

# Exposure to Granular and Liquid Formulations of the Turfgrass Insecticide Chlorpyrifos [DURSBAN]

Beginning in the summer of 1989, a research team, headed by Prof. Gary Stephenson of the Department of Environmental Biology have been investigating the exposure of home owners and applicators to pesticides, commencing with work on the herbicide, 2,4-D. Their focus has recently changed to the insecticide, chlorpyrifos, which is marketed under the trade name of Dursban. This insecticide is used extensively to control chinch bug, sod webworm and the grubs of European chafer, June and Japanese beetles. The chemical is available in the granular form as an impregnated fertilizer and as a liquid formulation.

The researchers' objective was to determine the effect of clothing worn and formulation on the exposure level of the operator when applying granular or liquid chlorpyrifos. In addition they looked at the potential harm to the public or to the home owner who might be in the vicinity during and after the application.

Chlorpyrifos is an enzyme inhibitor [acetyl cholinesterase] with a oral [ingested] LD<sub>50</sub> of 135-163 mg/kg body weight and an acute dermal [skin] LD<sub>50</sub> of 202 mg/kg body weight. Pesticide applicators who routinely spray organophosphorous pesticides are advised to have their cholinesterase determined prior to the spray season and to have weekly blood tests during the spray season.

The researchers applied granular 0.5% chlorpyrifos impregnated fertilizer with a cyclone spreader during early May to the first week in June to provide 1 kg ai/hectare for white grub control. A liquid formulation of chlorpyrifos at 100 ai/hectare was applied with a hose-end sprayer delivering 5 kg/hectare during late July through to September.

Volunteer applicators were divided into two groups, those using protective gear and those not using any special protec-

**Table 1:** The exposure of protected and unprotected applicators of chlorpyrifos and bystanders to a granular application (total urine chlorpyrifos equivalent in four days).

Volunteer No.	Protected		Volunteer No.	Not Protected	
	Applicator	Bystander		Applicator	Bystander
1	trace	trace	1-7,9,13	non detectable	non detectable
10	non detectable	non detectable	2	604	non detectable
			10	540	trace
			13	Trace	non detectable

**Table 2:** The exposure of protected and unprotected applicators of chlorpyrifos and bystanders to a liquid application (total urine chlorpyrifos equivalent in four days).

Volunteer No.	Protected		Volunteer No.	Not Protected	
	Applicator	Bystander		Applicator	Bystander
1,2,6,8,10	non detectable	non detectable	1	802	non detectable
3	non detectable	trace	2	239	non detectable
4,11	trace	non detectable	3	249	non detectable
5	373	367	4	446	non detectable
7	291	non detectable	5	443	trace
9	485	non detectable	6	268	non detectable
			7	321	non detectable
			8	trace	non detectable
			9	trace	non detectable
			10	383	non detectable

tion. The protective gear consisted of long pants, long sleaved shirts, rubber boots and nitrile gloves. Those not using protection used their choice of shirts and pants, but had no rubber boots or gloves. The protected group of applicators were instructed in the careful application of the chemical whereas the non protected group received no instructions. Bystand-

ers were those normally present in the household but may not have been present when the actual spray operation occurred.

The exposure to chlorpyrifos was determined by measurement of a metabolite of the chemical in the urine of the participants for four days after the application. The limit of detection of the metabolite in

the urine was 18 ppb and the limit of establishing a quantitative amount was 25 ppb.

The results of their studies are summarized in Table 1 for those using granular applications and in Table 2 for those using liquid applications. Trace amounts, that is a level between 18 and 25 ppb were detected in one applicator of granular material and one bystander among those using protective gear (Table 1). Amounts ranging from a trace to 604 g were excreted in the urine of applicators not using protective gear and a trace in one bystander.

Exposure occurred more frequently among those not using protective clothing. Three applicators and one bystander showed trace or greater amounts of the insecticide in their urine

The use of a liquid formulation significantly increased the number of applicators showing a trace amount or greater of chlorpyrifos in their urine (Table 2). A trace or quantifiable amount was determined in three bystanders where the liquid formulation was applied. Where no protective clothing was used all 10 applicators had trace or greater amounts of the insecticide in their urine in contrast to three of the eleven applicators taking some degree of protection.

The highest level of exposure was with applicator # 1 who used no special clothing. His exposure level on one day was 0.798 mg which for an individual weighing 91 kilograms results in daily intake of .009 mg, close to the allowable average daily intake of .01 mg/kg body weight/day.

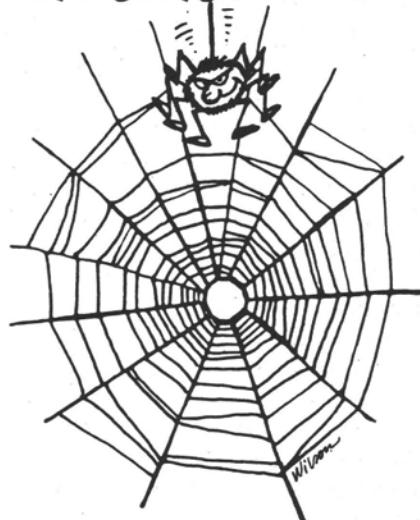
The study was primarily focused toward the home owner applicator and the risk of exposure of his immediate family. Nevertheless, the turf manager must recognize his personal exposure but also those who may be in the immediate vicinity, whether he is in parks, playgrounds and sports fields, and schedule his spray operations accordingly.

The low exposure resulting from the granular impregnated fertilizer appeared to be the safest system. The use of this product, however, requires the simultaneous need for a plant nutrient and an insecticide. This is not always the case in a well managed sports field.

# Caught in the Web - Using the Internet

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Seldom a day goes by that the popular media doesn't include an article relating the benefits [and necessities] of being linked to the Internet. Major businesses and institutions have established "Web Sites" and increasingly, information is being transmitted, and business being conducted, over the Internet. A significant number of readers of this article may already be linked to this global network via computers at work and/or at home. For many others, the Internet remains a black box [or a black hole], clouded in mystery and confounded by the jargon related to its use. For those who have ventured onto the Web - the experience may have varied from enlightenment to total frustration. In 1996, the volume of useful information remains a minuscule fraction of the total information available. The purpose of this article is to provide for complete neophytes an introduction to using the Internet, and to suggest some useful or interesting sites to travel to for information related to turfgrass and turfgrass management.

## What is the Internet and how do I get on it?

The internet is a network of different intercommunicating computer systems funded by governments and commercial organizations and linking more than 40 countries around the globe. The network may be accessed in a variety of ways - probably the one we hear about most is the World Wide Web (WWW or W3) [also known simply as the Web]. The Web arranges information in documents with links between them. The links facilitate rapid movement between related documents.

## What can I do on the Internet?

Of the many uses which may be made of these global computer linkages, the most common activities include:

- Electronic mail (E-mail) - a method of communication between individual or groups (the latter route uses collective "mailing lists" where all members of the group receive all communications).
- File Transfer Protocols (FTP) - used to download files from other sites to your computer.
- Search functions - used to search the Internet for information, contacts and databases.
- Discussion groups/bulletin boards - groups with more or less targeted subject matter which allow general discussion and interchange. These groups may be mediated, allowing for some control of what is acceptable and what is not.

## How do I connect?

For most of us, access to the Internet will be via a "dial-up connection" through a modem and telephone line. If you are looking at the purchase of a modem, buy the "fastest" model available for your computer - no matter what the capacity, there will always be some days when it

