/5/04	5	1.59	17.69	16.57	16.10	14.98	481.3	1.31	480.0
307	D	6-8	5/5/04	7	1.77	17.25	16.06	15.48	14.29	383.1	1.31	381.8
307	E	8-10	5/5/04	9	1.75	16.95	15.74	15.20	13.99	638.7	6.22	632.5
307	F	10-15	5/5/04	12.5	1.61	17.21	15.70	15.60	14.09	1571.2	6.22	1565.0
307	G	15-20	5/5/04	17.5	1.63	17.31	15.24	15.68	13.61	1478	6.22	1471.8
307	H	20-25	5/5/04	22.5	1.65	17.42	15.27	15.77	13.62	1530.7	6.22	1524.5
307	I	25-30	5/5/04	27.5	1.70	17.04	14.84	15.34	13.14	1472.1	6.22	1465.9
307	Leachate			27.5								
307	I + Leachate			27.5								
307	A Rerun		6/16/04		1.59	17.38	16.42	15.79	14.83	1022.3	1.3	1021.0

Table 3C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 307) (Continued).

Sample #	Depth Code	Depth Range	4 min Combustion Cycle Sub Sample 1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Warm Fallow Soil Treatment										
307	A	0-2	1.12	1.04	1.08	1.04	5.85	6.47	0.94	961.30
307	B	2-4	1.14	1.01	1.02	1.06	6.48	7.19	0.94	744.85
307	C	4-6	0.99	1.12	1.03	1.04	6.76	7.48	0.93	447.55
307	D	6-8	0.99	1.12	1.04	1.13	7.41	8.33	0.93	353.50
307	E	8-10	1.12	1.04	0.98	1.19	7.69	8.65	0.92	583.86
307	F	10-15	1.02	1.01	0.99	1.08	9.62	10.72	0.90	1414.46
307	G	15-20	1.04	1.03	1.02	1.02	13.58	15.21	0.86	1271.87
307	H	20-25	1.12	1.05	1.14	1.08	14.08	15.79	0.86	1309.83
307	I	25-30	1.03	1.13	1.15	1.04	14.82	16.74	0.85	1248.57
307	Leachate									
307	I + Leachate									
307	A Rerun		1.09	1.11	1.10		5.85	6.47	0.94	961.30

Table 3C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 307) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Warm Fallow Soil Treatment											
307	A	0-2	6982.4	5520.7	7841.8	5147.6	6,234	5,308	7,261	4,950	5,938
307	B	2-4	3652.7	3467	2626.9	2848.8	3,204	3,433	2,575	2,688	2,975
307	C	4-6	1538.3	1998.3	1557	1494.5	1,554	1,784	1,512	1,437	1,572
307	D	6-8	1134.3	1292.3	1126.6	1252.5	1,146	1,154	1,083	1,108	1,123
307	E	8-10	869.5	781.3	721	786.8	776	751	736	661	731
307	F	10-15	444.9	325.8	295.7	223.9	436	323	299	207	316
307	G	15-20	194.2	113.1	151.9	136.5	187	110	149	134	145
307	H	20-25	83.9	92.1	87.2	84.5	75	88	76	78	79
307	I	25-30	81.6	67.4	81.2	75.1	79	60	71	72	70
307	Leachate										
307	I + Leachate										
307	A Rerun		5688.9	5730.4	5683.9		5,219	5,163	5,167		5,183

Table 3C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 307) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Warm Fallow Soil Treatment											
307	A	0-2	6,621	5,638	7,712	5,257	0.99168	6,566	5,591	7,648	5,213
307	B	2-4	3,426	3,671	2,754	2,874	0.99168	3,398	3,640	2,731	2,850
307	C	4-6	1,666	1,914	1,621	1,541	0.99168	1,653	1,898	1,608	1,528
307	D	6-8	1,237	1,246	1,170	1,197	1.03827	1,285	1,294	1,215	1,243
307	E	8-10	841	814	797	716	1.03827	873	845	827	744
307	F	10-15	483	357	330	229	1.03827	501	371	343	238
307	G	15-20	216	127	172	155	1.03151	223	131	178	160
307	H	20-25	87	102	89	91	1.03151	90	105	92	94
307	I	25-30	93	70	83	85	1.03151	96	72	86	87
307	Leachate										
307	I + Leachate										
307	A Rerun		5,543	5,483	5,488	#DIV/0!	1.06967	5,929	5,865	5,870	

Table 3C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 307) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Warm Fallow Soil Treatment			AVERAGE(32.6,33.6)					
307	A	0-2	33.1	5,881.7	5,558.0	5,817.4	5,180.1	5,609
307	B	2-4	33.1	3,364.7	3,607.0	2,698.0	2,816.9	3,122
307	C	4-6	33.1	1,619.5	1,864.5	1,574.7	1,495.3	1,638
307	D	6-8	33.1	1,251.7	1,260.8	1,181.6	1,209.8	1,226
307	E	8-10	33.1	840.1	811.9	794.4	710.5	789
307	F	10-15	33.1	468.0	337.5	310.0	205.1	330
307	G	15-20	33.1	189.8	98.0	144.7	126.6	140
307	H	20-25	33.1	56.8	72.2	58.7	60.8	62
307	I	25-30	33.1	62.8	39.1	52.4	54.4	52
307	Leachate			.	.	.	.	
307	I + Leachate			.	.	.	.	
307	A Rerun		47.7	5,881.7	5,817.4	5,822.7		

Table 3C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to warm-climate fallow soil (sample 307) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Warm Fallow Soil Treatment												
307	A	0-2	5,392,222	.	.	5392222	49.23	93.43	0.527	52.7	0.53	3.76
307	B	2-4	2,325,146	.	.	2325146	21.23	93.43	0.227	22.7	0.68	3.76
307	C	4-6	733,302	.	.	733302	6.69	93.43	0.072	7.2	0.36	3.76
307	D	6-8	433,386	.	.	433386	3.96	93.43	0.042	4.2	0.30	3.76
307	E	8-10	460,790	.	.	460790	4.21	93.43	0.045	4.5	0.41	3.76
307	F	10-15	466,947	.	.	466947	4.26	93.43	0.046	4.6	0.57	3.76
307	G	15-20	177,762	.	.	177762	1.62	93.43	0.017	1.7	0.30	3.76
307	H	20-25	81,407	.	.	81407	0.74	93.43	0.008	0.8	0.18	3.76
307	I	25-30	65,156	.	.	65156	0.59	93.43	0.006	0.6	0.18	3.76
307	Leachate		98,027	.	.	98027	0.89	93.43	0.010	1.0	0.26	3.76
307	I + Leachate		163,184	.	.	163184	1.49	93.43	0.016	1.6	0.44	3.76
307	A Rerun											
							93.43				3.76	

Table 4A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 401).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Cold Fallow Soil												
401	A	0-2	5/7/04	1	1.59	17.14	15.81	15.55	14.22	702.6	1.31	701.3
401	B	2-4	5/7/04	3	1.58	17.89	16.43	16.31	14.85	403.4	1.31	402.1
401	C	4-6	5/7/04	5	1.58	17.34	15.82	15.76	14.24	531.8	1.31	530.5
401	D	6-8	5/7/04	7	1.77	17.23	15.64	15.46	13.87	800.2	1.31	798.9
401	E	8-10	5/7/04	9	1.74	17.01	15.23	15.27	13.49	691	6.22	684.8
401	F	10-15	5/7/04	12.5	1.61	17.36	15.02	15.75	13.41	1514.3	6.22	1508.1
401	G	15-20	5/7/04	17.5	1.62	17.85	15.32	16.23	13.70	1554.1	6.22	1547.9
401	H	20-25	5/7/04	22.5	1.65	17.46	15.08	15.81	13.43	1601.9	6.22	1595.7
401	I	25-30	5/7/04	27.5	1.71	17.72	15.20	16.01	13.49	2425.1	6.22	2418.9
401	Leachate			27.5								
401	I + Leachate			27.5								

Table 4A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 401) (Continued).

			4 min Combustion Cycle							
			Sub Sample				Water Content			Soil-Roots Total
			1	2	3	4	% Moisture	% Moisture Dry	Dry Soil	Section
Sample #	Depth Code	Depth Range	Burn Weight (g)	Burn Weight (g)	Burn Weight (g)	Burn Weight (g)	**Wet** Weight Basis	Weight Basis	Fraction	Dry Weight (g)
Cold Fallow Soil										
401	A	0-2	1.05	1.06	1.03	1.11	8.41	9.35	0.92	642.29
401	B	2-4	1.09	1.10	1.04	1.14	8.89	9.83	0.91	366.36
401	C	4-6	1.08	1.11	1.03	1.05	9.61	10.67	0.90	479.52
401	D	6-8	1.06	1.03	1.10	1.06	10.17	11.46	0.90	717.67
401	E	8-10	1.06	1.08	1.08	1.04	11.69	13.19	0.88	604.75
401	F	10-15	1.06	1.04	1.02	1.06	15.58	17.45	0.84	1273.13
401	G	15-20	1.08	1.14	1.10	1.10	16.51	18.47	0.83	1292.26
401	H	20-25	1.31	1.19	1.06	1.05	15.78	17.72	0.84	1343.84
401	I	25-30	1.24	1.30	1.16	1.06	16.58	18.68	0.83	2017.86
401	Leachate									
401	I + Leachate									

Table 4A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 401) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Cold Fallow Soil											
401	A	0-2	8407	9330.6	6834.3	9233.3	8,007	8,802	6,635	8,318	7,941
401	B	2-4	3416.4	3711.2	3093.1	3663.7	3,134	3,374	2,974	3,214	3,174
401	C	4-6	3016	3063.4	2857.8	2744	2,793	2,760	2,775	2,613	2,735
401	D	6-8	2290.8	2108.5	2416.2	2452.2	2,161	2,047	2,197	2,313	2,180
401	E	8-10	1569.2	1576.4	1542.5	1753.7	1,480	1,460	1,428	1,686	1,514
401	F	10-15	894.7	912	869.5	989.9	844	877	852	934	877
401	G	15-20	336.3	350.8	280.2	393.6	311	308	255	358	308
401	H	20-25	127	135.7	122.3	112.1	97	114	115	107	108
401	I	25-30	117.7	84.8	69.1	74.9	95	65	60	71	73
401	Leachate										
401	I + Leachate										

Table 4A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 401) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Cold Fallow Soil											
401	A	0-2	8,742	9,611	7,245	9,082	1.01895	8,908	9,793	7,382	9,254
401	B	2-4	3,440	3,703	3,264	3,527	1.01895	3,505	3,773	3,326	3,594
401	C	4-6	3,089	3,053	3,069	2,891	1.01895	3,148	3,111	3,128	2,946
401	D	6-8	2,406	2,279	2,445	2,575	0.99986	2,405	2,278	2,445	2,575
401	E	8-10	1,676	1,653	1,617	1,909	0.99986	1,676	1,653	1,617	1,909
401	F	10-15	1,000	1,039	1,010	1,106	0.99986	1,000	1,039	1,010	1,106
401	G	15-20	373	369	305	429	0.99452	371	367	303	426
401	H	20-25	115	135	137	127	0.99452	114	135	136	126
401	I	25-30	114	78	71	85	0.99452	113	78	71	84
401	Leachate										
401	I + Leachate										

Table 4A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 401) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Cold Fallow Soil			AVERAGE(32.8,44.3)					
401	A	0-2	38.55	8,869.2	9,754.6	7,343.4	9,215.9	8,796
401	B	2-4	38.55	3,466.6	3,734.5	3,287.5	3,555.5	3,511
401	C	4-6	38.55	3,109.4	3,072.5	3,089.1	2,907.4	3,045
401	D	6-8	38.55	2,366.8	2,239.9	2,406.2	2,536.3	2,387
401	E	8-10	38.55	1,637.5	1,614.0	1,578.5	1,870.6	1,675
401	F	10-15	38.55	961.1	1,000.1	971.1	1,067.5	1,000
401	G	15-20	38.55	332.4	328.0	264.9	387.7	328
401	H	20-25	38.55	75.9	96.1	97.7	87.5	89
401	I	25-30	38.55	74.6	39.2	32.5	45.7	48
401	Leachate			.	.	.	.	
401	I + Leachate			.	.	.	.	

Table 4A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 401) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Cold Fallow Soil												
401	A	0-2	5,649,482	.	.	5649482	51.57	120.24	0.429	42.9	0.43	5.34
401	B	2-4	1,286,301	.	.	1286301	11.74	120.24	0.098	9.8	0.29	5.34
401	C	4-6	1,459,943	.	.	1459943	13.33	120.24	0.111	11.1	0.55	5.34
401	D	6-8	1,713,305	.	.	1713305	15.64	120.24	0.130	13.0	0.91	5.34
401	E	8-10	1,013,043	.	.	1013043	9.25	120.24	0.077	7.7	0.69	5.34
401	F	10-15	1,273,059	.	.	1273059	11.62	120.24	0.097	9.7	1.21	5.34
401	G	15-20	424,187	.	.	424187	3.87	120.24	0.032	3.2	0.56	5.34
401	H	20-25	120,029	.	.	120029	1.10	120.24	0.009	0.9	0.21	5.34
401	I	25-30	96,848	.	.	96848	0.88	120.24	0.007	0.7	0.20	5.34
401	Leachate		135,676	.	.	135676	1.24	120.24	0.010	1.0	0.28	5.34
401	I + Leachate		232,525	.	.	232525	2.12	120.24	0.018	1.8	0.49	5.34
							120.24				5.341	

Table 4B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 402).

Sample #	Depth Code	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Cold Fallow Soil											
402	A	5/7/04	1	1.61	17.66	16.13	16.05	14.52	776.5	1.31	775.2
402	B	5/7/04	3	1.58	17.07	15.47	15.49	13.89	633.1	1.31	631.8
402	C	5/7/04	5	1.57	17.35	15.64	15.78	14.07	748.6	1.31	747.3
402	D	5/7/04	7	1.60	17.15	15.30	15.55	13.70	602.3	1.31	601.0
402	E	5/7/04	9	1.67	17.13	15.07	15.46	13.40	727.2	6.22	721.0
402	F	5/7/04	12.5	1.58	17.33	14.85	15.75	13.27	1449.4	6.22	1443.2
402	G	5/7/04	17.5	1.60	17.18	14.55	15.58	12.95	1715.3	6.22	1709.1
402	H	5/7/04	22.5	1.67	17.65	15.10	15.98	13.43	1229.5	6.22	1223.3
402	I	5/7/04	27.5	1.63	17.50	14.95	15.87	13.32	2123.3	6.22	2117.1
402	Leachate		27.5								
402	I + Leachate		27.5								

Table 4B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 402) (Continued).

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Cold Fallow Soil										
402	A	0-2	1.15	1.11	1.11	1.15	9.49	10.54	0.91	701.66
402	B	2-4	1.06	1.04	1.06	1.14	10.34	11.52	0.90	566.45
402	C	4-6	1.14	1.05	1.03	1.09	10.93	12.15	0.89	665.59
402	D	6-8	1.07	1.10	1.04	1.12	12.09	13.50	0.88	528.32
402	E	8-10	1.07	1.09	1.18	1.04	13.67	15.37	0.86	622.43
402	F	10-15	1.09	1.13	1.11	1.18	16.70	18.69	0.83	1202.16
402	G	15-20	1.05	1.07	1.15	1.24	18.08	20.31	0.82	1400.15
402	H	20-25	1.24	1.09	1.14	1.08	16.89	18.99	0.83	1016.70
402	I	25-30	1.07	1.13	1.11	1.19	17.06	19.14	0.83	1755.97
402	Leachate									
402	I + Leachate									

Table 4B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 402) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Cold Fallow Soil											
402	A	0-2	8310.3	6346.9	6417.9	7193	7,226	5,718	5,782	6,255	6,245
402	B	2-4	3282	2969.4	3230.7	3618.2	3,096	2,855	3,048	3,174	3,043
402	C	4-6	2305.4	2187.7	2172.7	2174	2,022	2,084	2,109	1,994	2,052
402	D	6-8	1726	1590.2	1426.9	1647.2	1,613	1,446	1,372	1,471	1,475
402	E	8-10	1052.2	1213.1	1298.5	1088.4	983	1,113	1,100	1,047	1,061
402	F	10-15	624.3	791.2	799.4	782.5	573	700	720	663	664
402	G	15-20	175.7	494.9	343	194.8	167	463	298	157	271
402	H	20-25	133.8	131.4	129.8	127.4	108	121	114	118	115
402	I	25-30	64.2	69.1	110.5	76	60	61	100	64	71
402	Leachate										
402	I + Leachate										

Table 4B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 402) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Cold Fallow Soil											
402	A	0-2	7,984	6,317	6,388	6,910	1.03749	8,283	6,554	6,627	7,169
402	B	2-4	3,453	3,185	3,399	3,540	1.03749	3,583	3,304	3,527	3,673
402	C	4-6	2,271	2,339	2,368	2,239	1.03749	2,356	2,427	2,457	2,323
402	D	6-8	1,835	1,644	1,561	1,673	1.04902	1,925	1,725	1,637	1,755
402	E	8-10	1,139	1,289	1,275	1,212	1.04902	1,195	1,352	1,337	1,272
402	F	10-15	688	841	865	796	1.04902	721	882	907	835
402	G	15-20	204	565	364	192	1.05342	215	595	384	202
402	H	20-25	130	145	137	142	1.05342	137	153	144	150
402	I	25-30	72	74	120	77	1.05342	76	78	126	81
402	Leachate										
402	I + Leachate										

Table 4B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 402) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Cold Fallow Soil								
402	A	0-2	43.1	8,239.8	6,510.9	6,584.2	7,126.2	7,115
402	B	2-4	43.1	3,539.8	3,260.8	3,483.8	3,629.6	3,478
402	C	4-6	43.1	2,312.5	2,383.9	2,414.0	2,280.2	2,348
402	D	6-8	43.1	1,881.8	1,682.0	1,594.1	1,711.9	1,717
402	E	8-10	43.1	1,151.8	1,309.3	1,294.0	1,228.6	1,246
402	F	10-15	43.1	678.2	838.7	863.8	792.0	793
402	G	15-20	43.1	172.1	551.6	340.4	158.9	306
402	H	20-25	43.1	93.7	109.7	101.2	106.4	103
402	I	25-30	43.1	33.1	34.6	83.3	38.0	47
402	Leachate			.	.	.	.	
402	I + Leachate			.	.	.	.	

Table 4B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 402) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Cold Fallow Soil												
402	A	0-2	4,992,496	.	.	4992496	45.58	110.34	0.413	41.3	0.41	5.34
402	B	2-4	1,970,378	.	.	1970378	17.99	110.34	0.163	16.3	0.49	5.34
402	C	4-6	1,562,572	.	.	1562572	14.26	110.34	0.129	12.9	0.65	5.34
402	D	6-8	907,373	.	.	907373	8.28	110.34	0.075	7.5	0.53	5.34
402	E	8-10	775,492	.	.	775492	7.08	110.34	0.064	6.4	0.58	5.34
402	F	10-15	953,525	.	.	953525	8.70	110.34	0.079	7.9	0.99	5.34
402	G	15-20	428,101	.	.	428101	3.91	110.34	0.035	3.5	0.62	5.34
402	H	20-25	104,461	.	.	104461	0.95	110.34	0.009	0.9	0.19	5.34
402	I	25-30	82,975	.	.	82975	0.76	110.34	0.007	0.7	0.19	5.34
402	Leachate		309,339	.	.	309339	2.82	110.34	0.026	2.6	0.70	5.34
402	I + Leachate		392,313	.	.	392313	3.58	110.34	0.032	3.2	0.89	5.34
							110.34				5.344	

Table 4C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 405).

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Soil (g)	Dry Soil (g)	Roots Bag + Section Wet Weight (g)	Bag + Label Weight (g)	Total Section Wet Weight (g)
Cold Fallow Soil												
405	A	0-2	5/10/04	1	1.59	17.25	15.67	15.66	14.08	564	1.31	562.7
405	B	2-4	5/10/04	3	1.57	17.69	16.01	16.12	14.44	741.3	1.31	740.0
405	C	4-6	5/10/04	5	1.57	17.05	15.41	15.48	13.84	555.2	1.31	553.9
405	D	6-8	5/10/04	7	1.76	17.51	15.50	15.75	13.74	917.6	1.31	916.3
405	E	8-10	5/10/04	9	1.74	17.72	15.53	15.98	13.79	904.9	6.22	898.7
405	F	10-15	5/10/04	12.5	1.61	17.38	14.89	15.77	13.28	1206.4	6.22	1200.2
405	G	15-20	5/10/04	17.5	1.63	17.43	14.70	15.80	13.07	1808.2	6.22	1802.0
405	H	20-25	5/10/04	22.5	1.65	17.33	14.82	15.68	13.17	1520.3	6.22	1514.1
405	I	25-30	5/10/04	27.5	1.71	17.13	14.93	15.42	13.22	1654.2	6.22	1648.0
405	Leachate			27.5								
405	I + Leachate			27.5								
405	A ReRUN		6/16/04		1.59	17.25	15.67	15.66	14.08	564.0	1.3	562.7

Table 4C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 405) (Continued).

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture **Wet** Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Soil-Roots Total Section Dry Weight (g)
Cold Fallow Soil										
405	A	0-2	1.07	1.17	1.06	1.10	10.08	11.22	0.90	505.95
405	B	2-4	1.13	1.06	1.05	1.08	10.49	11.63	0.90	662.34
405	C	4-6	1.06	1.08	1.08	1.09	10.64	11.85	0.89	494.94
405	D	6-8	1.08	1.12	1.18	1.08	12.97	14.63	0.87	797.47
405	E	8-10	1.20	1.20	1.06	1.19	14.10	15.88	0.86	771.95
405	F	10-15	1.17	1.14	1.11	1.12	16.72	18.75	0.83	999.48
405	G	15-20	1.09	1.09	1.14	1.19	18.57	20.89	0.81	1467.33
405	H	20-25	1.04	1.18	1.14	1.16	16.94	19.06	0.83	1257.65
405	I	25-30	1.02	1.10	1.15	1.14	14.74	16.64	0.85	1405.14
405	Leachate									
405	I + Leachate									
405	A ReRUN		1.15	1.23			10.08	11.22	0.90	505.95

Table 4C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 405) (Continued).

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wet wt	2 14C Actual DPM divided by burn wet wt	3 14C Actual DPM divided by burn wet wt	4 14C Actual DPM divided by burn wet wt	**Mean** 14C Actual DPM divided by burn wt
Cold Fallow Soil											
405	A	0-2	6548.5	8358.4	6813.2	6776.6	6,120	7,144	6,428	6,161	6,463
405	B	2-4	3607	3337.5	3208.9	3467.6	3,192	3,149	3,056	3,211	3,152
405	C	4-6	2658.4	2523.1	2023.4	2379.2	2,508	2,336	1,874	2,183	2,225
405	D	6-8	1740.5	1532	2065	1789.3	1,612	1,368	1,750	1,657	1,597
405	E	8-10	1444.8	1223.1	996.6	1294.1	1,204	1,019	940	1,087	1,063
405	F	10-15	757.8	735.4	690.6	716.5	648	645	622	640	639
405	G	15-20	373.8	419.8	273.2	417.7	343	385	240	351	330
405	H	20-25	72.5	127.7	100.2	95.4	70	108	88	82	87
405	I	25-30	51.3	58.2	71.2	50.6	50	53	62	44	52
405	Leachate										
405	I + Leachate										
405	A ReRUN		8539.3	8770.2			7,425	7,130			7,278

Table 4C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 405) (Continued).

Sample #	Depth Code	Depth Range	1 14 C DPM Dry Gram	2 14 C DPM Dry Gram	3 14 C DPM Dry Gram	4 14 C DPM Dry Gram	1 / BO Correction Factor	1 14C Corrected DPM for Dry Gram	2 14C Corrected DPM for Dry Gram	3 14C Corrected DPM for Dry Gram	4 14C Corrected DPM for Dry Gram
Cold Fallow Soil											
405	A	0-2	6,806	7,945	7,148	6,851	0.89525	6,093	7,113	6,400	6,134
405	B	2-4	3,566	3,518	3,414	3,587	0.89525	3,193	3,149	3,057	3,211
405	C	4-6	2,807	2,614	2,097	2,443	0.89525	2,513	2,341	1,877	2,187
405	D	6-8	1,852	1,572	2,011	1,904	0.9319	1,726	1,465	1,874	1,774
405	E	8-10	1,402	1,187	1,095	1,266	0.9319	1,306	1,106	1,020	1,180
405	F	10-15	778	775	747	768	0.9319	725	722	696	716
405	G	15-20	421	473	294	431	0.937	395	443	276	404
405	H	20-25	84	130	106	99	0.937	79	122	99	93
405	I	25-30	59	62	73	52	0.937	55	58	68	49
405	Leachate										
405	I + Leachate										
405	A ReRUN		8,258	7,930			1.06967	8,833	8,482		

Table 4C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 405) (Continued).

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	1.0 14C Calculated DPM for Dry Gram	2.0 14C Calculated DPM for Dry Gram	3.0 14C Calculated DPM for Dry Gram	4.0 14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram
Cold Fallow Soil								
405	A	0-2	36.95	6,056.5	7,075.8	6,362.6	6,096.7	6,398
405	B	2-4	36.95	3,155.7	3,112.3	3,019.8	3,174.5	3,116
405	C	4-6	36.95	2,475.7	2,303.6	1,840.1	2,149.9	2,192
405	D	6-8	36.95	1,688.6	1,427.7	1,836.9	1,737.0	1,673
405	E	8-10	36.95	1,269.3	1,068.8	983.0	1,142.8	1,116
405	F	10-15	36.95	687.8	684.9	659.3	678.9	678
405	G	15-20	36.95	357.7	406.2	238.8	367.0	342
405	H	20-25	36.95	41.7	85.1	62.2	55.8	61
405	I	25-30	36.95	18.3	21.2	31.1	11.8	21
405	Leachate			.	.	.	.	
405	I + Leachate			.	.	.	.	
405	A ReRUN		47.7	8,785.7	8,434.5			8,610

Table 4C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine applied to cold-climate fallow soil (sample 405) (Continued).

Sample #	Depth Code	Depth Range	Soil Total DPM Dry Section	Root Total DPM Dry Section	Shoot Total DPM Dry Section	Grand Total DPM Dry Section	Fraction of 14C Applied %	Total Recovery 14C %	Normalized Fraction of 14C Applied	Normal % of Applied	Mobility Index Section	Mobility Index Collected
Cold Fallow Soil												
405	A	0-2	3,237,048	.	.	3237048	29.55	90.92	0.325	32.5	0.33	5.45
405	B	2-4	2,063,563	.	.	2063563	18.84	90.92	0.207	20.7	0.62	5.45
405	C	4-6	1,085,073	.	.	1085073	9.91	90.92	0.109	10.9	0.54	5.45
405	D	6-8	1,333,806	.	.	1333806	12.18	90.92	0.134	13.4	0.94	5.45
405	E	8-10	861,488	.	.	861488	7.86	90.92	0.086	8.6	0.78	5.45
405	F	10-15	677,384	.	.	677384	6.18	90.92	0.068	6.8	0.85	5.45
405	G	15-20	502,435	.	.	502435	4.59	90.92	0.050	5.0	0.88	5.45
405	H	20-25	76,980	.	.	76980	0.70	90.92	0.008	0.8	0.17	5.45
405	I	25-30	28,956	.	.	28956	0.26	90.92	0.003	0.3	0.08	5.45
405	Leachate		92,805	.	.	92805	0.85	90.92	0.009	0.9	0.26	5.45
405	I + Leachate		121,761	.	.	121761	1.11	90.92	0.012	1.2	0.34	5.45
405	A ReRUN		4,356,337									
							90.92				5.45	

Table 5A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 101).

Vegetative Structures

Sample #	Depth Code	Depth Range	Date	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)
Roots												
Actively Growing												
101	Verdure			-1	1.59	2.04	2.00	0.45	0.41	8.16	3.39	4.77
101	A	0-2	6/5/04	1	1.56	3.05	2.17	1.49	0.61	19.76	2.26	17.5
101	B	2-4	6/5/04	3	1.57	3.03	2.33	1.46	0.76	19.9	2.22	17.68
101	C	4-6	6/5/04	5	1.58	2.08	2.03	0.50	0.45	6.65	2.25	4.4
101	D	6-8	6/5/04	7	1.60	1.80	1.79	0.20	0.19	3.21	2.24	0.97
101	E	8-10	6/5/04	9	1.57	1.62	1.61	0.05	0.03	2.44	2.25	0.19
101	F	10-15	6/5/04	12.5	1.59	1.64	1.63	0.05	0.04	2.45	2.24	0.21
101	G	15-20	6/5/04	17.5								
101	A RERUN	0-2	6/14/04	1	1.57	1.95	1.89	0.38	0.32	19.76	2.26	17.50
	Verdure Rerun		6/15/04		1.59	2.04	2.00	0.45	0.41	8.16	3.39	4.77

Table 5A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)
Roots										
Actively Growing			6/5/04	Machine failure As and tops may be reweighed.						
101	Verdure		0.05	0.05	0.07	0.07	2.00	9.76	0.98	4.67
101	A	0-2	0.28	0.31	0.31	0.35	40.55	144.26	0.59	10.40
101	B	2-4	0.17	0.25	0.22	0.26	30.04	92.11	0.70	12.37
101	C	4-6	0.16	0.15	0.18	0.16	2.46	11.11	0.98	4.29
101	D	6-8	0.07	0.08	0.11	0.15	0.56	5.26	0.99	0.96
101	E	8-10	0.03	0.07			0.93	42.86	0.99	0.19
101	F	10-15	0.05	0.10			0.61	25.00	0.99	0.21
101	G	15-20								
101	A RERUN	0-2	0.09	0.09			3.17	18.75	0.97	16.94
	Verdure Rerun		0.05	0.06	0.06		2.00	9.76	0.98	4.67

Table 5A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14C Actual DPM Wet Gram	Sub Sample 2 14C Actual DPM Wet Gram	Sub Sample 3 14C Actual DPM Wet Gram	Sub Sample 4 14C Actual DPM Wet Gram	Sub Sample 1 14C Actual DPM divided by burn wt	Sub Sample 2 14C Actual DPM divided by burn wt	Sub Sample 3 14C Actual DPM divided by burn wt	Sub Sample 4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Roots											
Actively Growing											
101	Verdure		7973.6	5340.6	11852.1	12704.5	159,472	106,812	169,316	181,493	154,273
101	A	0-2	3544.5	4314.8	4435		12,659	13,919	14,306		13,628
101	B	2-4	817.6	966.2	1366.3	1282.4	4,809	3,865	6,210	4,932	4,954
101	C	4-6	941	1150.7	1440.3	1341.7	5,881	7,671	8,002	8,386	7,485
101	D	6-8	399.5	377.6	453.9	496.5	5,707	4,720	4,126	3,310	4,466
101	E	8-10	136.8	202.2			4,560	2,889			3,724
101	F	10-15	96.4	125.6			1,928	1,256			1,592
101	G	15-20									
101	A RERUN	0-2	3031.7	3424.1			33,686	38,046			35,866
	Verdure Rerun		12073	7332.5	18219.7		241,460	122,208	303,662		222,443

Table 5A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14 C DPM Dry Gram	Sub Sample 2 14 C DPM Dry Gram	Sub Sample 3 14 C DPM Dry Gram	Sub Sample 4 14 C DPM Dry Gram	1 / BO Correction Factor	Sub Sample 1 14C Corrected DPM for Dry Gram	Sub Sample 2 14C Corrected DPM for Dry Gram	Sub Sample 3 14C Corrected DPM for Dry Gram	Sub Sample 4 14C Corrected DPM for Dry Gram
Roots											
Actively Growing											
101	Verdure		162,727	108,992	172,771	185,197	1.10597	179,971	120,542	191,080	204,823
101	A	0-2	21,294	23,414	24,066		0.94315	20,084	22,083	22,698	
101	B	2-4	6,875	5,525	8,878	7,050	0.94315	6,484	5,210	8,373	6,650
101	C	4-6	6,030	7,865	8,204	8,597	0.86699	5,228	6,819	7,113	7,454
101	D	6-8	5,739	4,747	4,150	3,329	0.86699	4,976	4,115	3,598	2,886
101	E	8-10	4,603	2,916			0.86699	3,991	2,528		
101	F	10-15	1,940	1,264			0.86699	1,682	1,096		
101	G	15-20									
101	A RERUN	0-2	34,790	39,293			1.10597	38,477	43,457		
	Verdure Rerun		246,388	124,702	309,859		1.14248	281,493	142,470	354,007	

Table 5A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Roots									
Actively Growing									
101	Verdure		48.7	179,922.6	120,493.4	191,031.7	204,774.1	174,055	813,640
101	A	0-2	45.9	20,038.0	22,036.7	22,651.8	38,430.2	25,789	268,291
101	B	2-4	45.9	6,438.1	5,164.6	8,326.9	6,603.8	6,633	82,044
101	C	4-6	45.9	5,181.8	6,773.0	7,066.6	7,407.9	6,607	28,356
101	D	6-8	45.9	4,929.9	4,069.3	3,551.7	2,839.9	3,848	3,711
101	E	8-10	45.9	3,944.9	2,482.1	.	.	3,213	605
101	F	10-15	45.9	1,636.0	1,049.8	.	.	1,343	280
101	G	15-20		.	.	.	.		.
101	A RERUN	0-2	46.6	38,430.2	43,410.4	.	.	40,920	693,372
	Verdure Rerun		49.0	281,443.8	142,420.8	353,958.1	.	259,274	1,212,003

Table 5B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 102).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)
Roots												
Actively Growing												
102	Verdure		6/15/04	-1	1.57	1.93	1.91	0.36	0.34	13.03	3.33	9.7
102	A	0-2	6/15/04	1	1.58	2.03	2.00	0.45	0.42	11.32	2.2	9.12
102	B	2-4	6/15/04	3	1.56	2.00	1.97	0.44	0.41	12.75	2.23	10.52
102	C	4-6	6/15/04	5	1.55	1.82	1.80	0.27	0.25	4.31	2.22	2.09
102	D	6-8	6/15/04	7	1.57	1.69	1.67	0.12	0.10	3.07	2.24	0.83
102	E	8-10	6/15/04	9	1.61	1.67	1.66	0.06	0.05	2.83	2.23	0.6
102	F	10-15	6/15/04	12.5	1.60	1.67	1.66	0.07	0.06	2.75	2.23	0.52
102	G	15-20	6/15/04	17.5				0.00	0.00			
102	A ReRUN		6/16/04		1.58	2.03	2.00	0.45	0.42	11.32	2.20	9.12

Table 5B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)
Roots										
Actively Growing			6/5/04	Machine failure As and tops may be reweighed.						
102	Verdure		0.08	0.08	0.10	0.09	1.05	5.88	0.99	9.60
102	A	0-2	0.10	0.08	0.09	0.09	1.50	7.14	0.99	8.98
102	B	2-4	0.07	0.08	0.10	0.08	1.52	7.32	0.98	10.36
102	C	4-6	0.05	0.07	0.06	0.07	1.11	8.00	0.99	2.07
102	D	6-8	0.08	0.06	0.08	0.06	1.20	20.00	0.99	0.82
102	E	8-10	0.06	0.07	0.06	0.06	0.60	20.00	0.99	0.60
102	F	10-15	0.06	0.06	0.07	0.11	0.60	16.67	0.99	0.52
102	G	15-20								
102	A ReRUN		0.08	0.13			1.50	7.14	0.99	8.98

Table 5B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

			Sub Sample				Sub Sample				
Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wt	2 14C Actual DPM divided by burn wt	3 14C Actual DPM divided by burn wt	4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt

Roots

Actively Growing

Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wt	2 14C Actual DPM divided by burn wt	3 14C Actual DPM divided by burn wt	4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
102	Verdure		8884.2	12279.5	12396.6	9638.2	111,053	153,494	123,966	107,091	123,901
102	A	0-2	2529	1789.8	1473.3	4648.3	25,290	22,373	16,370	51,648	28,920
102	B	2-4	741.1	1655.9	893.9	989.2	10,587	20,699	8,939	12,365	13,147
102	C	4-6	298.1	399.6	329.8	360.8	5,962	5,709	5,497	5,154	5,580
102	D	6-8	279.2	261	276.2	200.8	3,490	4,350	3,453	3,347	3,660
102	E	8-10	143.2	178.3	176.9	143.1	2,387	2,547	2,948	2,385	2,567
102	F	10-15	168.5	148.7	129.5	162.2	2,808	2,478	1,850	1,475	2,153
102	G	15-20									
102	A ReRUN		1423.3	2024.8			17,791	15,575			16,683

Table 5B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14 C DPM Dry Gram	Sub Sample 2 14 C DPM Dry Gram	Sub Sample 3 14 C DPM Dry Gram	Sub Sample 4 14 C DPM Dry Gram	1 / BO Correction Factor	Sub Sample 1 14C Corrected DPM for Dry Gram	Sub Sample 2 14C Corrected DPM for Dry Gram	Sub Sample 3 14C Corrected DPM for Dry Gram	Sub Sample 4 14C Corrected DPM for Dry Gram
Roots											
Actively Growing											
102	Verdure		112,228	155,118	125,278	108,224	1.10597	124,121	171,556	138,554	119,693
102	A	0-2	25,675	22,713	16,619	52,434	1.09903	28,218	24,962	18,265	57,627
102	B	2-4	10,751	21,019	9,077	12,556	1.09903	11,815	23,100	9,976	13,800
102	C	4-6	6,029	5,773	5,558	5,212	1.09903	6,626	6,344	6,109	5,728
102	D	6-8	3,532	4,403	3,494	3,387	1.09152	3,856	4,806	3,814	3,697
102	E	8-10	2,401	2,563	2,966	2,399	1.09152	2,621	2,797	3,238	2,619
102	F	10-15	2,825	2,493	1,861	1,483	1.09152	3,084	2,722	2,032	1,619
102	G	15-20									
102	A ReRUN		18,062	15,813			1.14248	20,636	18,066		

Table 5B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Roots									
Actively Growing									
102	Verdure		48.7	124,072.2	171,507.8	138,505.3	119,644.6	138,432	1,328,734
102	A	0-2	49.1	28,168.6	24,913.3	18,216.0	20,591.4	22,972	206,365
102	B	2-4	49.1	11,766.4	23,051.2	9,927.0	13,750.5	14,624	151,499
102	C	4-6	49.1	6,576.9	6,295.3	6,059.8	5,679.3	6,153	12,716
102	D	6-8	49.1	3,806.5	4,756.6	3,765.1	3,648.1	3,994	3,275
102	E	8-10	49.1	2,571.8	2,748.0	3,188.6	2,570.0	2,770	1,652
102	F	10-15	49.1	3,034.8	2,672.4	1,982.5	1,570.2	2,315	1,197
102	G	15-20		.	.	.	.		.
102	A ReRUN		44.3	20,591.4	18,021.2	.	.	19,306	173,432

Table 5C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 103).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)
Roots												
Actively Growing												
103	Verdure			-1	1.60	2.02	1.99	0.42	0.39	10	3.54	6.46
103	A	0-2	6/16/04	1	1.57	2.09	2.06	0.52	0.49	7.09	2.21	4.88
103	B	2-4	6/16/04	3	1.56	2.38	2.32	0.82	0.76	10.24	2.25	7.99
103	C	4-6	6/16/04	5	1.59	1.97	1.94	0.38	0.35	7.52	2.22	5.3
103	D	6-8	6/16/04	7	1.57	1.79	1.78	0.22	0.21	4.41	2.24	2.17
103	E	8-10	6/16/04	9	1.59	1.65	1.65	0.06	0.06	2.78	2.24	0.54
103	F	10-15	6/16/04	12.5	1.56	1.62	1.62	0.06	0.06	2.71	2.23	0.48
103	G	15-20	6/16/04	17.5				0.00	0.00			
103	F RERUN				1.56	1.62	1.62	0.06	0.06	2.71	2.23	0.48

Table 5C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)
Roots										
Actively Growing			6/5/04	Machine failure As and tops may be reweighed.						
103	Verdure		0.06	0.05	0.06	0.06	1.51	7.69	0.98	6.36
103	A	0-2	0.12	0.11	0.09	0.10	1.46	6.12	0.99	4.81
103	B	2-4	0.13	0.08	0.08	0.11	2.59	7.89	0.97	7.78
103	C	4-6	0.12	0.11	0.11	0.10	1.55	8.57	0.98	5.22
103	D	6-8	0.08	0.08	0.09	0.10	0.56	4.76	0.99	2.16
103	E	8-10	0.06	0.08	0.07	0.07	0.00	0.00	1.00	0.54
103	F	10-15	0.05	0.06	0.07	0.06	0.00	0.00	1.00	0.48
103	G	15-20								
103	F RERUN		0.04	0.03	0.03	0.06	0.00	0.00	1.00	0.48

Table 5C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14C Actual DPM Wet Gram	Sub Sample 2 14C Actual DPM Wet Gram	Sub Sample 3 14C Actual DPM Wet Gram	Sub Sample 4 14C Actual DPM Wet Gram	Sub Sample 1 14C Actual DPM divided by burn wt	Sub Sample 2 14C Actual DPM divided by burn wt	Sub Sample 3 14C Actual DPM divided by burn wt	Sub Sample 4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Roots											
Actively Growing											
103	Verdure		6723.6	8908.1	10208.8	8976.6	112,060	178,162	170,147	149,610	152,495
103	A	0-2	3930.9	4843.1	3063	4238.6	32,758	44,028	34,033	42,386	38,301
103	B	2-4	1615.2	1550.6	1301.7	1273.7	12,425	19,383	16,271	11,579	14,914
103	C	4-6	398.2	767.6	657.2	675.5	3,318	6,978	5,975	6,755	5,757
103	D	6-8	553.9	1011.8	553.1	681.1	6,924	12,648	6,146	6,811	8,132
103	E	8-10	154.3	184	174.7	200	2,572	2,300	2,496	2,857	2,556
103	F	10-15	232.6	319.2	354	326.8	4,652	5,320	5,057	5,447	5,119
103	G	15-20									
103	F RERUN		79.4	93	81.5	107.1	1,985	3,100	2,717	1,785	2,397

Table 5C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14 C DPM Dry Gram	Sub Sample 2 14 C DPM Dry Gram	Sub Sample 3 14 C DPM Dry Gram	Sub Sample 4 14 C DPM Dry Gram	1 / BO Correction Factor	Sub Sample 1 14C Corrected DPM for Dry Gram	Sub Sample 2 14C Corrected DPM for Dry Gram	Sub Sample 3 14C Corrected DPM for Dry Gram	Sub Sample 4 14C Corrected DPM for Dry Gram
Roots											
Actively Growing											
103	Verdure		113,775	180,889	172,751	151,900	1.13022	128,591	204,444	195,247	171,680
103	A	0-2	33,242	44,679	34,536	43,012	1.17839	39,172	52,649	40,697	50,685
103	B	2-4	12,754	19,897	16,703	11,887	1.17839	15,030	23,447	19,683	14,007
103	C	4-6	3,370	7,088	6,068	6,861	1.17839	3,972	8,352	7,151	8,085
103	D	6-8	6,963	12,719	6,180	6,849	1.24147	8,644	15,790	7,673	8,503
103	E	8-10	2,572	2,300	2,496	2,857	1.24147	3,193	2,855	3,098	3,547
103	F	10-15	4,652	5,320	5,057	5,447	1.24147	5,775	6,605	6,278	6,762
103	G	15-20									
103	F RERUN		1,985	3,100	2,717	1,785	0.98845	1,962	3,064	2,685	1,764

Table 5C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Roots									
Actively Growing									
103	Verdure		41.5	128,549.6	204,402.9	195,205.2	171,639.0	174,949	1,113,134
103	A	0-2	37.7	39,133.9	52,611.5	40,659.6	50,647.7	45,763	220,072
103	B	2-4	37.7	14,992.1	23,408.9	19,645.2	13,969.3	18,004	140,131
103	C	4-6	37.7	3,934.0	8,314.5	7,113.2	8,047.4	6,852	35,755
103	D	6-8	37.7	8,606.5	15,752.5	7,634.9	8,465.7	10,115	21,826
103	E	8-10	37.7	3,155.0	2,817.7	3,060.7	3,509.4	3,136	1,693
103	F	10-15	37.7	1,908.5	3,010.6	2,631.7	1,710.8	2,315	1,111
103	G	15-20		.	.	.	.		.
103	F RERUN		53.6	1,908.5	3,010.6	2,631.7	1,710.8	2,315	1,111

Table 6A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 201).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)
Roots												
Dormant												
201	Verdure		6/2/04	-1	1.57	1.80	1.79	0.23	0.22	7.7	3.28	4.42
201	A	0-2	6/2/04	1	1.55	1.94	1.87	0.39	0.32	12.13	2.23	9.9
201	B	2-4	6/2/04	3	1.56	1.85	1.82	0.29	0.26	8.66	2.23	6.43
201	C	4-6	6/2/04	5	1.55	1.71	1.69	0.16	0.14	2.95	2.23	0.72
201	D	6-8	6/2/04	7	1.55	1.61	1.61	0.06	0.06	2.66	2.23	0.43
201	E	8-10	6/2/04	9	1.56	1.60	1.60	0.04	0.04	2.53	2.25	0.28
201	F	10-15	6/2/04	12.5	1.57	1.65	1.65	0.08	0.08	2.5	2.24	0.26
201	G	15-20	6/2/04	17.5	1.56	1.60	1.60	0.06	0.06	2.3	2.25	0.05
201	A ReRUN		6/3/04		1.55	1.94	1.87	0.39	0.32	12.13	2.23	9.90
201	A RERUN	0-2	6/14/04		1.57	2.02	1.97	0.45	0.40	12.13	2.23	9.90
201	A RERUN	0-2	6/15/04		1.57	2.02	1.97	0.45	0.40	12.13	2.23	9.90

Table 6A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 201) (Continued).

Vegetative Structures

4 min Combustion Cycle

			Sub Sample				Water Content			Total
			1	2	3	4	% Moisture	% Moisture	Dry Soil	Section
Sample #	Depth Code	Depth Range	Burn Weight (g)	Burn Weight (g)	Burn Weight (g)	Burn Weight (g)	Wet Weight Basis	Dry Weight Basis	Fraction	Dry Weight (g)
Roots										
Dormant			6/2/04							
201	Verdure		0.10	0.10	0.11	0.10	0.56	4.55	0.99	4.40
201	A	0-2	0.12	0.11	0.12	0.14	3.74	21.87	0.96	9.53
201	B	2-4	0.10	0.10	0.13	0.12	1.65	11.54	0.98	6.32
201	C	4-6	0.06	0.09	0.08	0.09	1.18	14.29	0.99	0.71
201	D	6-8	0.08	0.06	0.09	0.06	0.00	0.00	1.00	0.43
201	E	8-10	0.06	0.05	0.09		0.00	0.00	1.00	0.28
201	F	10-15	0.06	0.07	0.04		0.00	0.00	1.00	0.26
201	G	15-20	0.07				0.00	0.00	1.00	0.05
201	A ReRUN		0.11	0.11			3.74	21.87	0.96	9.53
201	A RERUN	0-2	0.08	0.10	0.09	0.07	2.54	12.50	0.97	9.65
201	A RERUN	0-2	0.09	0.10	0.08	0.10	2.54	12.50	0.97	9.65

Table 6A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 201) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14C Actual DPM Wet Gram	Sub Sample 2 14C Actual DPM Wet Gram	Sub Sample 3 14C Actual DPM Wet Gram	Sub Sample 4 14C Actual DPM Wet Gram	Sub Sample 1 14C Actual DPM divided by burn wt	Sub Sample 2 14C Actual DPM divided by burn wt	Sub Sample 3 14C Actual DPM divided by burn wt	Sub Sample 4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Roots											
Dormant											
201	Verdure		22477.4	21382.7	21029.3	27522.6	224,774	213,827	191,175	275,226	226,251
201	A	0-2			4520.3	6055			37,669	43,250	40,460
201	B	2-4	1470.5	1315.8	1493.1	1331.6	14,705	13,158	11,485	11,097	12,611
201	C	4-6	509.4	1246.8	900.2	1107.2	8,490	13,853	11,253	12,302	11,475
201	D	6-8	379.8	356.5	541.2	260.6	4,748	5,942	6,013	4,343	5,261
201	E	8-10	235.2	439.6	275.8		3,920	8,792	3,064		5,259
201	F	10-15	112.2	145.1	126.9		1,870	2,073	3,173		2,372
201	G	15-20	219.5				3,136				3,136
201	A ReRUN		4781.3	2945.9			43,466	26,781			35,124
201	A RERUN	0-2	3996.7	5092.6			49,959	50,926			50,442
201	A RERUN	0-2	4298.4	2875.7	3673.4	3584.3	47,760	28,757	45,918	35,843	39,569

Table 6A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 201) (Continued).

Vegetative Structures

			Sub Sample					Sub Sample			
			1	2	3	4		1	2	3	4
Sample #	Depth Code	Depth Range	14 C DPM Dry Gram	14 C DPM Dry Gram	14 C DPM Dry Gram	14 C DPM Dry Gram	1 / BO Correction Factor	14C Corrected DPM for Dry Gram	14C Corrected DPM for Dry Gram	14C Corrected DPM for Dry Gram	14C Corrected DPM for Dry Gram
Roots											
Dormant											
201	Verdure		226,037	215,028	192,249	276,772	1.06236	240,133	228,438	204,238	294,032
201	A	0-2			39,134	44,932	1.06236			41,575	47,734
201	B	2-4	14,951	13,379	11,678	11,283	1.06236	15,884	14,213	12,406	11,986
201	C	4-6	8,592	14,019	11,387	12,450	1.06236	9,127	14,893	12,097	13,226
201	D	6-8	4,748	5,942	6,013	4,343	1.09555	5,201	6,509	6,588	4,758
201	E	8-10	3,920	8,792	3,064		1.09555	4,295	9,632	3,357	
201	F	10-15	1,870	2,073	3,173		1.09555	2,049	2,271	3,476	
201	G	15-20	3,136				1.09555	3,435			
201	A ReRUN		45,157	27,822			0.9896	44,687	27,533		
201	A RERUN	0-2	51,260	52,252			1.10597	56,692	57,790		
201	A RERUN	0-2	49,004	29,506	47,113	36,776	1.14248	55,986	33,710	53,826	42,016

Table 6A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 201) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Roots									
Dormant									
201	Verdure		104.7	240,027.9	228,332.9	204,133.6	293,927.3	241,605	1,061,930
201	A	0-2	95.2	44,641.3	41,972.0	41,479.3	47,638.7	43,933	418,654
201	B	2-4	45.9	15,837.9	14,166.9	12,360.2	11,940.3	13,576	85,857
201	C	4-6	45.9	9,081.6	14,847.6	12,051.5	13,180.0	12,290	8,744
201	D	6-8	45.9	5,155.2	6,463.5	6,542.0	4,712.4	5,718	2,459
201	E	8-10	45.9	4,248.7	9,586.2	3,311.4	.	5,715	1,600
201	F	10-15	45.9	2,002.8	2,225.0	3,429.7	.	2,553	664
201	G	15-20	45.9	3,389.4	.	.	.	3,389	169
201	A ReRUN		45.9	44,641.3	27,487.2	.	.	36,064	343,671
201	A RERUN	0-2	49.1	56,642.8	57,740.4	.	.	57,192	551,827
201	A RERUN	0-2	44.3	55,941.4	33,665.5	53,781.6	41,972.0	46,340	447,124

Table 6B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 202).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)
Roots												
Dormant												
202	Verdure		6/4/04	-1	1.56	1.84	1.81	0.28	0.25	8.3	3.6	4.7
202	A	0-2	6/4/04	1	1.57	3.16	2.35	1.59	0.78	29.09	2.25	26.84
202	B	2-4	6/4/04	3	1.59	1.86	1.79	0.27	0.20	7.8	2.25	5.55
202	C	4-6	6/4/04	5	1.57	1.74	1.72	0.17	0.15	3.04	2.25	0.79
202	D	6-8	6/4/04	7								0
202	E	8-10	6/4/04	9								
	D&Ecombined				1.57	1.65	1.64	0.08	0.07	2.7	2.25	0.45
202	F	10-15	6/4/04	12.5	1.59	1.66	1.66	0.07	0.07	2.58	2.25	0.33
202	G	15-20	6/4/04	17.5								0

Table 6B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 202) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)

Roots

Sample #	Depth Code	Depth Range	1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	% Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)
Dormant			6/2/04							
202	Verdure		0.11	0.11	0.11	0.11	1.66	12.00	0.98	4.62
202	A	0-2	0.27	0.21	0.20	0.22	34.47	103.85	0.66	17.59
202	B	2-4	0.17	0.13	0.16	0.17	3.91	35.00	0.96	5.33
202	C	4-6	0.08	0.10	0.13	0.13	1.16	13.33	0.99	0.78
202	D	6-8								0.22
202	E	8-10								0.22
	D&Ecombined		0.09	0.09	0.10	0.08	0.61	14.29	0.99	0.45
202	F	10-15	0.06	0.08	0.08		0.00	0.00	1.00	0.33
202	G	15-20								

Table 6B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 202) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14C Actual DPM Wet Gram	Sub Sample 2 14C Actual DPM Wet Gram	Sub Sample 3 14C Actual DPM Wet Gram	Sub Sample 4 14C Actual DPM Wet Gram	Sub Sample 1 14C Actual DPM divided by burn wt	Sub Sample 2 14C Actual DPM divided by burn wt	Sub Sample 3 14C Actual DPM divided by burn wt	Sub Sample 4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Roots											
Dormant											
202	Verdure		20690.1	23558.8	18025	18712.9	188,092	214,171	163,864	170,117	184,061
202	A	0-2	3293.4	3839.3	3324.5	11107.1	12,198	18,282	16,623	50,487	24,397
202	B	2-4	1069.7	1470.7	1747.7	1985.9	6,292	11,313	10,923	11,682	10,053
202	C	4-6	493.3	584.3	727.4	823.2	6,166	5,843	5,595	6,332	5,984
202	D	6-8									
202	E	8-10									
	D&Ecombined		254.9	266.5	301	248.7	2,832	2,961	3,010	3,109	2,978
202	F	10-15	131.9	158.1	163.4		2,198	1,976	2,043		2,072
202	G	15-20									

Table 6B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 202) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14 C DPM Dry Gram	Sub Sample 2 14 C DPM Dry Gram	Sub Sample 3 14 C DPM Dry Gram	Sub Sample 4 14 C DPM Dry Gram	1 / BO Correction Factor	Sub Sample 1 14C Corrected DPM for Dry Gram	Sub Sample 2 14C Corrected DPM for Dry Gram	Sub Sample 3 14C Corrected DPM for Dry Gram	Sub Sample 4 14C Corrected DPM for Dry Gram
Roots											
Dormant											
202	Verdure		191,262	217,781	166,625	172,984	0.84652	161,908	184,356	141,052	146,435
202	A	0-2	18,613	27,898	25,366	77,042	0.84652	15,757	23,617	21,472	65,217
202	B	2-4	6,548	11,773	11,368	12,157	0.84652	5,543	9,967	9,623	10,291
202	C	4-6	6,239	5,912	5,661	6,407	0.94283	5,882	5,574	5,338	6,041
202	D	6-8									
202	E	8-10									
	D&Ecombined		2,850	2,979	3,028	3,128	0.94283	2,687	2,809	2,855	2,949
202	F	10-15	2,198	1,976	2,043		0.94283	2,073	1,863	1,926	
202	G	15-20									

Table 6B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 202) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Roots									
Dormant									
202	Verdure		95.2	161,812.4	184,261.1	140,957.0	146,340.1	158,343	731,876
202	A	0-2	45.9	15,710.9	23,570.8	21,426.6	65,171.6	31,470	553,518
202	B	2-4	45.9	5,497.5	9,920.6	9,577.1	10,245.4	8,810	46,984
202	C	4-6	45.9	5,836.2	5,527.9	5,291.7	5,994.6	5,663	4,421
202	D	6-8		1,320.4	1,381.5	1,404.7	1,451.6	1,390	311
202	E	8-10		1,320.4	1,381.5	1,404.7	1,451.6	1,390	311
	D&Ecombined		45.9	2,640.8	2,763.1	2,809.4	2,903.1	2,779	1,243
202	F	10-15	45.9	2,026.8	1,817.4	1,879.8	.	1,908	630
202	G	15-20		.	.	.	.		.

Table 6C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 204).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)

Roots

Dormant

204	Verdure		6/3/04	-1	1.57	1.76	1.75	0.19	0.18	5.99	3.48	2.51
204	A	0-2	6/3/04	1	1.56	2.15	2.02	0.59	0.46	15.19	2.35	12.84
204	B	2-4	6/3/04	3	1.59	1.90	1.80	0.31	0.21	12.22	2.29	9.93
204	C	4-6	6/3/04	5	1.58	1.92	1.84	0.34	0.26	5.32	2.32	3
204	D	6-8	6/3/04	7	1.58	1.78	1.70	0.20	0.12	3.02	2.25	0.77
204	E	8-10	6/3/04	9	1.56	1.67	1.66	0.11	0.10	2.6	2.24	0.36
204	F	10-15	6/3/04	12.5	1.57	1.64	1.63	0.07	0.06	2.57	2.27	0.3
204	G	15-20	6/3/04	17.5								
204	A RERUN		6/15/04		1.56	2.15	2.02	0.59	0.46	15.19	2.35	12.84
204	B RERUN		6/15/04		1.59	1.90	1.80	0.31	0.21	12.22	2.29	9.93

Table 6C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 204) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)

Roots

Dormant

Sample #	Depth Code	Depth Range	1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	% Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)
			6/2/04 6/3/04							
204	Verdure		0.09	0.10	0.10	0.10	0.57	5.56	0.99	2.50
204	A	0-2	0.15	0.14	0.14	0.15	6.44	28.26	0.94	12.01
204	B	2-4	0.12	0.14	0.17	0.13	5.56	47.62	0.94	9.38
204	C	4-6	0.11	0.10	0.11	0.11	4.35	30.77	0.96	2.87
204	D	6-8	0.10	0.12	0.11	0.15	4.71	66.67	0.95	0.73
204	E	8-10	0.07	0.07	0.11		0.60	10.00	0.99	0.36
204	F	10-15	0.06	0.06	0.10		0.61	16.67	0.99	0.30
204	G	15-20								
204	A RERUN		0.12	0.16			6.44	28.26	0.94	12.01
204	B RERUN		0.16	0.13			5.56	47.62	0.94	9.38

Table 6C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 204) (Continued).

Vegetative Structures

			Sub Sample				Sub Sample				
Sample #	Depth Code	Depth Range	1 14C Actual DPM Wet Gram	2 14C Actual DPM Wet Gram	3 14C Actual DPM Wet Gram	4 14C Actual DPM Wet Gram	1 14C Actual DPM divided by burn wt	2 14C Actual DPM divided by burn wt	3 14C Actual DPM divided by burn wt	4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt

Roots

Dormant

204	Verdure		13262.2	14970.6	24558.9	14939.7	147,358	149,706	245,589	149,397	173,012
204	A	0-2	3552.2	9865.1	4271.6	3027.2	23,681	70,465	30,511	20,181	36,210
204	B	2-4	1425.1	1307.9	1500.7	1369	11,876	9,342	8,828	10,531	10,144
204	C	4-6	1017.9	848.7	862.9	843.4	9,254	8,487	7,845	7,667	8,313
204	D	6-8	341.9	400.9	448.6	605.3	3,419	3,341	4,078	4,035	3,718
204	E	8-10	254.5	285.4	535.4		3,636	4,077	4,867		4,193
204	F	10-15	130	133.7	199.6		2,167	2,228	1,996		2,130
204	G	15-20									
204	A RERUN		4771.7	3994.7			39,764	24,967			32,366
204	B RERUN		1884.3	1206.9			11,777	9,284			10,530

Table 6C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 204) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14 C DPM Dry Gram	Sub Sample 2 14 C DPM Dry Gram	Sub Sample 3 14 C DPM Dry Gram	Sub Sample 4 14 C DPM Dry Gram	1 / BO Correction Factor	Sub Sample 1 14C Corrected DPM for Dry Gram	Sub Sample 2 14C Corrected DPM for Dry Gram	Sub Sample 3 14C Corrected DPM for Dry Gram	Sub Sample 4 14C Corrected DPM for Dry Gram
Roots											
Dormant											
204	Verdure		148,205	150,566	247,000	150,256	0.9896	146,664	149,001	244,432	148,693
204	A	0-2	25,310	75,312	32,610	21,569	0.95647	24,208	72,033	31,190	20,630
204	B	2-4	12,574	9,892	9,347	11,150	0.95647	12,027	9,461	8,940	10,665
204	C	4-6	9,674	8,873	8,201	8,016	0.95647	9,253	8,487	7,844	7,667
204	D	6-8	3,588	3,506	4,280	4,235	0.96259	3,454	3,375	4,119	4,076
204	E	8-10	3,658	4,102	4,897	0	0.96259	3,521	3,948	4,714	
204	F	10-15	2,180	2,242	2,008	0	0.96259	2,098	2,158	1,933	
204	G	15-20									
204	A RERUN		42,499	26,684	0	0	1.14248	48,555	30,486		
204	B RERUN		12,470	9,830	0	0	1.14248	14,246	11,231		

Table 6C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in roots when applied to dormant bermudagrass (sample 204) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Roots									
Dormant									
204	Verdure		95.2	146,568.3	148,905.5	244,336.8	148,598.0	172,102	429,508
204	A	0-2	45.9	24,162.5	30,441.8	31,144.6	20,584.6	26,583	319,363
204	B	2-4	45.9	11,981.1	9,415.2	8,894.1	10,618.9	10,227	95,915
204	C	4-6	45.9	9,207.2	8,440.6	7,798.2	7,620.9	8,267	23,722
204	D	6-8	45.9	3,407.7	3,328.8	4,073.6	4,030.3	3,710	2,722
204	E	8-10	45.9	3,475.0	3,902.5	4,667.7	.	4,015	1,437
204	F	10-15	45.9	2,052.6	2,112.3	1,887.3	.	2,017	602
204	G	15-20		.	.	.	.		.
204	A RERUN		44.3	48,510.2	30,441.8	.	.	39,476	474,251
204	B RERUN		44.3	14,202.0	11,186.2	.	.	12,694	119,050

Table 7A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 101).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)
Shoots												
	Collection Date		Burn Date									
101	Background	A	6/1/04		1.57	1.77	1.67	0.20	0.10			
101	12-Apr	B	6/1/04		1.56	1.75	1.61	0.19	0.05			2.36
101	15-Apr	C	6/1/04		1.56	1.70	1.60	0.14	0.04			0.62
101	19-Apr	D	6/1/04		1.55	1.76	1.61	0.21	0.06			1.91
101	22-Apr	E	6/1/04		1.60	1.79	1.68	0.19	0.08			1.3
101	27-Apr	F	6/1/04		1.55	1.74	1.61	0.19	0.06			2.38
101	29-Apr	G	6/1/04		1.57	1.77	1.64	0.20	0.07			0.68
101	3-May	H	6/1/04		1.57	1.77	1.63	0.20	0.06			1.15

Table 7A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)

Shoots

Sample #	Collection Date	Depth	1	2	3	4	% Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)
101	Background	A					5.99	100.00	0.94	0.00
101	12-Apr	B	0.10	0.11	0.12	0.10	8.70	280.00	0.91	2.15
101	15-Apr	C	0.10	0.10	0.07	0.12	6.25	250.00	0.94	0.58
101	19-Apr	D	0.10	0.11	0.11	0.12	9.32	250.00	0.91	1.73
101	22-Apr	E	0.10	0.11	0.11	0.10	6.36	128.92	0.94	1.22
101	27-Apr	F	0.11	0.12	0.11	0.11	8.07	216.67	0.92	2.19
101	29-Apr	G	0.09	0.09	0.11	0.10	7.93	185.71	0.92	0.63
101	3-May	H	0.10	0.11	0.11	0.10	8.59	233.33	0.91	1.05

Table 7A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14C Actual DPM Wet Gram	Sub Sample 2 14C Actual DPM Wet Gram	Sub Sample 3 14C Actual DPM Wet Gram	Sub Sample 4 14C Actual DPM Wet Gram	Sub Sample 1 14C Actual DPM divided by burn wt	Sub Sample 2 14C Actual DPM divided by burn wt	Sub Sample 3 14C Actual DPM divided by burn wt	Sub Sample 4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Shoots											
	Collection Date										
101	Background	A									
101	12-Apr	B	1701.4	2440	2437.6	2759.9	17,014	22,182	20,313	27,599	21,777
101	15-Apr	C	1639.7	2054.9	1333.9	2000.2	16,397	20,549	19,056	16,668	18,168
101	19-Apr	D	2203.4	2623	2356.8	3051.2	22,034	23,845	21,425	25,427	23,183
101	22-Apr	E	2985.1	3144.1	3165.8	2442.1	29,851	28,583	28,780	24,421	27,909
101	27-Apr	F	2532.2	2930.6	2486.1	3073.5	23,020	24,422	22,601	27,941	24,496
101	29-Apr	G	3396.6	2315.4	3566.3	3814.4	37,740	25,727	32,421	38,144	33,508
101	3-May	H	1856.6	1341.5	1710.7	1959.8	18,566	12,195	15,552	19,598	16,478

Table 7A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14C Actual DPM Wet Gram	Sub Sample 2 14C Actual DPM Wet Gram	Sub Sample 3 14C Actual DPM Wet Gram	Sub Sample 4 14C Actual DPM Wet Gram	Sub Sample 1 14C Actual DPM divided by burn wt	Sub Sample 2 14C Actual DPM divided by burn wt	Sub Sample 3 14C Actual DPM divided by burn wt	Sub Sample 4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Shoots											
	Collection Date										
101	Background	A									
101	12-Apr	B	18,634	24,294	22,248	30,227	1.0147	18,909	24,652	22,576	30,673
101	15-Apr	C	17,490	21,919	20,326	17,780	0.9525	16,659	20,877	19,360	16,934
101	19-Apr	D	24,298	26,295	23,627	28,039	0.9935	24,140	26,125	23,473	27,857
101	22-Apr	E	31,878	30,523	30,734	26,079	1.0484	33,422	32,002	32,223	27,342
101	27-Apr	F	25,042	26,567	24,586	30,395	1.0521	26,346	27,950	25,866	31,978
101	29-Apr	G	40,989	27,942	35,212	41,428	1.0357	42,452	28,939	36,469	42,906
101	3-May	H	20,310	13,341	17,013	21,439	0.9968	20,246	13,299	16,959	21,371

Table 7A. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 101) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Shoots									
	Collection Date								
101	Background	A							
101	12-Apr	B	95.2	18,813.8	24,557.3	22,480.7	30,577.8	24,107	51,946
101	15-Apr	C	45.9	16,612.8	20,831.0	19,313.9	16,888.4	18,412	10,702
101	19-Apr	D	45.9	24,094.3	26,078.9	23,427.6	27,811.2	25,353	43,913
101	22-Apr	E	45.9	33,376.0	31,956.0	32,176.8	27,296.4	31,201	37,983
101	27-Apr	F	45.9	26,299.9	27,904.1	25,820.2	31,931.7	27,989	61,235
101	29-Apr	G	45.9	42,406.1	28,892.8	36,422.9	42,860.5	37,646	23,570
101	3-May	H	45.9	20,199.6	13,252.8	16,912.8	21,325.0	17,923	18,841
									248,189

Table 7B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 102).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)

Shoots

	Collection Date		Burn Date									
102	Background	A	6/1/04									
102	12-Apr	B	6/1/04		1.56	1.79	1.61	0.23	0.05			2.58
102	15-Apr	C	6/1/04		1.55	1.75	1.61	0.20	0.06			0.88
102	19-Apr	D	6/1/04		1.58	1.80	1.63	0.22	0.05			1.93
102	22-Apr	E	6/1/04		1.60	1.80	1.66	0.20	0.06			1.57
102	27-Apr	F	6/1/04		1.58	1.78	1.65	0.20	0.07			2.7
102	29-Apr	G	6/1/04		1.59	1.72	1.64	0.13	0.05			0.79
102	3-May	H	6/1/04		1.60	1.84	1.67	0.24	0.07			1.28

Table 7B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	Sub Sample 2 Burn Weight (g)	Sub Sample 3 Burn Weight (g)	Sub Sample 4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)

Shoots

Sample #	Collection Date	Depth Code	1	2	3	4	% Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)
102	Background	A	0.09	0.09			#DIV/0!			
102	12-Apr	B	0.10	0.11	0.10	0.10	11.18	360.00	0.89	2.29
102	15-Apr	C	0.09	0.10	0.11	0.12	8.70	233.33	0.91	0.80
102	19-Apr	D	0.10	0.12	0.11	0.13	10.43	340.00	0.90	1.73
102	22-Apr	E	0.12	0.11	0.12	0.10	8.43	233.33	0.92	1.44
102	27-Apr	F	0.10	0.13	0.11	0.12	7.88	185.71	0.92	2.49
102	29-Apr	G	0.07	0.09	0.13	0.11	4.88	160.00	0.95	0.75
102	3-May	H	0.11	0.11	0.10	0.11	10.18	242.86	0.90	1.15

Table 7B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

			Sub Sample				Sub Sample				
			1	2	3	4	1	2	3	4	
Sample #	Depth Code	Depth Range	14C Actual DPM Wet Gram	14C Actual DPM Wet Gram	14C Actual DPM Wet Gram	14C Actual DPM Wet Gram	14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Shoots											
	Collection Date										
102	Background	A	36.1				401				
102	12-Apr	B	2372.7	2281.3	2549.1	2613.7	23,727	20,739	25,491	26,137	24,024
102	15-Apr	C	1985.9	1842.5	2138.1	2377.4	22,066	18,425	19,437	19,812	19,935
102	19-Apr	D	3146	3479.6	3300.2	3557.3	31,460	28,997	30,002	27,364	29,456
102	22-Apr	E	3261.1	2544.2	3152	3742.2	27,176	23,129	26,267	37,422	28,498
102	27-Apr	F	2412.1	2746.3	2920.9	2966.6	24,121	21,125	26,554	24,722	24,130
102	29-Apr	G	2711.9	3406.9	5525.5	3855.7	38,741	37,854	42,504	35,052	38,538
102	3-May	H	2049.7	1840.6	1789.4	2427.8	18,634	16,733	17,894	22,071	18,833

Table 7B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14 C DPM Dry Gram	Sub Sample 2 14 C DPM Dry Gram	Sub Sample 3 14 C DPM Dry Gram	Sub Sample 4 14 C DPM Dry Gram	1 / BO Correction Factor	Sub Sample 1 14C Corrected DPM for Dry Gram	Sub Sample 2 14C Corrected DPM for Dry Gram	Sub Sample 3 14C Corrected DPM for Dry Gram	Sub Sample 4 14C Corrected DPM for Dry Gram
Shoots											
	Collection Date										
102	Background	A									
102	12-Apr	B	26,714	23,350	28,700	29,427	1.01474	27,107	23,694	29,123	29,861
102	15-Apr	C	24,167	20,180	21,288	21,698	0.95246	23,018	19,220	20,276	20,667
102	19-Apr	D	35,123	32,373	33,495	30,550	0.99351	34,895	32,163	33,278	30,352
102	22-Apr	E	29,679	25,259	28,686	40,869	1.04844	31,117	26,483	30,076	42,848
102	27-Apr	F	26,184	22,932	28,825	26,836	1.05206	27,547	24,126	30,325	28,233
102	29-Apr	G	40,728	39,796	44,684	36,849	1.03569	42,182	41,216	46,278	38,164
102	3-May	H	20,745	18,629	19,922	24,572	0.9968	20,679	18,570	19,858	24,494

Table 7B. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 102) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Shoots									
	Collection Date								
102	Background	A							
102	12-Apr	B	95.2	27,012.2	23,598.6	29,027.5	29,765.5	27,351	62,676
102	15-Apr	C	45.9	22,972.3	19,174.5	20,230.5	20,621.1	20,750	16,672
102	19-Apr	D	45.9	34,849.4	32,117.1	33,232.0	30,306.0	32,626	56,401
102	22-Apr	E	45.9	31,070.6	26,437.1	30,029.6	42,802.6	32,585	46,844
102	27-Apr	F	45.9	27,501.3	24,080.2	30,279.5	28,187.3	27,512	68,430
102	29-Apr	G	45.9	42,135.8	41,170.0	46,232.3	38,118.5	41,914	31,497
102	3-May	H	45.9	20,633.2	18,523.7	19,812.4	24,447.8	20,854	23,976
									306,496

Table 7C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 103).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sample #	Depth Ave	Pan Weight (g)	Wet Soil + pan (g)	Dry Soil + pan (g)	Wet Roots (g)	Dry Roots (g)	Bag + Section Section Wet Weight (g)	Dried + Sieved + Washed Bag Weight (g)	Total Section Section Wet Weight (g)

Shoots

	Collection Date		Burn Date									
103	Background	A	6/1/04									
103	12-Apr	B	6/1/04		1.56	1.79	1.62	0.23	0.06			2.84
103	15-Apr	C	6/1/04		1.58	1.72	1.62	0.14	0.04			0.95
103	19-Apr	D	6/1/04		1.57	1.77	1.66	0.20	0.09			2.07
103	22-Apr	E	6/1/04		1.59	1.84	1.67	0.25	0.08			1.61
103	27-Apr	F	6/1/04		1.56	1.76	1.63	0.20	0.07			2.14
103	29-Apr	G	6/1/04		1.59	1.76	1.65	0.17	0.06			0.75
103	3-May	H	6/1/04		1.61	1.81	1.67	0.20	0.06			1.29

Table 7C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

4 min Combustion Cycle

Sample #	Depth Code	Depth Range	Sub Sample 1 Burn Weight (g)	2 Burn Weight (g)	3 Burn Weight (g)	4 Burn Weight (g)	Water Content % Moisture Wet Weight Basis	% Moisture Dry Weight Basis	Dry Soil Fraction	Total Section Dry Weight (g)

Shoots

	Collection Date									
103	Background	A	0.11				#DIV/0!			
103	12-Apr	B	0.11	0.12	0.11	0.12	10.49	283.33	0.90	2.54
103	15-Apr	C	0.12	0.11	0.12	0.12	6.17	250.00	0.94	0.89
103	19-Apr	D	0.12	0.12	0.12	0.10	6.63	122.22	0.93	1.93
103	22-Apr	E	0.10	0.11	0.11	0.13	10.18	212.50	0.90	1.45
103	27-Apr	F	0.12	0.10	0.12	0.11	7.98	185.71	0.92	1.97
103	29-Apr	G	0.09	0.10	0.10	0.10	6.67	183.33	0.93	0.70
103	3-May	H	0.11	0.13	0.12	0.11	8.38	233.33	0.92	1.18

Table 7C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Sub Sample 1 14C Actual DPM Wet Gram	Sub Sample 2 14C Actual DPM Wet Gram	Sub Sample 3 14C Actual DPM Wet Gram	Sub Sample 4 14C Actual DPM Wet Gram	Sub Sample 1 14C Actual DPM divided by burn wt	Sub Sample 2 14C Actual DPM divided by burn wt	Sub Sample 3 14C Actual DPM divided by burn wt	Sub Sample 4 14C Actual DPM divided by burn wt	14C Actual DPM divided by burn wt
Shoots											
	Collection Date										
103	Background	A									
103	12-Apr	B	2602.7	2479.2	1916.4	2311.7	23,661	20,660	17,422	19,264	20,252
103	15-Apr	C	1660.7	1655.7	2301.4	2612.5	13,839	15,052	19,178	21,771	17,460
103	19-Apr	D	3035.1	3921.3	3067.4	2954.6	25,293	32,678	25,562	29,546	28,269
103	22-Apr	E	2588.7	2111.7	2704.4	2674.4	25,887	19,197	24,585	20,572	22,561
103	27-Apr	F	2520	2539	2804.4	3355.3	21,000	25,390	23,370	30,503	25,066
103	29-Apr	G	3545.8	3490.5	3434.4	3553.3	39,398	34,905	34,344	35,533	36,045
103	3-May	H	2093.5	2337.2	1452.1	1845.1	19,032	17,978	12,101	16,774	16,471

Table 7C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

			Sub Sample					Sub Sample			
			1	2	3	4		1	2	3	4
Sample #	Depth Code	Depth Range	14 C DPM Dry Gram	14 C DPM Dry Gram	14 C DPM Dry Gram	14 C DPM Dry Gram	1 / BO Correction Factor	14C Corrected DPM for Dry Gram	14C Corrected DPM for Dry Gram	14C Corrected DPM for Dry Gram	14C Corrected DPM for Dry Gram

Shoots

	Collection Date										
103	Background	A									
103	12-Apr	B	26,435	23,082	19,464	21,523	1.01474	26,825	23,422	19,751	21,840
103	15-Apr	C	14,750	16,042	20,440	23,203	0.95246	14,048	15,279	19,468	22,100
103	19-Apr	D	27,087	34,997	27,376	31,643	0.99351	26,912	34,770	27,198	31,438
103	22-Apr	E	28,821	21,373	27,372	22,904	1.04844	30,217	22,408	28,698	24,013
103	27-Apr	F	22,820	27,590	25,395	33,146	1.05206	24,008	29,027	26,718	34,872
103	29-Apr	G	42,212	37,398	36,797	38,071	1.03569	43,718	38,733	38,110	39,430
103	3-May	H	20,773	19,624	13,208	18,308	0.9968	20,707	19,561	13,166	18,250

Table 7C. Raw data and calculations used to determine the normalized percent of applied 14C labeled simazine in clippings when applied to actively-growing bermudagrass (sample 103) (Continued).

Vegetative Structures

Sample #	Depth Code	Depth Range	Adjust Background Soil DPM Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	14C Calculated DPM for Dry Gram	Mean Calculated DPM for Dry Gram	Root Total DPM Dry Section
Shoots									
	Collection Date								
103	Background	A							
103	12-Apr	B	95.2	26,729.4	23,327.2	19,656.1	21,744.8	22,864	58,121
103	15-Apr	C	45.9	14,002.6	15,233.6	19,422.5	22,054.2	17,678	15,758
103	19-Apr	D	45.9	26,865.9	34,723.7	27,152.3	31,391.7	30,033	58,049
103	22-Apr	E	45.9	30,171.1	22,362.4	28,651.8	23,967.4	26,288	38,016
103	27-Apr	F	45.9	23,962.2	28,981.0	26,671.7	34,826.1	28,610	56,343
103	29-Apr	G	45.9	43,672.5	38,687.0	38,064.5	39,383.9	39,952	27,966
103	3-May	H	45.9	20,661.0	19,514.9	13,120.0	18,204.1	17,875	21,126
									275,378

Appendix B

Table 1. Raw data and calculations used to determine the percent of applied 14C labeled simazine in leachate.

Date	WEIGHT	TARE	LEACH Volume	DPM	Corrected DPM	Total DPM	% OF APPLIED
101	ACTIVELY GROWING						
8-Apr	413.1	284.6	128.5	35.0	1.7	218.5	0.0020
12-Apr	1341.7	764.9	576.8	35.7	2.4	1,384.3	0.0126
15-Apr	1579.1	764.1	815.0	46.8	13.5	11,002.5	0.1004
19-Apr	1238.2	766.1	472.1	41.0	7.7	3,635.2	0.0332
22-Apr	1316.9	767.7	549.2	41.1	7.8	4,283.8	0.0391
27-Apr	1179.6	764.5	415.1	44.4	11.1	4,607.6	0.0421
29-Apr	1457.3	722.6	734.7	40.8	7.5	5,510.3	0.0503
			3691.4		51.7	30,642.1	0.2797
102	ACTIVELY GROWING						
8-Apr	384.2	284.7	99.5	39.9	6.6	656.7	0.0060
12-Apr	1202.8	725.5	477.3	106.8	73.5	35,081.6	0.3203
15-Apr	1607.1	763.0	844.1	74.6	41.3	34,861.3	0.3182
19-Apr	1167.0	765.6	401.4	77.6	44.3	17,782.0	0.1623
22-Apr	1274.5	770.7	503.8	86.8	53.5	26,953.3	0.2461
27-Apr	1098.3	724.1	374.2	76.3	43.0	16,090.6	0.1469
29-Apr	1401.0	722.8	678.2	85.3	52.0	35,266.4	0.3219
						166,691.9	1.5217

Table 1. Raw data and calculations used to determine the percent of applied 14C labeled simazine in leachate (Continued).

Date	WEIGHT	TARE	LEACH Volume	DPM	Corrected DPM	Total DPM	% OF APPLIED
103	ACTIVELY GROWING						
8-Apr	335.1	285.6	49.5	217.5	184.2	9,117.9	0.0832
12-Apr	1321.2	764.5	556.7	55.3	22.0	12,247.4	0.1118
15-Apr	1543.2	762.0	781.2	62.5	29.2	22,811.0	0.2082
19-Apr	1113.4	762.6	350.8	54.8	21.5	7,542.2	0.0689
22-Apr	1297.7	770.0	527.7	51.0	17.7	9,340.3	0.0853
27-Apr	1045.4	724.7	320.7	50.0	16.7	5,355.7	0.0489
29-Apr	1388.8	724.3	664.5	49.4	16.1	10,698.5	0.0977
						77,113.0	0.7040
303	WARM FALLOW SOIL						
8-Apr	414.0	285.6	128.4	49.3	16.0	2,054.4	0.0188
12-Apr	1379.3	761.6	617.7	41.3	8.0	4,941.6	0.0451
15-Apr	1500.7	763.7	737.0	38.5	5.2	3,832.4	0.0350
19-Apr	1226.0	764.1	461.9	39.4	6.1	2,817.6	0.0257
22-Apr	1193.4	765.4	428.0	46.9	13.6	5,820.8	0.0531
27-Apr	1161.2	764.0	397.2	49.8	16.5	6,553.8	0.0598
29-Apr	1381.2	724.7	656.5	54.5	21.2	13,917.8	0.1271
						39,938.4	0.3646

Table 1. Raw data and calculations used to determine the percent of applied 14C labeled simazine in leachate (Continued).

Date	WEIGHT	TARE	LEACH Volume	DPM	Corrected DPM	Total DPM	% OF APPLIED
304	WARM FALLOW SOIL						
8-Apr	368.7	285.7	83.0	49.9	16.6	1,377.8	0.0126
12-Apr	1397.5	762.5	635.0	41.2	7.9	5,016.5	0.0458
15-Apr	1548.8	762.8	786.0	84.8	51.5	40,479.0	0.3695
19-Apr	1246.5	765.4	481.1	109.1	75.8	36,467.4	0.3329
22-Apr	1248.1	765.2	482.9	110.9	77.6	37,473.0	0.3421
27-Apr	1162.4	762.8	399.6	93.5	60.2	24,055.9	0.2196
29-Apr	1473.7	724.8	748.9	94.7	61.4	45,982.5	0.4198
						190,852.1	1.7423
307	WARM FALLOW SOIL						
8-Apr	404.0	285.4	118.6	35.1	1.8	213.5	0.0019
12-Apr	1356.6	723.6	633.0	35.5	2.2	1,392.6	0.0127
15-Apr	1500.3	763.1	737.2	34.3	1.0	737.2	0.0067
19-Apr	1216.4	766.6	449.8	38.4	5.1	2,294.0	0.0209
22-Apr	1222.7	722.8	499.9	70.3	37.0	18,496.3	0.1689
27-Apr	1180.5	763.8	416.7	94.6	61.3	25,543.7	0.2332
29-Apr	1425.3	725.3	700.0	103.8	70.5	49,350.0	0.4505
						98,027.3	0.8949

Table 1. Raw data and calculations used to determine the percent of applied 14C labeled simazine in leachate (Continued).

Date	WEIGHT	TARE	LEACH Volume	DPM	Corrected DPM	Total DPM	% OF APPLIED
401 COLD FALLOW SOIL							
8-Apr	464.4	285.3	179.1	33.3	0.0	0.0	0.0000
12-Apr	1547.9	764.0	783.9	34.3	1.0	783.9	0.0072
15-Apr	1599.0	764.0	835.0	43.8	10.5	8,767.5	0.0800
19-Apr	1540.7	764.2	776.5	52.6	19.3	14,986.5	0.1368
22-Apr	1539.2	723.7	815.5	65.0	31.7	25,851.4	0.2360
27-Apr	1489.7	724.3	765.4	79.6	46.3	35,438.0	0.3235
29-Apr	1570.4	725.5	844.9	92.3	59.0	49,849.1	0.4551
						135,676.3	1.2386
402 COLD FALLOW SOIL							
8-Apr	452.0	285.4	166.6	35.7	2.4	399.8	0.0037
12-Apr	1459.0	723.6	735.4	73.4	40.1	29,489.5	0.2692
15-Apr	1584.3	763.4	820.9	96.6	63.3	51,963.0	0.4744
19-Apr	1608.9	764.2	844.7	92.7	59.4	50,175.2	0.4580
22-Apr	1586.1	765.4	820.7	98.9	65.6	53,837.9	0.4915
27-Apr	1523.5	762.6	760.9	95.0	61.7	46,947.5	0.4286
29-Apr	1552.3	724.1	828.2	125.7	92.4	76,525.7	0.6986
						309,338.7	2.8239

Table 1. Raw data and calculations used to determine the percent of applied 14C labeled simazine in leachate (Continued).

Date	WEIGHT	TARE	LEACH Volume	DPM	Corrected DPM	Total DPM	% OF APPLIED
405	COLD FALLOW SOIL						
8-Apr	474.5	285.0	189.5	39.0	5.7	1,080.2	0.0099
12-Apr	1485.7	723.8	761.9	39.2	5.9	4,495.2	0.0410
15-Apr	1485.9	765.2	720.7	41.1	7.8	5,621.5	0.0513
19-Apr	1536.6	764.5	772.1	53.7	20.4	15,750.8	0.1438
22-Apr	1592.0	768.9	823.1	51.3	18.0	14,815.8	0.1353
27-Apr	1498.0	723.7	774.3	61.5	28.2	21,835.3	0.1993
29-Apr	1558.5	723.7	834.8	68.3	35.0	29,218.0	0.2667
						92,816.7	0.8473

Appendix C

Table 1. Links to PowerPoint presentations and videos

PowerPoint	Video
Field Lysimeters	Field Lysimeter
^{14}C labeled Simazine	Mole Cricket
Fipronil / Mole Cricket	Harvey
Thanks for the help	Dr. Weber on Gator