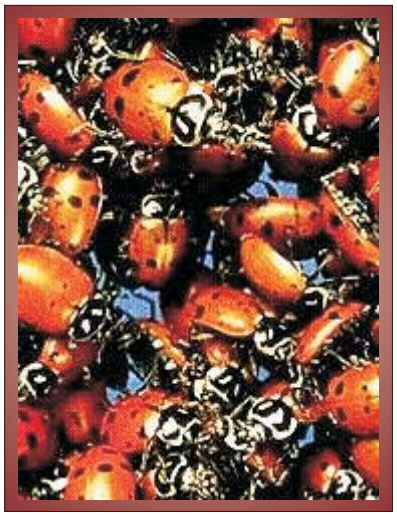
Pesticides

Background

A pesticide is any substance used to kill or control insects, weeds, fungi, rodents, bacteria, or other unwanted organisms. Pesticides provide a range of benefits, including increased food production and reduction of insect-borne disease, but their use also raises questions about possible adverse impacts on the environment. Once released into the environment, pesticides can move through the hydrologic system to streams and ground water where they may affect humans, aquatic life and wildlife[1]. Since New Jersey is the most densely populated state in the nation, there are many different patterns of pesticide use in close proximity to each other. Agricultural fields, formerly surrounded by other agricultural fields, are now surrounded by housing developments. Golf courses are built on former agricultural lands or are adjacent to wetlands. Homeowners attempt to maintain their lawns while their neighbors may object to unwanted exposure to pesticides. The use of pesticides affects nearly every New Jersey resident, and this creates a need for balance between the risks and benefits of pesticide use.

Pesticides can be broken into two broad groups: chemical and biological (biopesticides). Chemical pesticides are generally synthetic materials that directly kill or inactivate the pest. Chemical insecticides generally work by affecting the nervous system though disruption of an enzyme that regulates acetylcholine, a neurotransmitter. Some common insecticides include chlorpyrifos and terbufos, the two most commonly used insecticides, and N-Methyl carbamate, which is widely used in homes, gardens, and agriculture. Atrazine and metolachlor, the two most commonly used chemical herbicides; kill weeds selectively by impairing metabolic processes that are unique to plant life.

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. Biopesticides fall into three major classes: microbial, plant incorporated protectants (PIPs) and biochemical. Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient. PIPs are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists can take the gene for the Bt pesticidal protein, and introduce the gene into the plant's own genetic material. Then the plant, instead of the Bt bacterium, manufactures the substance that destroys the pest. Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Biochemical pesticides include substances, such as insect sex pheromones that interfere with mating as well as various scented plant extracts that attract insect pests to traps.[2]



DEP initiatives have been implemented to ensure that those who choose to apply pesticides do so in a safe and proper manner, thereby minimizing pesticide exposure to the public and the environment. The cornerstone of these efforts is Integrated Pest Management (IPM), a holistic approach to controlling pests that uses a wide variety of tools such as sanitation, structural modifications and other management techniques rather than automatically turning to chemical control as a first option. IPM does not call for the elimination of pesticides but places them within an overall framework of pest control. When the decision to use pesticides is made, the pesticides with the least harmful impact on humans and the environment should be employed. This approach provides the potential for significant use reduction and exposure reduction, resulting in an overall reduced risk.

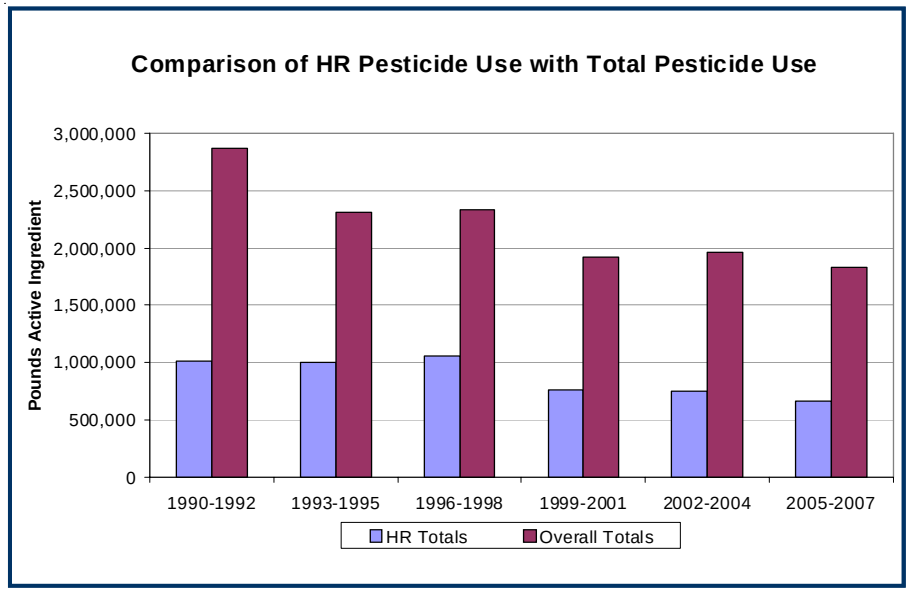
In 2004, new rules were adopted requiring the implementation of IPM practices at public, private and charter schools throughout the state.[3] These new measures will reduce children's exposure to potentially harmful pesticides and help safeguard public health. A 1993 National Research Council report, *Pesticides in the Diets of Infants and Children*, [4] found that children's bodies often take in larger doses of pesticides than adults because their metabolisms quickly process airborne substances and children may be more vulnerable to the toxic effects of pesticides because their bodies are smaller and their immune systems are not fully developed.

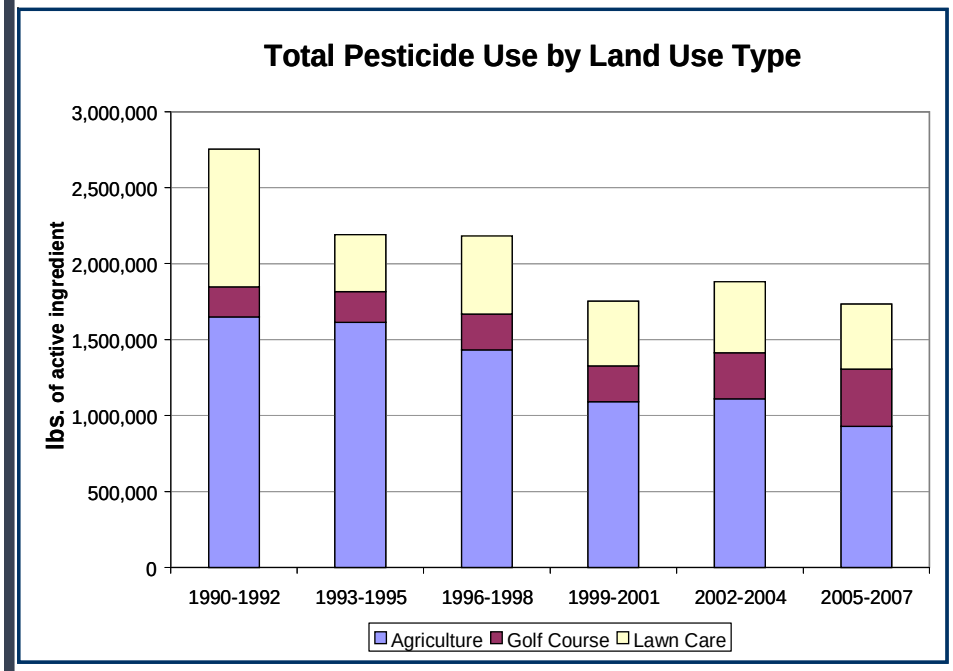
Trends

The New Jersey Pesticide Control Program began a series of pesticide use surveys in 1985. These surveys encompass categories of licensed pesticide applicators in New Jersey and provide the starting point for both assessing the risk and determining the impact of pesticide use. The information collected by these surveys is used by agencies within DEP, along with other state agencies to aid in research, exposure management and monitoring effects in areas such as ground water protection, farm worker protection and education, and residual pesticide sam-

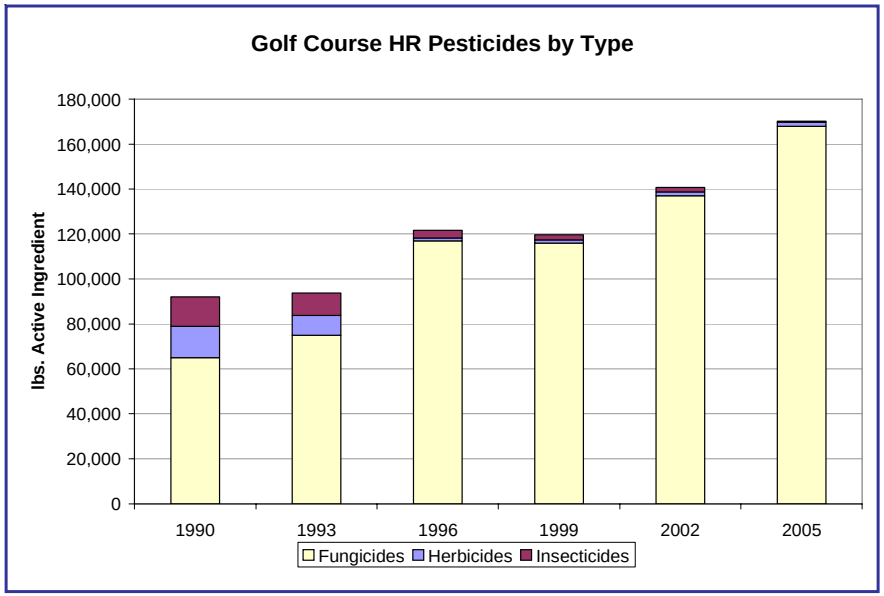
pling. These data are specific for New Jersey and represent New Jersey residents' responses to the situations and pest pressures surrounding them. These use surveys also help the Department to quantify the use of high risk (HR) pesticides. HR pesticides are those which pose significant risks to human and environmental health either because of the compounds' carcinogenity, toxicity or a high likelihood of the pesticide leaching into ground water.

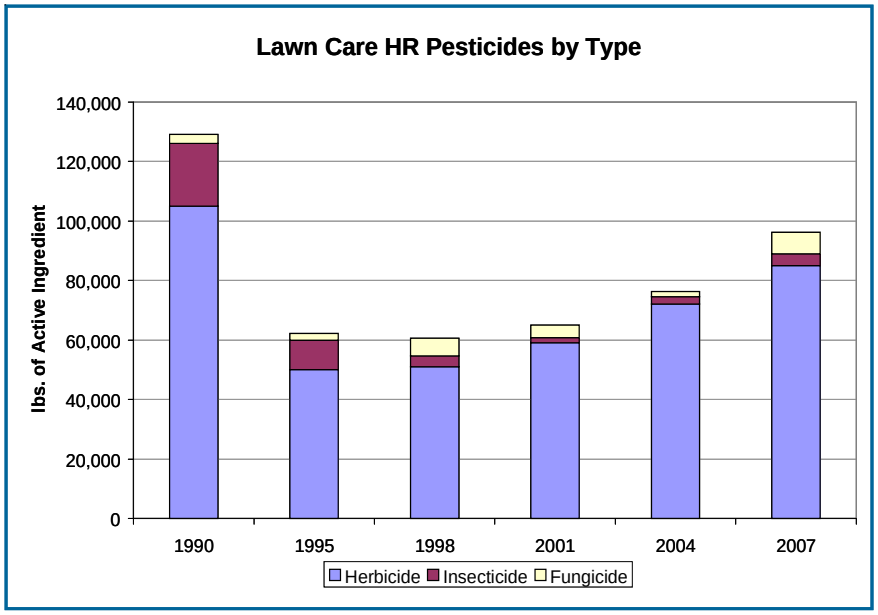
The charts below compare total pesticide use by land use type and the pounds active ingredient of HR pesticides with the total pounds active ingredient of pesticides, reported from the Agricultural, Lawn Care, Right-of-Way and Golf Course surveys over their three-year time slots. It appears that total overall use of all pesticides, as well as HR pesticides, has decreased since 1990, however, total pesticide use for golf courses has increased; this could be due to a number of factors, including an increase in the number of golf courses over this time period. The percentage of HR pesticide use remains at about one-third of all pesticide use in all survey series years.



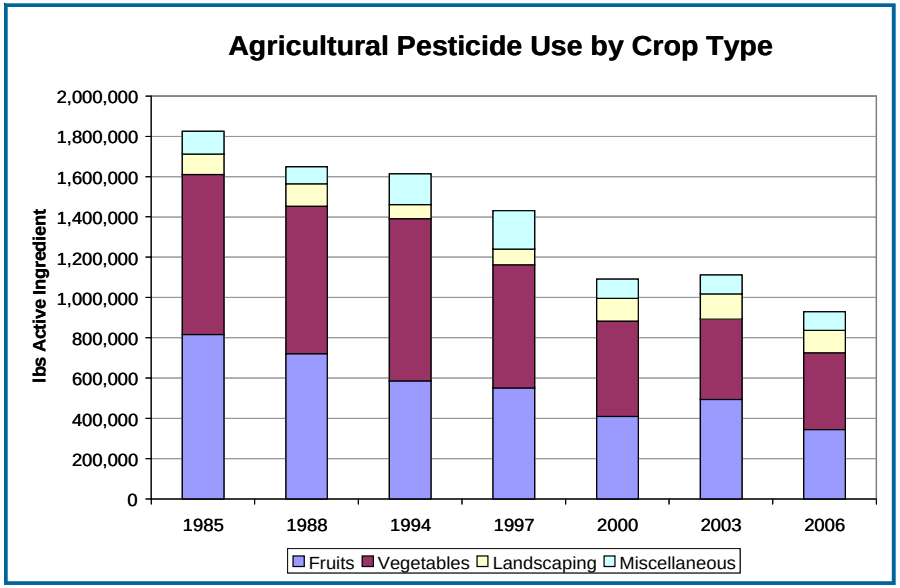


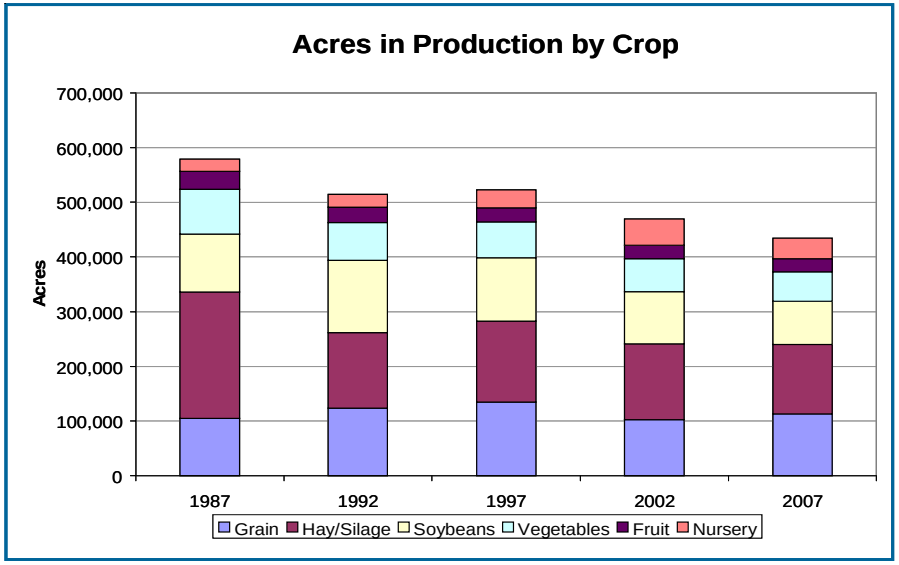
The following three charts show HR herbicides, insecticides and fungicides as a percentage of total pesticides for differing land uses. Golf course pesticide use appears to be dominated by the application of fungicide, with minimal contributions from HR insecticides and herbicides. The HR fungicide, chlorothalonil, is the most widely used in this particular land use and has been, in fact, steadily increasing from approximately 32% of total pesticide use in 1990 to 45% of the total pesticide use for 2005. Lawn care pesticide use seems to be dominated by the use of herbicides, with minimal contributions from HR insecticides and fungicides. Though the percentage of HR pesticides in this land use type is the lowest of the three, the trend, particularly in HR herbicides seems to be increasing. It should be noted that this data refers to professional lawn care services only. The amount of pesticides purchased through retail outlets and used by consumers is not well documented; it is likely that this particular use could be significant. The Pesticide Control Program is currently attempting to rectify this data gap, but so far, an estimate has not been developed. In contrast, agricultural HR pesticide use appears to be more evenly distributed between herbicides and fungicides, with the use of herbicides decreasing, and the use of fungicides staying relatively stable. The use of HR insecticides seems to be steadily decreasing to around 3 % of total pesticide use for 2006.





The use of all pesticides in agriculture seems to be decreasing overall (see *Pesticide Use by Crop Type* figure) with significant decreases in application on fruits and vegetables. This data, however, has not been normalized with respect to the changes in the types of crops grown here in New Jersey; nor has it provided for any decrease in overall agricultural acreage in the state, which is shown in the subsequent *Acres in Production by Crop* figure[5]. This figure shows an overall decrease in agricultural acreage, within which, there appears to be a general increase in nursery crop. This overall decrease of acreage in agriculture is likely to be a contributor to the decrease in total agricultural pesticides use overall.





Outlook and Implications

In reporting and evaluating pesticide use, it is important to consider the many, diverse influences on pesticide use. Weather conditions influence pest pressure and the associated response, as does cropping patterns in agricultural settings. Economic factors, like the demand for golf course playability and certain crops can also play a significant role in pesticide use. Finally, the changing land use patterns around the State, the decline in agricultural acreage and the increase in residential acreage, can also play a part in pesticide use.

In addition to the Agricultural, Lawn Care, Right-of-Way, and Golf Course pesticide use surveys from which many of the above figures were derived, the Pesticide Control Program also administers surveys for structural, aquatic, and mosquito control pesticide use. These surveys are relatively recent, and there is not sufficient data to determine any trends in use.

Ambient levels of some pesticides have been estimated by the USEPA as part of its National Assessment of Toxic Air Pollutants (NATA). More information on NATA and estimated ambient levels of the included pesticides and other air toxics is available online.[6]

More Information

www.nj.gov/dep/enforcement/pcp/index.htm
www.csrees.usda.gov/nea/pest/pest.html
www.epa.gov/pesticides/controlling/index.htm

References

The information in this report was provided by DEP, Pesticide Control Program and the DEP publication *Environmental Indicators Technical Report- 2nd Edition -2001*, which can be accessed at www.state.nj.us/dep/dsr/indicator-report/

[1] Pesticides in the Nation's Streams and Ground Water, 1992-2001, US Geological Survey, US Department of the Interior
[2] http://www.epa.gov/pesticides/about/types.htm
[3] DEP, www.nj.gov/dep/enforcement/pcp/pcp-ipm.htm
[4] Pesticides in the Diets of Infants and Children, 1993, Committee on Pesticides in the Diets of Infants and Children, National Research Council, ISBN: 0-309-04875-3
[5] 2007 Census of Agriculture: New Jersey State and County Data, Volume 1, Geographic Area Series Part 30. National Agricultural Statistics Service, USDA
[6] See http://www.epa.gov/ttn/atw/nata1999/nsata99.html.