

# Pesticide Residues<sup>1</sup>

Frederick M. Fishel<sup>2</sup>

*This fact sheet discusses factors that affect residues of pesticides, including the reasons for their persistence and means to avoid their hazards.*

## Introduction

Whenever pesticides are applied, their residues will remain on treated surfaces for a time. The chemical properties, frequency of application, rate applied, and environmental factors determine how much residue will be present. Residues are important in certain circumstances and necessary for some types of pest control where their presence provides continuous control. Herbicides applied where crop rotation is not a factor or in areas where total long-term weed control is desired, such as fence-rows and adjacent to buildings. Protecting structural foundations from termites is another desirable feature of pesticide residues. However, residues are undesirable when they expose people, domestic animals, or wildlife to unsafe levels of pesticides. Pesticides that move off-site or miss the intended application site can remain as residues in soil, water, or on surfaces. Also, pesticide containers can hold small amounts of residues that require proper cleaning and disposal to prevent environmental contamination (refer to EDIS Fact Sheets [PI-3 Pesticide Container Rinsing](#) and [PI-18 Proper Disposal of Pesticide Waste](#)). Acceptable levels of residues for any pesticide are known as its tolerance, which is the maximum amount of a pesticide that may remain on or in raw

agricultural commodities. Government agencies set these acceptable levels. Research is conducted using laboratory and animal tests to establish tolerances. From this research, amounts of pesticides that remain are determined to be harmless to consumers. A conservative margin of safety is included in tolerance levels when established by the Environmental Protection Agency (EPA). Each pesticide that is registered for a food use must have an established tolerance, and their levels will vary depending upon the pesticide's mode of action, toxicity, and all uses of the pesticide. In establishing the tolerance of a pesticide, researchers consider the total diet of the consumer and their nonfood exposure throughout a lifetime of 70 years. State and federal agencies monitor produce to ensure that growers do not exceed pesticide residue tolerances. Any produce that is found to exceed a tolerance is seized. Occasionally, pesticides can be erroneously present due to:

- The crop absorbing pesticides that were applied to the site previously;
- A grower applying pesticides to an unregistered crop;
- A grower applying a rate of pesticide that exceeds the label recommendations;
- The pesticide is applied too close to the crop's harvest; or
- Drift of a pesticide from another site.

1. This document is PI-69, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date September 2005. Revised March 2014 and March 2017. Reviewed April 2020. Visit the EDIS website at <https://edis.ifas.ufl.edu>.

2. Frederick M. Fishel, professor, Agronomy Department and director, Pesticide Information Office; UF/IFAS Extension, Gainesville, FL 32611.

The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication does not signify our approval to the exclusion of other products of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer's label.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For more information on obtaining other UF/IFAS Extension publications, contact your county's UF/IFAS Extension office.

U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A & M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Nick T. Place, dean for UF/IFAS Extension.

Postharvest use of pesticides can also leave residues on produce. Improper use of pesticides in warehouses, markets, or restaurants may also leave illegal residues on food products. According to a survey by the Food Marketing Institute, food safety was identified as the number one issue that can affect a retail operation. Although very rare, excessive pesticide residues on food products are a concern. The persistence of a pesticide is the amount of time from its application until its breakdown. Certain pesticides do not degrade rapidly in the environment, thus would be referred to as persistent. Some of these pesticides, such as many of the chlorinated hydrocarbon insecticides, were banned for use once these characteristics were determined. Undesirable features of persistence include:

- The potential for pesticide exposure;
- Some pesticide labels will require longer restricted-entry intervals, and
- The increased chance of the pesticide leaving the treated site through water movement, leaching, and wind.

Persistence may restrict growers from planting certain crops on a previously treated site. Regulations establish plantback restrictions to prevent injury from residues to subsequent crops. When these restrictions apply, the pesticide label will specify which crops may be grown or those which should not be planted. The label will also state how long after application a grower must wait before planting other crops. Plantback restrictions are a good reason for keeping accurate pesticide application records.

## Pesticide Accumulation

Accumulation refers to the buildup of pesticides resulting from repeated use. It may occur in the soil, groundwater, plants, lakes, ponds, and animal tissues. A concern in Florida is that copper compounds used as fungicides in citrus groves accumulate after many years of use.

## Pesticide Breakdown (Degradation)

Special hazards may exist when pesticides degrade in the environment. Some degrade into toxic compounds before breaking down further. Others may fail to break down because of unusual environmental conditions. Each location has unique environmental conditions that will influence the way chemicals degrade. Some of these environmental factors include:

- Soil texture;

- Soil moisture;
- Soil organic matter;
- Air flow, temperature, and rainfall; and,
- The presence of plants and animals.

For example, some herbicide rates must be adjusted according to the type of soil that they are applied to in order to be effective, or in some cases, to prevent crop injury.

## Avoiding Hazardous Residues

The following measures can reduce the hazard of harmful pesticide residues:

- Comply with label directions for application rate, timing, and placement;
- Avoid incompatible mixtures that create pesticide wastes;
- Avoid pesticide spills;
- Prevent back siphoning into sources of water during the mixing process;
- Calibrate application equipment accurately;
- Avoid mixing more material than is necessary for the job;
- Select pesticides that break down rapidly; and,
- Use formulations that reduce the chances of drift.

## Damage to Treated Surfaces

Pesticides may sometimes stain or damage treated surfaces where they are exposed. The pesticide's active ingredient or its inert ingredients may be responsible for the damage (refer to EDIS Fact Sheet *PI-44 What Are Inert Ingredients?*). Application rates and the concentration of the spray mixture may be responsible for this type of damage. To determine if damage to the treated site will occur, apply a small amount to a test area first.

## Additional Information

Dean, T.W., O.N. Nesheim, and F.M. Fishel. 2005. *Pesticide Container Rinsing*. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/pi003>

Fishel, F.M. 2005. *What are Inert Ingredients?* Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/pi081>

Florida Department of Agriculture and Consumer Services, Bureau of Inspection and Incident Response <http://www.flaes.org/complimonitoring/index.html>

Food Marketing Institute. <http://www.fmi.org/foodsafety/>.

Nesheim, O.N. and F.M. Fishel. 2000. *Proper Disposal of Pesticide Waste*. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/pi010>