WHAT'S GOING ON WITH OUR FOOD?

EFFECT OF PESTICIDES & OTHER SUBSTANCES

What's Going on with our Food?

Lesson 1: Food Consumption and Pesticides

Sunshine State Standards: SC.G.2.4.6

Objective

Students will learn general concepts about food consumption and what is in our food; pesticides will be introduced and discussed.

Material

Information on per capita food consumption

List of common kinds of pesticides (handouts attached)

Procedure

Teacher will lead a general discussion on various topics (see suggestions attached) such as foods we consume, what is considered a pesticide, what alternatives to pesticides can be used in farming, and what are some effects of pesticides on humans.

Activity

Students should find articles in newspapers or magazines that mention and discuss the topics discussed in the class lecture, eg., pesticides, growth hormones and antibiotics. After reading two articles, students are asked to write short descriptions of the articles to share with the class.

Assessment

Comprehension of the topics and completion of assignments.

What's Going on with our Food?

Discussion of Food Consumption and Pesticides

Introduction
What did we eat last night? Discuss favorite foods.

Per capita food consumption
How much beef is eaten in a year? Fruits? Vegetables?

What are pesticides and what are they used for?

Definition: A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests can be insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses. Though often misunderstood to refer only to *insecticides*, the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests. Under United States law, a pesticide is also any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.
(see www.epa.gov)

Common pesticides (Briefly discuss each one listed on handout.)

What are not pesticides?
The U.S. definition of pesticides is quite broad, but it does have some exclusions:

- Drugs used to control diseases of humans or animals (such as livestock and pets) are not considered pesticides. Such drugs are regulated by the Food and Drug Administration.

- Fertilizers, nutrients, and other substances used to promote plant survival and health are not considered plant growth regulators and thus are not pesticides.

- Biological control agents, except for certain microorganisms, are exempted from regulation by EPA. (Biological control agents include beneficial predators such as birds or ladybugs that eat insect pests.)

- The EPA has also exempted certain other low-risk substances, such as cedar chips, garlic, and mint oil.

How do Pesticides reach us?

Pesticides can be absorbed through the skin, swallowed or inhaled (most toxic). During application, pesticides drift and settle on ponds, laundry, toys, pools and furniture. People and pets track pesticide residue into the house. Only 5% of pesticides reach

target weeds. The rest runs off into water or dissipates in the air. Drift from landscaping can range from 12 feet to 14.5 miles. More serious effects appear to be produced by direct inhalation of pesticide sprays than by absorption or ingestion of toxins. Pesticides initiate and propagate multiple chemical sensitivities. About 16 million US citizens are sensitive to pesticides (i.e., they have compromised immune functioning as a result of pesticide exposure).

What are the Health Risks, besides sensitivity and toxicity?

- Increased risk of leukemia
- Cancer: lung, brain, testicular, lymphoma
- Increase in spontaneous abortions
- Greater genetic damage
- Decreased fertility
- Liver and pancreatic damage
- Neuropathy
- Disturbances to immune systems (asthma/ allergies)
- Increases in stillbirths
- Decreased sperm counts

What are the Main Risks for Children?

- Cancer: leukemia, brain
- Asthma and allergies
- Polyneuritis (numbness and pain in lower limbs)
- Altered neurological functioning and long-lasting neuro-behavioral impairments
- Birth defects
- Neurotoxicity
- Gangrene (tissue death) of the extremities

Who is most susceptible?

- Children, infants and fetuses: Relative to adults, children have more rapid breathing and metabolic rates, greater surface to body mass ratios, and thinner skin. Children spend more time in contact with the ground, more frequently place their fingers in their mouths, and are less likely to be able to read hazard signs.
- Adults with asthma, lupus erythematosus, vasculitis, dermatitis and chemical sensitivity
- Animals: pets, wildlife of all kinds and their habitat.

What are the possible effects on Animals and Wildlife?

- Cancer
- Abnormal thyroid function
- Decreased fertility
- Decreased hatching success
- Demasculinization and feminization of males
- Alteration of immune function
- Birds die after eating granular pesticides

From: Environmental Protection Agency (www.epa.gov)

What is a Pesticide?

A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests can be insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses. Though often misunderstood to refer only to *insecticides*, the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests. Under United States law, a pesticide is also any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

Many household products are pesticides. Did you know that all of these common products are considered pesticides?

- Cockroach sprays and baits
- Insect repellents for personal use.
- Rat and other rodent poisons.
- Flea and tick sprays, powders, and pet collars.
- Kitchen, laundry, and bath disinfectants and sanitizers.
- Products that kill mold and mildew.
- Some lawn and garden products, such as weed killers.
- Some swimming pool chemicals.

By their very nature, most pesticides create some risk of harm to humans, animals, or the environment because they are designed to kill or otherwise adversely affect living organisms. At the same time, pesticides are useful to society because of their ability to kill potential disease-causing organisms and control insects, weeds, and other pests. In the United States, the Office of Pesticide Programs of the Environmental Protection Agency is chiefly responsible for regulating pesticides. Biologically-based pesticides, such as pheromones and microbial pesticides, are becoming increasingly popular and often are safer than traditional chemical pesticides.

Here are some common kinds of pesticides and their function:

Algicides
Control algae in lakes, canals, swimming pools, water tanks, and other sites.

Antifouling agents
Kill or repel organisms that attach to underwater surfaces, such as boat bottoms.

Antimicrobials
Kill microorganisms (such as bacteria and viruses).

Attractants
Attract pests (for example, to lure an insect or rodent to a trap). (However, food is not considered a pesticide when used as an attractant.)

Biocides
Kill microorganisms.
Disinfectants and sanitizers
Kill or inactivate disease-producing microorganisms on inanimate objects.

Fungicides
Kill fungi (including blights, mildews, molds, and rusts).

Fumigants
Produce gas or vapor intended to destroy pests in buildings or soil.

Herbicides
Kill weeds and other plants that grow where they are not wanted.
Insecticides
Kill insects and other arthropods.
Miticides (also called acaricides)
Kill mites that feed on plants and animals.
Microbial pesticides
Microorganisms that kill, inhibit, or out compete pests, including insects or other microorganisms.
Molluscicides
Kill snails and slugs.
Nematicides
Kill nematodes (microscopic, worm-like organisms that feed on plant roots).
Ovicides
Kill eggs of insects and mites.
Pheromones
Biochemicals used to disrupt the mating behavior of insects.
Repellents
Repel pests, including insects (such as mosquitoes) and birds.
Rodenticides
Control mice and other rodents.

The term pesticide also includes these substances:

Defoliants
Cause leaves or other foliage to drop from a plant, usually to facilitate harvest.
Desiccants
Promote drying of living tissues, such as unwanted plant tops.
Insect growth regulators
Disrupt the molting, maturity from pupal stage to adult, or other life processes of insects.
Plant growth regulators
Substances (excluding fertilizers or other plant nutrients) that alter the expected growth, flowering, or reproduction rate of plants.

What about pest control devices?

EPA also has a role in regulating devices used to control pests. More specifically, a "device" is any instrument or contrivance (other than a firearm) intended for trapping, destroying, repelling, or mitigating any pest. A mousetrap is an example of a device. Unlike pesticides, EPA does not require devices to be registered with the Agency. Devices are subject to certain labeling, packaging, record keeping, and import/export requirements, however.

What is not a pesticide?

The U.S. definition of pesticides is quite broad, but it does have some exclusions:

- Drugs used to control diseases of humans or animals (such as livestock and pets) are not considered pesticides; such drugs are regulated by the Food and Drug Administration.
- Fertilizers, nutrients, and other substances used to promote plant survival and health are not considered plant growth regulators and thus are not pesticides.
- Biological control agents, except for certain microorganisms, are exempted from regulation by EPA. (Biological control agents include beneficial predators such as birds or ladybugs that eat insect pests.)
- Products which contain certain low-risk ingredients, such as garlic and mint oil, have been exempted from Federal registration requirements, although State regulatory requirements may still apply. For a list of ingredients which may be exempt, and a discussion of allowable label claims for such products, see EPA's Pesticide Registration Notice 2000-6, "Minimum Risk Pesticides Exempted under FIFRA Section 25(b)."

What are Biopesticides?

Biopesticides (also known as biological pesticides) are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, garlic, mint, and baking soda all have pesticidal applications and are considered biopesticides. At the end of 1998, there were approximately 175 registered biopesticide active ingredients and 700 products. Biopesticides fall into three major categories:

1) Microbial pesticides contain a microorganism (bacterium, fungus, virus, protozoan or alga) as the active ingredient. The most widely known microbial pesticides are varieties of the bacterium *Bacillus thuringiensis*, or Bt, which can control certain insects in cabbage, potatoes, and other crops. Bt produces a protein that is harmful to specific insect pests. Certain other microbial pesticides act by out-competing pest organisms. Microbial pesticides need to be continuously monitored to ensure they do not become capable of harming non-target organisms, including humans.

2) Plant-pesticides 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 plants= own genetic material. Then the plantBinstead of the Bt bacterium--manufactures the substance that destroys the pest. Both the protein and its genetic material are regulated by EPA; the plant itself is not regulated.

3) Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Conventional pesticides, by contrast, are synthetic materials that usually kill or inactivate the pest. Biochemical pesticides include substances that interfere with growth or mating, such as plant growth regulators, or substances that repel or attract pests, such as pheromones. Because it is sometimes difficult to determine whether a natural pesticide controls the pest by a non-toxic mode of action, EPA has established a committee to determine whether a pesticide meets the criteria for a biochemical pesticide.

What are the advantages of using biopesticides?

- Biopesticides are inherently less harmful than conventional pesticides.
- Biopesticides are designed to affect only one specific pest or, in some cases, a few target organisms, in contrast to broad spectrum, conventional pesticides that may affect organisms as different as birds, insects, and mammals.
- Biopesticides often are effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly decrease the use of conventional pesticides, while crop yields remain high.
- To use biopesticides effectively, however, users need to know a great deal about managing pests.

How does EPA encourage the development and use of biopesticides?

In 1994, the Biopesticides and Pollution Prevention Division was established in the Office of Pesticide Programs to facilitate the registration of biopesticides. This Division promotes the use of safer pesticides, including biopesticides, as components of IPM programs. The Division also coordinates the Pesticide Environmental Stewardship Program (PESP). (See related fact sheets on IPM and PESP.) Since biopesticides tend to pose fewer risks than conventional pesticides, EPA generally requires much less data to register a biopesticide than to register a conventional pesticide. In fact, new biopesticides are often registered in less than a year, compared with an average of more than 3 years for conventional pesticides. While biopesticides require less data and are registered in less time than conventional pesticides, EPA must always conduct rigorous reviews to ensure that pesticides will not have adverse effects on human health or the environment. For EPA to be sure that a pesticide is safe, the Agency requires that registrants submit a variety of data about the composition, toxicity, degradation, and other characteristics of the pesticide.

Microbial and Antimicrobial Pesticides:

These are two separate and distinct types of pesticides registered by EPA.

Microbial Pesticides are microbes, including bacteria, that help to control insects and weeds, as well as fungi and bacteria that cause plant diseases. These are one type of biopesticide.

Antimicrobial Pesticides are pesticides that control unwanted microbes on inanimate objects, in water, and on selected foods under certain circumstances. These pesticides are almost always chemicals, and they act by killing or inactivating microbes that are pests. Antimicrobial pesticides include the disinfectants used in swimming pools, drinking water supplies, and in hospitals to control microbes that can cause disease.

7 Pesticide Safety Tips

9/14/98

While waiting for the Environmental Protection Agency to implement the 1996 Food Quality Protection Act successfully, Consumers Union urges consumers to follow these "Seven Pesticide Safety Tips":

- Wash or peel all fruits and vegetables and remove outer leaves of leafy vegetables to reduce the level of pesticide residues on foods;
- Buy organic foods when they are available and affordable;
- Eat a wide variety of fruits and vegetables to vary your exposure to pesticides;
- Be informed -- Ask your school board about pest control policies in schools and urge the adoption of Integrated Pest Management &endash; relying on non-chemical controls and prevention to reduce pest populations -- at your child's school;
- Use home pesticide products as a last resort and always follow the instructions on the product label;
- Do not use home pesticide products that contain two classes of insecticides, OPs and carbamates, which interfere with the nervous system. Some brand names in this category include Sevin, Dursban, Empire, Equity, Spectracide, Knox Out, and Ficam; and
- Reduce home and garden use of pesticides by practicing Integrated Pest Management (IPM) or hire exterminators who practice IPM.

FOR MORE INFORMATION: Contact Consumers Union at 202/462-6262

Quick Facts About Pesticides and Pest Management

From: "Pest Management at the Crossroads"
By Consumer Policy Institute, N.Y. (www.consunion.org)

Public Health:

Each year in the U.S., some 110,000 pesticide poisonings are reported by poison control centers, and 23,000 people visit emergency rooms for the same reason. And every year, about 20 people nationwide -- mostly children -- die from accidental pesticide poisoning.

Where once the primary public-health concern surrounding pesticides was the possibility of acute poisoning and the long-term potential for cancer, today's risk managers recognize that pesticides can also affect the nervous, endocrine, immune and reproductive systems, and that they pose heightened threats to infants, young children, the unborn, and other subpopulations that are especially susceptible to toxic pollutants.

Converting to 100 percent biointensive IPM by 2020, as Consumers Union recommends, will reduce the total public health risk from pesticides by at least 75 percent from today's levels.

Environment:

Most environmental risks and ecological damage from pesticide use result from toxic effects of pesticides on various living organisms. Studies have found insecticides are the most toxic class of pesticides, followed by herbicides, acaricides (mite killers) and fungicides.

Impacts on non-target organisms depend on how the pesticide degrades and moves through the hydrological cycle, the soil and food chains.

Adverse impacts on beneficial organisms tend to be greatest where several different pesticides, especially insecticides, are applied routinely.

Effectiveness:

It takes from two to five applications of pesticides today to accomplish what just one application accomplished in the early 1970s.

More than 500 insect pests, 270 weed species and 150 plant diseases are now resistant to one or more pesticides.

The federal Environmental Protection Agency (EPA) has banned some of the worst pesticides, but the agency currently approves about 10 new active ingredients for each one it takes off the market. The EPA's rulings in the 1970s ended 25 percent of insecticide applications then in use. Since 1986, however, EPA's actions have reduced pesticide use by less than 1 percent.

Costs:

In 1995, U.S. pesticide sales totaled $10.4 billion, and amounted to 1.25 billion pounds of active ingredients. About 75 percent of those expenditures went for agricultural applications.

Efforts to regulate pesticides cost American industry and taxpayers well in excess of $1 billion a year. While the public-health benefits of pesticide regulation have been shrinking, costs have been rising and are expected to rise still further. A growing share of the cost of pesticide regulation, moreover, is borne by state governments.

Federal expenditures for research on pesticides or pest management in 1995 totaled some $255 million. Less than 13 percent of that (about $32 million) supported work that contributes to biointensive IPM. The pesticide industry, meanwhile, spent about twice that much in 1995 just on print advertising.

What's Going on with our Food?

Lesson 2: Genetically Engineered Food, Growth Hormones & Antibiotics

Sunshine State Standards: SC.G.2.4.6

Objective

To familiarize students with genetically engineered foods, growth hormones and antibiotics in our food supply.

Material

Articles on Genetically Engineered Food and Hormones in Food (handouts attached)

Procedure

Teacher will lead a general discussion about genetically engineered food, growth hormones and antibiotics in the foods we eat.

Activity

Students should find articles in newspapers or magazines that mention and discuss the topics discussed in the class lecture, eg., genetic engineering, growth hormones and antibiotics. After reading two articles, students are asked to write short descriptions of the articles to share with the class.

Assessment

Comprehension of the topics and completion of assignments.

What's Going on with our Food?

Discussion of Genetically Engineered Food, Growth Hormones & Antibiotics in Food

What are genetically engineered foods?

Genetically engineered foods are created by taking DNA from one living organism and transplanting it into another. Genetic engineering copies genes that are selected for their desired traits, and transfers them between living organisms. The resulting organisms are called "transgenic species" or "living modified organisms". This modified gene material cannot result from traditional selective breeding. So far, 50 genetically engineered crops have been approved by the USDA including potatoes, tomatoes, melons and beets. Genetically engineered rice, wheat, cucumbers, strawberries, apples, sugarcane and walnuts are being grown on test sites.

How long has genetic engineering existed in food technology?

Genetic engineering became prevalent in 1995-1996 when United States regulators (EPA and FDA), approved the introduction of several new genetically engineered crop species.

The basic facts

In 1999, one-fourth of American crops were genetically engineered, including:

- 35 percent of all corn
- 55 percent of all soybeans
- nearly half of all cotton.

Some common foods that frequently contain genetically engineered ingredients:

- Tortilla chips
- Drink mixes
- Taco shells
- Veggie burgers
- Muffin mix
- Baby formulas

- Foods that contain soybean or corn derivatives. Soy finds its way into about 60 percent of processed foods; risky ingredients include soy oil, soy flour, lecithin, and soy protein isolates and concentrates. Corn products commonly found in processed foods include corn oil, cornstarch, corn flour and corn syrup.

- Animal products. Genetically modified organisms can find their way into meat, poultry, seafood, milk, cheese, yogurt and whey. Most of the corn and soybeans grown in the United States are fed to farm animals. Also, dairy products may come from cows that have been treated with bovine growth hormone (BGH).

Do genetically altered crops use less pesticide and herbicides?

Many believe that pesticide usage will increase. Because these new crops can withstand pesticides, farmers will use more to rid their fields of weeds. In recent years farmers have increased chemical agents usage to maintain yields

Are genetically engineered foods safe?

The FDA, which says that these foods are safe, does not regulate these foods. These foods do not require labeling, but a growing number of people are demanding that such foods be labeled to alert the consumer as to what they are buying. Opponents of these types of foods say that the long-term effect on both consumers and the environment is not well known.

What are growth hormones and antibiotics?

Growth hormones are used throughout the livestock industry. These hormones are used to increase production of meat, dairy and eggs. Hormones make animals grow bigger and faster, and increase milk and egg production. Growth hormones have decreased the age of slaughter for chickens from 16 weeks in 1950 to seven weeks today. Antibiotics are used to prevent and treat various diseases in animals. Antibiotics are also used in low levels to help animals digest feed more efficiently.

There are six scientifically approved hormones that are most frequently used in the livestock industry. There are three naturally occurring hormones:

- Estradiol
- Progesterone
- Testosterone

There are three synthetic hormones that are used in livestock:

- Melengestrol acetate
- Trenbolone acetate
- Zeranol

Antibiotics

Antibiotic feed additives are products that are officially approved to be incorporated into animal feed to create favorable conditions in the animal's intestine for the digestion of feed. Antibiotics are used in trace amounts primarily in hog or poultry feed or water and improve feed conversion and animal productivity. Antibiotics also play a role in maintaining a healthy digestive system that enables an animal to gain weight without incurring excessive amounts of fat and to resist intestinal disease. It is estimated that the use of digestive enhancers improves the conversion efficiency of farm livestock between 3% to 6%, reducing production costs and helping control prices passed to the consumer. However, in cattle, antibiotics are only used to treat disease.

Concerns

International trade has been affected as a result of the use of growth hormones by various countries. There are opposing opinions as to the impact and affect that growth hormones have in the industry. Producers see the financial benefits of utilizing growth hormones, while some consumers believe that using the hormones may have some impact on human development if there are minimal amounts of residues left in the meat. Antibiotics are also considered an issue in food safety, as most recently there appears to be a development of antibiotic resistance within the human and animal populations.

From Environmental Defense Fund (www.edf.org)

Genetically Engineered Foods: Who's Minding the Store

Q What are genetically engineered foods?
A The edible portions of genetically engineered plants or animals (e.g. tomatoes from genetically engineered tomato plants) are what most people mean when they speak of genetically engineered foods. Genetically engineered plants and animals are modified by modern genetic techniques, such as recombinant DNA, which allow researchers to modify genetic material in ways not possible with traditional selective breeding. For example, researchers can transfer genetic material from one species to another, such as from animals to plants.
In some cases chemical additives manufactured by genetically engineered bacteria are also called genetically engineered foods. For example rennin, an enzyme used in cheese manufacturing, is extracted from bacteria engineered with a copy of a cow gene. However, unlike consumers of genetically engineered tomatoes, consumers of engineered additives do not directly consume genetically engineered organisms.

Q What's coming to grocery store shelves?
A A wide variety of genetically engineered crop plants are now under development, and some crops have reached the marketplace. As of August 1995, the U.S. Department of Agriculture had reviewed more than 1500 submissions for field trials of genetically engineered crops. Crops now in commercial production include tomatoes altered with a synthetic gene that retards softening; potatoes and corn with bacterial genes for insecticidal toxins; soybeans and cotton (some grown for cottonseed oil) with bacterial genes that allow the crops to tolerate applications of chemical weedkillers; and squash with viral genes that confer disease resistance. Although their development is not as far along, livestock and fish are also being genetically engineered.

Q Are genetically engineered foods dangerous?
A Although most are likely to be safe, some may not be. To consumers, most genetically engineered foods are essentially foods with added substances -- usually proteins. This is because genes are "translated" into proteins by cells. Therefore, when a genetic engineer adds, say, a bacterial gene to a tomato, he or she is essentially adding a bacterial protein to that tomato. In most cases these added proteins will likely prove safe for human consumption. Nevertheless, just as with conventional food additives, substances added to foods via genetic engineering may in some instances prove hazardous.
A major concern about adding proteins to foods via genetic engineering is that they may cause susceptible individuals to become allergic to foods they previously could safely consume. Food allergies are a serious public health concern, which food allergists estimate affect roughly 2.5 - 5 million Americans. Allergic reactions cause discomforts and in some cases life-threatening anaphylactic shock. Since virtually all known food allergens are proteins, foods with new proteins added via genetic engineering could sometimes become newly allergenic. These concerns about food allergy are real. One company has already dropped plans to commercialize soybeans with a brazil nut gene after testing revealed the soybeans were likely to cause allergic reactions in brazil nut allergic individuals. Unfortunately, food allergies are poorly understood, and in many cases scientists will not be able to test the potential allergenicity of genetically engineered foods.

Q Does the FDA's policy for foods from genetically engineered crops safeguard consumers?

A FDA's policy, announced by former Vice President Dan Quayle in May, 1992, as "regulatory relief," appears to do more to protect the biotechnology industry than to protect consumers. FDA's policy includes a series of "decisions trees" for industry decision-making, a series of yes-no questions, such as "Is there any reported toxicity? or "Does the biological function raise any safety concern?" Food producers are then supposed to decide for themselves whether they need to consult FDA before they market foods obtained from genetically engineered crops.

FDA, at least in principle, is applying the same regulations to substances added to foods via genetic engineering as apply to conventional chemicals added to food. But, FDA's decision trees appear to significantly weaken a longstanding requirement under food safety law: Food manufacturers must establish scientifically the safety of new substances added to food before selling them to the public, regardless of whether the manufacturers think they are safe. FDA's policy states that the agency will only require approval "in cases where safety questions exist sufficient to warrant formal pre-market review". Deciding if such questions exist is left to food manufacturers.