Ontario Agri-Food Education Inc.

The PESTICIDE DEBATE

CONTROVERSIAL ENVIRONMENTAL ISSUES

Grades 9-12

ACKNOWLEDGEMENTS

Writer - Pat Gough Education Consultant OAFE

Editors - Brian Watson Director, Resource Development OAFE
Adrienne Robertson OAFE

Layout/Graphics - Lynn Chudleigh

Printing - Printcraft

Many thanks to the following for their support, cooperation, and advice in the completion of this resource:

Jackie Fraser - AGCare
Richard Groen - Crop Life
Ryan Hicks - Ad Farm

Funding for this project was provided in part by Agriculture and Agri-Food Canada through the Agricultural Adaptation Council

Funding for this project was provided in part by Crop Life Canada, Ontario Council

Ontario Agri-Food Education Inc. receives support from the Ontario Ministry of Agriculture, Food and Rural Affairs

THE PESTICIDE DEBATE:
CONTROVERSIAL ENVIRONMENTAL ISSUES

Teacher Introduction

WHAT IS THIS RESOURCE ABOUT?

Welcome to a great learning adventure for both you and your students. Dealing with difficult issues and making decisions are important concepts to study. Tackling complicated issues such as agricultural pesticide use can cause a lot of stress and confusion if you, as teacher, are unsure of the questions asked or the research presented. Several partners have supported the writing of this resource to recommend lessons, suggest websites, provide activities and articles along with appropriate assessment, because there is a need for secondary students to examine all sides of these issues. That is how we have designed this document. You will find comments throughout this resource that reads: ***For Your Eyes Only***. Those are intended to equip teachers with additional information or quick tips.

WHY WAS IT WRITTEN?

This resource is about discovery and exploration. There are no right or wrong answers. We are presenting facts and opinions of various organizations, individuals and experts. We invite you to begin this journey with an open mind approaching it as a learning process, without searching for definitive answers. We hope that "The Pesticide Debate: Controversial Environmental Issues" encourages discussions, debates, teamwork and individual research, which leaves each learner with a better understanding about recognizing differences and appreciating choices. We provide many articles for reading and discussion. Have classroom and group discussions. The more your students read, the better informed and more aware they become. In the end, we are all trying to prepare informed decision makers for life in the 21st century.

One of the mandates in writing curriculum for Ontario Agri-Food Education (O.A.F.E.) is to ensure that all of our work is presented without bias. We ask that you respect that mandate as you work through these activities. All of us approach new learning with past experiences and ideas that have formed the basis for our opinions. Some of these opinions come from family belief systems, societal influence, peer group pressures, media reporting, television programming, schooling, governmental decision makers and others.

The pesticide debate has gone on for decades. Most people, probably including you, have heard enough in the media and through interest groups to scare themselves half to death. Very, very few people really understand the complexities of pesticide chemistry, regulation, safety, toxicity, and epidemiology. These issues don't lend themselves as well to a media sound bite, unlike simple statements like "pesticides are poison". The intent of this resource is not to "promote" pesticide use - that would make this resource as unhelpful as the many anti-pesticide materials available. What we ask of you, as a teacher, is to encourage students to develop media savvy, learn to distinguish fact from opinion, and learn about scientific credibility. We want them to ultimately form their own informed opinion about agricultural pesticide use.

HOW COULD YOU USE THIS RESOURCE?

Please see the Learning Expectations on pages 4 to 5 and you will get a better idea about which grades would be best suited for these activities. It offers activities for grades 10, 11,12 Science, Grade 9 Geography and grade 12 Food and Nutrition sciences. A teacher may choose one activity or several to complete. Below is a quick glance about what each activity offers. It is worth your time to come back several times over the year so your classes can enjoy many hands-on, engaging activities.

Lesson # 1: (page 6) — **What is Your Opinion?** This is a great introduction for all grades so that students begin to understand biases. Techniques for Analyzing an Issue can be used in any subject area. You can explore many issues here.

Lesson # 2: (page 11) — **Exploring Biases Further.** This lesson provides students an opportunity to work in groups exploring various issues re pesticides. Recommended for any secondary science class, plus grade 12 Food and Nutrition classes.

Lesson # 3: (page 21) — **Checking Out the Facts.** Again pesticides are explored including a wonderful tool for self-evaluation in a group. Any grade could use this as they check on facts pertinent to their unit of study.

Lesson #4: (page 23) — **What is Stewardship?** You'll need a computer lab for this one. It's worth your time to go to the trouble. Grades 9-12 can learn a lot from both the Farmer Frank computer game and Pesticide Reduction clip. The Letter from a Farmer brings it all home.

Lesson # 5: (page 25) — **Pesticide Articles.** Even grade 9 Geography classes can benefit from this look at an ecological footprint. Interesting articles get every science and food class student thinking and raising questions from both sides.

Lesson # 6: (page 30) — **What Others Think.** This lesson starts at home where the students locate some specific websites so they can be prepared for Lesson #7 that leads to creative controversy. Well worth it!

Lesson # 7: (page 31) — **Creative Controversy.** Don't miss this one. Every grade should go through this process because it forces students to present and advocate their position. The Creative Controversy Model and Evaluation will guide them to success. Once they understand the process, you can use it anywhere.

Lesson # 8: (page 34) — **Reversing Perspective.** Why bother looking at one side if you don't look at the other. The class synthesis and opinion scale reveal many previous biases. This is where the kids really begin to see learning being constructed.

Lesson # 9: (page 35) — **Media (and Your) Influence on Hot Topics.** You **need** to do this lesson. Once your class has been exposed to many techniques for examining issues, they can finally choose their own hot media topic to research. This is a wonderful opportunity for an independent or group study. Action research at its best!

Lesson #10: (page 40) — **Presentations.** Is it a video, a play, a work of art, poetry or a song that will report their findings? Always fun and exciting.

Teacher Background Information

New technological innovations are necessary to sustain an increasing population and a simultaneous growth in the demand for food. The demand for increased food production from a finite amount of farmland puts pressure on the environment. Students need a better understanding of the importance of food production, the concept of sustainable agriculture and the application of new technology in both urban and rural settings.

Educators face the challenge of ensuring that students acquire new skills and concepts to cope with a rapidly changing world. Ontario students need a global perspective from which they can solve problems, make decisions and plan effectively for the future.

The activities in this resource conduct inquiries with integrity and discipline, as they pertain to the use of pesticides, and other issues, in urban and rural settings. Learning expectations are highlighted at the beginning of this document. The activities included are NOT defined by time. Some may take only a few minutes; others may extend over several classes or command homework or research attention. As the classroom teacher, you know best what your class is capable of accomplishing. How long, how far, how much is left up to you. We provide you with articles and research that require experiencing the many sides of an issue.

Overview

The Internet contains much information about pesticides and controversial issues. To assist you in directing your students to examine credible, current sources, we have included some teacher directed lessons at the beginning of this unit of study. We want you and your students to:

- question everything and dig deeper for understanding, particularly about what the 'experts' say and if they are in fact experts;
- differentiate who is advocating for or against the use of pesticides (and other controversial issues) and why they advocate for that position;
- determine what organizations, individuals or groups have hidden agendas, driving factors or questionable motives; (e.g. fundraising)
- decide which organizations, groups or individuals provide a balance in their thoughts, ideas and writings.

In order to guide your students so that they read with discriminating eyes, we have included **Techniques for Analyzing an Issue**, (Appendix # 1c) in this resource. We recommend that you use it every time you have a discussion about any article that you are examining and that your students treat this appendix as a study tool. They need a copy of this appendix for all discussions. The questions in this appendix act as a guideline. Students need to ask them over and over again throughout this unit. You really want them to question everything and this should be reflected during debates and discussions. Encourage them not to accept anything at face value.

Learning Expectations

Students will experience several of these expectations in all of the following activities.

Science, Grade 9, Academic
Biology: Sustainable Ecosystems

- B1. assess the impact of human activities on the sustainability of terrestrial and/or aquatic ecosystems, and evaluate the effectiveness of courses of action intended to remedy or mitigate negative impacts;
- B2. investigate factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of these ecosystems;
- B3. demonstrate an understanding of the dynamic nature of ecosystems, particularly in terms of ecological balance and the impact of human activity on the sustainability of terrestrial and aquatic ecosystems.

Science, Grade 9 Applied
Biology: Sustainable Ecosystems and Human Activity

- B1. analyse the impact of human activity on terrestrial or aquatic ecosystems, and assess the effectiveness of selected initiatives related to environmental sustainability;
- B2. investigate some factors related to human activity that affect terrestrial or aquatic ecosystems, and describe the consequences that these factors have for the sustainability of these ecosystems;
- B3. demonstrate an understanding of characteristics of terrestrial and aquatic ecosystems, the interdependence within and between ecosystems, and the impact humans have on the sustainability of these ecosystems.

Biology, Grade 11, University Preparation

- F. Plants, Anatomy, Growth and Function
- F1. evaluate the importance of sustainable use of plants to Canadian society and other cultures.

Biology, Grade 11, College Preparation

- F. Plants in the Natural Environment
- F1. analyse the roles of plants in ecosystems, and assess the impact of human activities on the balance of plants within those ecosystems.

Chemistry, Grade 11, University Preparation

- B. Matter, Chemical Trends, and Chemical Bonding
- B1. analyse the properties of commonly used chemical substances and their effects on human health and the environment, and propose ways to lessen their impact.

- E. Solutions and Solubility
- E1. analyse the origins and effects of water pollution, and a variety of economic, social, and environmental issues related to drinking water.

Chemistry, Grade 12, University Preparation

- B. Organic Chemistry

Overall Expectations

- B.1 assess the social and environmental impact of organic compounds used in everyday life, and propose a course of action to reduce the use of compounds that are harmful to human health and the environment.

Chemistry, Grade 12, College Preparation

- B. Matter and Qualitative Analysis

By the end of this course students will:

- B1. evaluate the effects of chemical substances on the environment, and analyse practical applications of qualitative analysis of matter.

- C. Organic Chemistry

Overall Expectations

By the end of this course, students will:

- C1. evaluate the impact on society, human health, and the environment of products made usingorganic compounds.

Environmental Science, Grade 11, University/College Preparation

- B. Scientific Solutions to Contemporary Environmental Challenges
- B1. analyse social and economic issues related to an environmental challenge, and how societal needs influence scientific endeavours related to the environment.

- C. Human Health and the Environment

Overall Expectations:

By the end of this course, students will:

- C1. analyse initiatives, both governmental and non-governmental, that are intended to reduce the impact of environmental factors on human health;
- C2. investigate environmental factors that can affect human health, and analyse related data;
- C3. demonstrate an understanding of various environmental factors that can affect human health, and explain how the impact of these factors can be reduced.

- D. Sustainable Agriculture and Forestry

Overall Expectations

By the end of this course, students will:

- D1. evaluate the impact of agricultural and forestry practices on human health, the economy, and the environment;
- D2. investigate conditions necessary for plant growth, including the soil components most suitable for various species, and various environmentally sustainable methods that can be used to promote growth;
- D3. demonstrate an understanding of conditions required for plant growth and of a variety of environmentally sustainable practices that can be used to promote growth.

Environmental Science, Grade 11, Workplace Preparation

- B. Human Impact on the Environment

Overall Expectations:
By the end of this course students will:

- B1. analyse selected current environmental problems in terms of the role human activities have played in creating or perpetuating them, and propose possible solutions to one such problem;
- B2. investigate air, soil, and water quality in natural and disturbed environments, using appropriate technology;
- B3. demonstrate an understanding of some of the ways in which human activities affect the environment and how the impact of those activities is measured and monitored.

Geography of Canada, Grade 9, Academic or Applied: Geographic Foundations

The student will:

- demonstrate an understanding of the terms and concepts associated with regions (e.g., ecological footprint);
- demonstrate an understanding of how natural and human systems interact within ecozones;
- distinguish between the characteristics of urban and rural environments (e,g, population density, land use, forms of settlement, development patterns);
- produce a set of criteria for identifying regions, including ecozones;
- use knowledge of the local bioregion to generate manageable research questions;
- identify how they can contribute to the quality of life in their homes, local bio-region, nation, and the world.

Geography of Canada, Grade 9, Academic or Applied: Human-Environment Interactions

The student will:

- demonstrate an understanding of what is meant by an "ecological footprint";
- demonstrate an understanding of how human activities (e.g., agricultural and urban development, waste management, parks development, forest harvesting, land reclamation) affect the environment;
- develop and test criteria to determine the value of natural resources, inclsuing agricultural lands and wilderness;
- explain how the effects of urban growth (e.g., development on former farm lands, destruction of wildlife habitats) alter the natural environment;
- research and report on ways of improving the balance between human needs and natural systems (e.g., recycling, river cleanups, ecological restoration of local woodlots or schoolyards, industrial initiatives to reduce pollution).

Geography of Canada, Grade 9, Academic or Applied: Global Connections

The student will:

- compare approaches to environmental concerns in Canada with those practiced in other nations(e.g., deforestation, regulations regarding pesticide use, pollution that crosses international borders);
- calculate Canada's share of selected world communities (e.g., minerals, fuels, forest and agricultural products, manufactured goods and services);
- compare, in terms of resource use and consumption, the ecological footprint of an average Canadian with that of an average citizen in a developing country.

Geography of Canada, Grade 9, Academic or Applied: Understanding and Managing Change

The student will:

- predict the consequences of human activity (e.g., agriculture, recreation) on natural systems (e.g., soil depletion, climate change);
- predict job and career opportunities that my be available in all sectors of the Canadian economy in the twenty-first century (e.g., in primary, secondary, tertiary, quaternary sectors).

Food and Nutrition Sciences, Grade 12, University/College Preparation Personal and Social Responsibilities

The student will:

- use a variety of print and electronic sources to find information on employment opportunities in areas relating to food an nutrition sciences, such as health and medicine, hospitality services, agriculture, and food technology and production;
- identify types of small businesses related to the food industry (e.g., cottage industries, vendors of Native food products, truck gardeners, pick-your-own produce ventures);
- design, cost, market, produce, and evaluate a food product.

Diversity, Interdependence, and Global Connections

The student will:

- demonstrate an understanding of the effects of different environmental factors and issues on the production and supply of food items(e.g. energy and resources required to produce various foods; use of pesticides, fertilizers, food additives, and irradiation);
- identify the impact of biotechnology (e.g. antibiotics in the food supply, bovine growth hormone) on food production, supply and safety;
- identify legislation governing pesticide and fertilizer use, food additives, and the labeling of biogenetically engineered foods;
- identify current food crises (e.g., contamination, crop failures), the factors causing each of them (e.g., production increases, unfavorable global weather changes), and their impact on the availability and cost of food.

Lesson 1 What Is Your Opinion?

Teacher Preparation

You will need magic markers and chart paper and cards. Post seven cards around the room with each one depicting one opinion: mildly agreed, agreed, strongly agreed, acceptable, mildly opposed, opposed, and strongly opposed. This opinion scale will stay up during the entire unit as you can use it over and over again. Spread the cards out with at least one metre between each card, as you will be asking students to stand under the word that best describes their opinion. You will also need copies of **What is a Pesticide?** (Appendix # 1a), **About AGCare** (Appendix # 1b) and **Techniques for Analyzing an Issue** (Appendix # 1c)**.**

ACTIVITY 1 DETECTING BIASES

1. This is basically a teacher directed introduction where your students are expressing their beliefs and how they think on several issues. The goal is to see if their thinking shifts at all as the unit unfolds. Simply ask: "What do you know about pesticides?" On a chart paper, record what points they make that you think are important. Allow time for discussion.

2. Then distribute, or on an overhead, have them read **What is a Pesticide?**, a document from AGCare (Appendix # 1a). Do you need to add any new facts to their chart that they did not mention? Who is AGCare? Copy or on an overhead, review the **About AGCare** (Appendix # 1b). To determine if AGCare is a reliable, unbiased source for information, introduce **Techniques for Analyzing an Issue (**Appendix # 1c). Be adamant that the students realize that this appendix is the one they will be using over and over again as they try to determine if their sources are reliable. At home they may want to go to the AGCare site themselves to get a better idea of the work that AGCare does. (www.agcare.org).

3. Introduce the opinion scale charts that you already have hanging around the room. Assure them that these charts will stay up in the room during this unit, as you will refer to them again and again. If there are too many students to stand under a chart at the same time, then send them up in groups. Have them stand under the word that best describes their opinion. Try these:

   a) Should Canadian farmers use pesticides to produce food crops?
   b) Should people use fertilizers, animal manure and pesticides on urban lawns and gardens?
   c) Should consumers purchase **only** locally grown foods?
   d) Should we produce blemish-free fruit by using fungicides?
   e) Should Canadians develop farmland to create subdivisions?
   f) Should we use fertilizers to improve crop yield?
   g) Should we encourage developing countries to produce field crops for sale on world markets?

4. Ask your students how they arrived at their answers. Who or what has impacted their beliefs? Allow for discussion. Then ask: Can you differentiate between a fact and an opinion? Examples:

   - Highway #403 is the most efficient way to travel from Hamilton to Toronto. (or fill in the name of a local road that is familiar to the students).
   - Smoking can cause cancer.
   - Enrico (or whoever) is eating an apple.
   - Less than 3% of the people in Canada are farmers. (*Less than 2% farm.*)
   - The economy is more important than the environment.
   - Women are more sensitive than men.
   - Pests can reduce crop production significantly.
   - Pizza is a healthy food source.

5. Explain that it is important when working through this unit that students must be cautious of detecting bias when researching or reporting. Refer to the bias section in the **Techniques for Analyzing An Issue** (Appendix #1c).

Appendix # 1a

What is a Pesticide?

A pesticide is any product used to manage, destroy, attract or repel a pest. (A pest can be considered to be any unwanted organism, such as an insect, weed, rodent, bacterium, fungus, etc.) In Canadian legislation and regulations, pesticides are also called "Pest Control Products". All pesticide products are subjected to intensive testing and screening for safety prior to their approval for use in Canada.

Within the group of products used as pesticides, there is much diversity with respect to:

- the types of pests controlled.
- their mode of action (i.e. how they control the pest)
- their risk to human health.
- their potential for adversely affecting non-target organisms such as birds, fish, wildlife or other aspects of the environment.

Types of Pesticides

The word "pesticide" is often used incorrectly to refer to products for controlling insects. "Pesticide" is a generic term, covering all products used for controlling any kind of pest. Under the broad heading of pesticide, there are many sub-categories, including:

- herbicides for controlling one or more species of weeds
- insecticides for insects
- fungicides for fungi and moulds
- nematicides for nematodes (parasitic microscopic worms living in the soil)
- bactericides for bacteria
- algicides for algae (such as in swimming pools)
- rodenticides for mice and rats
- miticides for mites (small insect-like animals related to spiders)

Within Canada, other products considered as pesticides include:

- insect repellants
- growth regulators (for limiting the growth of plants without otherwise adversely affecting their performance)
- wood preservatives
- disinfectants
- electronic devices for control of insects or rodents.

What Types of Compounds are Used as Pesticides?

Pesticides can be categorized as organic or inorganic in nature.

Organic compounds are those that contain carbon. They can either be naturally occurring compounds derived from a living organism or manufactured products. A few pesticides are naturally occurring compounds found in plants (e.g. the insecticide rotenone). Others are micro-organisms, such as the bacteria, *Bacillus thuringiensis* (Bt). However, the vast majority of pesticides are manufactured organic compounds.

Inorganic compounds are those that do not contain carbon. Prior to the 1950s, most of the products used as pesticides were inorganic in nature. Several of these contained toxic heavy metals such as lead, arsenic or mercury. Because of the persistent risk to human health they pose, pesticides containing heavy metals have been banned. Only a very few inorganic compounds continue to be used as pesticides and they are used only in very limited applications (e.g. ant bait, copper sulphate in organic apple production).

INTERNET RESOURCES:

Fact Sheet on the Pest Management Regulatory Agency
http://www.pmra arla.gc.ca/english/ pdf/fact/fs_pmra e.pdf

Appendix # 1b

ABOUT AGCare

Established in 1987 as an ad hoc committee to provide public communication and policy initiatives on crop protection and related environmental issues. Incorporated in 1991, AGCare (Agricultural Groups Concerned About Resources and the Environment) is defined as a coalition of agricultural groups that represent Ontario's 45,000 growers of field and horticultural crops. The organization provides science and research-based information and policy initiatives on pesticide use, crop biotechnology developments, nutrient management and other related environmental issues on behalf of its membership.

AGCare Member Organizations

Christian Farmers' Federation of Ontario (CFFO) www.christianfarmers.org
Federated Women's Institute of Ontario (FWIO) www.fwio.on.ca
Flowers Canada (Ontario) Inc. (FCO) www.flowerscanada.ca
Ontario Beekeepers' Association (OBA) www.ontariobee.com
Ontario Canola Growers' Association (OCGA)
Ontario Corn Producers' Association (OCPA) - www.ontariocorn.org
Ontario Federation of Agriculture (OFA) www.ofa.on.ca
Ontario Flue-Cured Tobacco Growers' Marketing Board (OFCTGMB)
Ontario Fruit and Vegetable Growers' Association (OFVGA) www.ofvga.org
Ontario Potato Board (OPB)
Ontario Processing Vegetable Growers (OPVG) www.ovfgmb.org
Ontario Seed Corn Growers (OSCG) www.seedcorngrowers.on.ca
Ontario Seed Growers' Association (OSGA)
Ontario Soil & Crop Improvement Association (OSCIA) www.ontariosoilcrop.org
Ontario Soybean Growers (OSG) www.soybean.on.ca
Ontario Wheat Producers' Marketing Board (OWPMB) www.ontariowheatboard.org

Ideas to Explore

1. Do the many members of AGCare increase or diminish the organization's credibility?
2. Are these members credible? What would you do to find out?
3. Why do you suppose these members belong to AGCare?
4. Do they have any similar reasons for belonging?
5. See **Techniques for Analyzing an Issue** (Appendix # 1c) when reading pesticide based articles. These questions will help you dig deeper as you begin to form your own opinions.

Appendix # 1c

Techniques for Analyzing An Issue

ANALYZING AN ISSUE: Questions to ask:

What is the nature of the issue and why is it important?
Who is involved in the issue?
Is there an historical background of the issue that needs to be identified?
What caused the issue?
What are the risks and/or the benefits?
Is there strong disagreement as to how the issue should be solved?

READING FOR BIAS: Questions to ask:

Does this source have a reputation for accuracy? Are the facts verified by reports from other sources? Has the author or organization of this article checked their facts with care? Is he/she/it credible? Was it necessary for he/she/it to follow a code of ethics? Were protocols adhered to?

Is this source biased? Does the source distort the facts to fit his/her preconceived notions? Does he/she present only one side of the controversy? Does this article "color" the news by printing those items favourable to a particular set of interests or political party? Has the person interviewed shown a bias because of the company for which he/she works or the causes in which he/she believes?

Is this information complete? Are you given all of the facts? Are some facts missing? Are some facts withheld? Have I checked every possible source of information to validate that this information is current and accurate?

Four Part Process For Analyzing An Issue

What is the issue you are reading about? (i.e., the nature of the controversy). You must first differentiate the values (what should be, what is best?); the information (what is truth, what is the case?); the concepts (what does this mean, how should this be defined?)

What are the arguments? What is being said? Is there adequate support for the claims being made? Examine fact vs. fiction. Examine bias.

What is assumed? Consider the validity of the position presented.

How are the arguments manipulated? Is there a political slant or is the information being used to manipulate opinion? Is the media/author/organization manipulating the argument?

Lesson 2 Exploring Biases Further

Teacher Preparation

You will need the five articles provided at the back of this lesson. (Appendix #2a-2e). You will also need the **Techniques for Analyzing an Issue** already distributed in Part 1. (Appendix 1c).

ACTIVITY 2 EXPLORING BIASES FURTHER

1. Remind the students that they will need to refer to **Techniques for Analyzing An Issue** as discussed in Lesson #1, (Appendix 1c). Review this sheet with the class.

2. Number the students off using letters a-e. Each student will be examining more background information about pesticides. There are 5 fact sheets #2a-e, as listed below. Each of these matches the letter given to the student, so that each student will end up with one fact sheet.

   a) Agricultural Pesticides and Human Health.

   b) Agricultural Pesticides and the Environment.

   c) Agricultural Pesticides and Food Safety.

   d) Integrated Pest Management.

   e) Why Farmers Use Pesticides.

3. Each student, once assigned one fact sheet to research, will write a one or two page response using the criteria outlined in Appendix # 1c. They must bring their finished response with them to class next week.

4. Let your students know that they must keep any of their assignment articles, notes etc. in an organized binder. You will be giving them a **Controversial Issues Project Evaluation** later.

Appendix # 2a

Agricultural Pesticides and Human Health

Because pesticides are designed to kill or otherwise affect the behaviour of some living organism, they can also pose a risk to other types of organisms, including humans. Before a pesticide can be used legally in Canada, it must be approved and registered by the Pest Management Regulatory Agency of Health Canada (PMRA). A pesticide will not be registered for use in Canada unless the potential total daily intake of residues of that pesticide, from all foods, is proven to be well below the level that might adversely affect the health of any age group.

The effects of a pesticide can be:

- **acute** - an immediate response to short term exposure to a high dosage, or
- **chronic** - a response to long term exposure to a low dosage.

Pesticides vary greatly with respect to how they work, the range of organisms they affect, their acute effects, and their chronic effects. Some pesticides can pose a significant risk to human health or to the environment, while other present very little risk at all. Reading the pesticide label is the quickest way to obtain information regarding the relative risk posed by a pesticide.

When applied properly, agricultural pesticides pose very little risk to people who are not involved directly in their use. The dosage one would receive through casual exposure would rarely be sufficient to cause a health problem (e.g. by walking through a treated field, by inhaling vapours from a treated area or by eating the produce from that field). However, highly sensitive people might experience an allergic reaction so caution remains advisable. Pesticides pose the greatest risk to the people who handle or apply them. In Ontario, no one may legally apply an agricultural pesticide without having been trained in the proper pesticide selection, handling, application, storage, and transportation of pesticides.

Acute Toxicity

The acute toxicities of pesticide products to humans range from low to very high. In general, insecticides are the group of pesticides that are most toxic to humans. Many insecticides attack the nervous system of the target insects and therefore, are toxic to some degree to other species with a nervous system (i.e. humans and animals). There is, however, considerably variation among insecticides. Some are so highly toxic that a few grams are sufficient to kill a person. Others, such as most of those available for home or garden use, are moderate in toxicity, or about the same as aspirin.

Herbicides (weed killers) account for about 80 percent of the agricultural pesticides used in Ontario. In general, herbicides are low to moderate in toxicity towards humans (and other animals), because most herbicides target chemical pathways that animals do not possess. A few agricultural herbicides are very toxic. Always check the safety precautions on the product label before using any pesticide. (No highly toxic herbicide is available for home or garden use.)

Chronic Health Effects

Because of the potential hazard, all pesticides being evaluated for use in Canada must undergo long-term animal testing to identify potential human risks. Long-term exposure to high dosages of some pesticides has caused chronic health problems in laboratory animals. The disorders have included cancer, tumors, birth defects, disruption of the endocrine system, genetic mutations and damage to vital organs such as the liver, lungs or kidneys, depending on the pesticide and the animal species. Not all pesticides cause chronic effects and no pesticide causes all of the above symptoms. Also, the injury occurred as the result of exposure to much higher dosages than pesticide residues in or on foods would represent. A pesticide will not be approved for use in Canada, unless the potential total daily intake of residues of that pesticide, from all foods, is well below the level that might adversely affect the health of any age group of people. (See Factsheet: Agricultural Pesticides and Food Safety)

Health studies suggest that fewer than two percent of human cancers can be attributed to residues in foods of synthetic chemicals, some of which may be pesticides. The greatest food-related cancer risks are associated with poor dietary habits (e.g. high fat, low fibre diets), naturally occurring carcinogens in foods, and carcinogens produced during food preparation (e.g. by grilling, frying or barbequing).

Pesticide and Animal Products

A group of insecticides introduced in the 1950s (but no longer in use in North American) exhibited a characteristic known as bio-accumulation or bio-magnification. These products, of which DDT is the best known example, are very resistant to being broken down, either in the environment or in the bodies of organisms that consumed them. Any of these persistent pesticides that entered the body of an animal remained there, stored in its body fat. Animals that fed on other animals accumulated all of the pesticides contained in its prey. Thus, the concentration of persistent pesticides tended to increase as one progressed up the food chain - the longer the food chain, the greater the accumulation.

Some people caution against eating meat and other products from cattle, pigs or poultry because of the perceived risk of consuming elevated pesticide residues. In fact, there is very little risk of being exposed to pesticide residues in animal products. Modern pesticides are much less persistent than was DDT, are more readily broken down by animals and are not prone to bio-accumulation. Furthermore, the agricultural food chain is very short because farm animals are fed plant products almost exclusively.

INTERNET RESOURCES:

The Regulation of Pesticides in Canada (Pest Management Regulatory Agency)
http://www.hc-sc.gc.ca/pmra-arla/english/pdf/fact/fs_pestreg-e.pdf

Fact Sheet on the Pest Management Regulatory Agency
http://www.pmra arla.gc.ca/english/pdf/fact/fs_pmra e.pdf

Chemical Carcinogens: Health Risks (Health Canada)
http://www.hc sc.gc.ca/ehp/ehd/catalogue/general/iyh/chemcarc.htm

Appendix # 2b

Agricultural Pesticides and the Environment

Before a pesticide can be sold or used in Canada, it must be approved and registered by the Pest Management Regulatory Agency (PMRA) of Health Canada. The pesticide will be registered only if the risks associated with it are acceptable and manageable and if it is of potential value to Canadians.

Pesticides vary greatly in their potential risk, depending on the properties of the specific product and the conditions into which it is applied. Some pesticides pose little risk to either the environment or to human health. Others can represent a significant hazard if they are not managed carefully.

The Environmental Risk Assessment is one of the key studies undertaken by PMRA when evaluating the acceptability of a pesticide for use in Canada. The information required for this review is obtained from a combination of laboratory studies and field studies of the pesticide and the products of its breakdown.

The risk of a pesticide causing damage to the environment depends on its:

- environmental fate - what happens to it in the environment and to what extent could non-target species be exposed to it?
- environmental toxicity - what is its potential to adversely affect non-target species?

Environmental fate studies of a pesticide are used to predict its behaviour in soil, water and air, its potential for uptake by plants and animals; and its potential for bio-accumulation. The factors considered during this assessment, include:

- expected use-patterns
- physical and chemical properties
- chemical or biological changes in the product after application
- the persistence of the product
- the risk of the pesticide contaminating either surface waters or groundwater, through runoff, soil erosion or leaching.

Environmental toxicology studies provide information on the hazards that a pesticide, and its breakdown products, pose to non-target plants and animals, either on land or in the water. Specific animal studies provide data related to the effects on birds, mammals, fish, earthworms, beneficial insects and important aquatic invertebrate species.

Risk Determination

By combining the results of the fate and toxicology studies, PMRA is able to determine the likelihood of the pesticide remaining in the environment in concentrations sufficient to cause adverse effects. The pesticide will not be approved for use if it poses an unacceptable risk to the environment.

WHAT HAPPENS TO A PESTICIDE AFTER APPLICATION?

The extent of the risk that a pesticide poses to the environment and human health depends, in large measure, on what happens to that pesticide after application. Two key factors are:

- its persistence - the length of time the pesticide remains in an active form in the environment, and
- the likelihood of the pesticide moving from the point of application.

After application in a field or orchard, pesticides are subjected to three main types of processes. The extent to which each of these processes act upon a pesticide depends on the properties of the pesticide, the soil, the weather and the crop.

1: Adsorption

Some pesticides are strongly attracted to soil particles and are held tightly by them. Pesticides held in this way are no longer able to control pests or cause damage to the environment, either by affecting non-target species or by contaminating water.

2: Transfer

Pesticides can be moved off-target (i.e. from the point to which they were applied) in a variety of ways:

- volatilization - the conversion of a solid or liquid into a gas and movement into the atmosphere.
- runoff - movement from a field in runoff water (also called surface water), either dissolved in the water itself or attached to soil particles being eroded from the field
- leaching - movement of materials down through the soil with water
- plant uptake - movement into plants through either the leaves or roots

Restrictions are placed on the manner in which pesticides prone to moving off-target may be used so as to minimize the risk of environmental damage.

3: Degradation
With the possible exception of the very small amount of pesticide that may leach into the groundwater, all pesticides are eventually degraded into harmless components through one or more of the following:

- Microbial breakdown - the pesticide is broken down (i.e. "eaten") by fungi, bacteria or other micro-organisms living in the soil, on the surface of plants or in surface water.
- Chemical degradation - the pesticide reacts with other compounds in the soil, especially water, to form non-toxic compounds.
- Photo-decomposition - some pesticides are broken down by sunlight.

A group of insecticides introduced after the 1950s, of which DDT is the best known example, exhibited a characteristic known as *bio-accumulation* or *bio-magnification*. These products were very resistant to being broken down, either in the environment or in the bodies of organisms consuming them. Any of these persistent pesticides that entered the body of an animal remained there, stored in its body fat. Animals that fed on other animals accumulated the pesticide contained in its prey. Thus, the concentration of persistent pesticides tended to increase as one progressed up the food chain - the longer the food chain, the greater the accumulation.

When these products were in widespread usage, the concentrations in some predatory birds and large fish species built up to very high levels. The populations of some species declined and some exhibited birth defects or other reproductive problems. Because of these concerns, usage of DDT and related products was either banned or greatly restricted by the mid-1970's. None of the pesticides in use in Canada today are prone to bio-accumulation.

PESTICIDES AND GROUNDWATER
Many rural homeowners are concerned about the potential for contamination of their wells by pesticides applied to their land or to neighbouring farms. Fortunately, pesticide contamination of groundwater in Ontario has been a rare occurrence and usually has resulted from a spill, rather than from normal agricultural use of pesticides.

Contamination Routes
There are three main routes by which wells can become contaminated.

- accidental spillage of pesticides into or around the well when a sprayer is being filled.
- flow of contaminated surface runoff water into a well that is not properly sealed.
- leaching of pesticides down through the soil into groundwater.

Contamination of wells from spillage and surface runoff are almost entirely preventable if both pesticide users and well-owners take the proper precautions.

There is little risk of pesticide contamination of the groundwater through leaching in Ontario, because the combination of conditions required for a pesticide to reach the groundwater occurs infrequently in Ontario.

- Many pesticides are not prone to leaching because they are immobilized by binding with soil particles.
- Water drains relatively slowly through all but the most porous of soils.
- Most pesticides in use today degrade within a few days or weeks after they are applied, and thus do not stay in an active form long enough to reach the groundwater under most of the soils in Ontario.

INTERNET RESOURCES:
The Regulation of Pesticides in Canada (Pest Management Regulatory Agency)
http://www.hc-sc.gc.ca/pmra-arla/english/pdf/fact/fs_pestreg-e.pdf

Fact Sheet on the Pest Management Regulatory Agency
http://www.pmra arla.gc.ca/english/pdf/fact/fs_pmra e.pdf

Pesticides and Groundwater Contamination (Ohio State University Bulletin 820)
http://www.ag.ohio state.edu/~ohioline/b820/index.html

Appendix # 2c

Agricultural Pesticides and Food Safety

The use of pesticides in Canada is regulated through the Pest Control Products Act, administered by the Pest Management Regulatory Agency (PMRA) of Health Canada. It is the mandate of PRMA to protect human health and safety and the environment by minimizing risks associated with pest control products. Thus, PMRA has the responsibility of assessing the acceptability of pesticides for use in Canada and determining acceptable levels for pesticide residues in food.

Before they will be registered for use in Canada, new pesticides must undergo a thorough evaluation by PMRA. For this evaluation, the manufacturer of a pesticide must submit an extensive array of information about the pesticide to PMRA. Completion of the scientific studies required to assemble these data typically takes four to five years.

To evaluate the potential health effects of a pesticide, PMRA requires data related to:

- potential health effects (both acute and chronic) of both the pesticide and the compounds into which it breaks down. Particular attention is paid to the potential for reproductive effects and cancer.
- physical and chemical properties of the pesticide.
- the required application techniques and the lowest rate at which it can be applied to provide effective pest control.
- how the pesticide is metabolized (i.e. broken down) in plants and animals.
- laboratory procedures for determining pesticide residue levels in foods and livestock feeds.
- potential residue levels in food, when the pesticide is applied at recommended levels.

Studies of the potential health hazards of both short-term and long-term exposure to the pesticide are conducted using laboratory animals. Short-term studies, lasting up to a few months, are used to determine the potential for damage to body tissues and organs. Long-term studies, lasting through a least two complete generations, indicate the likelihood that the pesticide will cause: damage to tissues, organs or the nervous system; cancer; reproductive problems; birth defects; genetic mutations; endocrine disruption; or altered immune responses. These studies are also used to obtain information about how the chemical is metabolized within the body and the potential for bio-accumulation.

These studies provide an indication of the nature of potential hazards to human health and of the risk that the pesticide could cause these effects in humans. They enable the PMRA to determine the “no observable adverse effect level” - the maximum dosage that laboratory animals can consume every day over their entire lifetime without experiencing harmful effects. This level forms the basis for calculating the maximum allowable level of residue in foods.

The “no observable adverse effect level” for laboratory animals is converted to a value for humans by dividing it by at least two uncertainty factors:

- a factor of 10, to adjust for the uncertainty in applying the results of animals studies to humans.
- another factor of 10, to allow for natural variability existing within the human population.
- an additional factor of up to 10 may be applied when necessary to ensure that the health of infants and children is adequately protected.
- additional factors may also be applied when they appear advisable

Once all of the appropriate factors have been applied, the result is established as the acceptable daily intake (ADI) for humans. The ADI is the amount of a pesticide that is considered safe for humans, of any age, to consume each day throughout their lives. As outlined above, the ADI is always at least 100 times less than the amount that could be consumed every day by laboratory animals without adverse effects.

To ensure that the total consumption of the pesticide by any age group does not exceed the ADI limit, PMRA then establishes the maximum amount of residue than can remain on foods at the point of sale. Three factors are taken into consideration to calculate the potential consumption of a pesticide by Canadians:

- the dietary habits of Canadians of various age groups (i.e. what foods do they eat and in what amounts);
- the foods during the production of which the pesticide is likely to have been applied, and
- the residues remaining in or on those foods at the point of sale, when the pesticide has been applied according to recommended practices.

A pesticide will not be registered unless it can be shown that no age group will consume more than the acceptable daily intake of the pesticide in their total daily intake from all foods.

The Canadian Food Inspection Agency (CFIA) is responsible for monitoring the Canadian food supply; both domestically produced and imported, to ensure that the maximum pesticide residue limits are not exceeded. Typically, about 98 percent of the samples tested by CFIA fall within the acceptable range and pesticide residues are not detected at all in about 80 percent of the samples.

INTERNET RESOURCES:

The Regulation of Pesticides in Canada (Pest Management Regulatory Agency)
http://www.hc-sc.gc.ca/pmra-arla/english/pdf/fact/fs_pestreg-e.pdf

Fact Sheet on the Pest Management Regulatory Agency (2001)
http://www.pmra arla.gc.ca/english/pdf/fact/fs_pmra e.pdf

Fact Sheet on Pesticides and Food
http://www.pmra arla.gc.ca/english/pdf/fact/fs_food e.pdf

Appendix # 2d

Integrated Pest Management

Integrated pest management (IPM) is a systems approach to pest control that assists the farmer in selecting pest control methods that will provide an optimum level of control, that are both economical and environmentally sound. Almost all farmers in Ontario use at least some elements of the IPM approach.

A complete IPM program consists of five basic components:

1. **Pest Identification:** What species of pests are present?
2. **Monitoring:** How many of each type of pest are present? When are they present? At what stage of their life cycle are they?
3. **Threshold Determination:** Are enough pests present to cause an economic loss?
4. **Picking a Control Method:** Which method, or combination of methods, will best control the pest(s)? Solutions must be effective, economical and environmentally sound.
5. **Evaluation:** How well did the control measure(s) work?

IPM involves the use of a combination of pest control practices, including:

Mechanical: Physically remove pests, using measures such as cultivation (weeds) or trapping (insects)

Cultural: Different growing conditions favours different pests and slows the buildup of any one pest. The most common cultural control method is crop rotation (i.e. changing the crop that is grown in a field from year-to-year). Time of planting, plant population and time of harvest also affect the incidence of some pests.

Biological: A number of pests have been controlled through the release of parasitic insects or diseases specific to those pests.

Genetic: Use of resistant varieties, developed with conventional breeding methods, has been the cornerstone of controlling diseases and some insects in most crops for decades. Crops that are resistant to certain insects have been developed through the use of biotechnology.

Chemical: Used only when other methods cannot provide adequate control.

Use of an IPM program enables a grower to:

- maintain effective and economical pest control over the long-term;
- minimize pesticide usage;
- minimize risks to human health and the environment;
- reduce the risk of the development of pesticide-resistant pest populations.

Appendix # 2e

Why Farmers Use Pesticides

Throughout the world, billions of dollars worth of foodstuffs are lost each year to pests, through reduced productivity, contamination or direct consumption of the product by pests. Severe infestations of some pests can result in the complete loss of crops or death of animals. Without some form of pest control, these losses would be even greater and could result in shortages of some types of foods and higher prices to the consumer. Furthermore, without pest control, the contamination of crop products caused by some pests could pose a hazard to the health of humans or animals.

The agricultural pests most commonly encountered in Ontario are weeds, insects, and diseases. Other pests that can affect some crops include nematodes, mites, slugs, birds and mammals. The types of damage caused by agricultural pests include:

Type of Damage	**Caused by:**
death of crop plants	insects, diseases
reduced growth or yield	insects, diseases, nematodes and weeds
spread of crop or livestock diseases	insects
reduced quality and appearance	insects, diseases and weeds
eating of the crop	insects, birds and mammals
contamination of crops with toxic compounds	diseases, weeds
increased difficulty in harvesting crop	insects, diseases and weeds
damage or spoilage to crops in storage	insects, diseases and rodents
contamination of harvested product	insects, rodents and weed seeds
quality loss through staining of harvested crop	weeds
poisonous to humans or livestock	weeds
serve as hosts for insect and/or disease pests	weeds
human health risk	diseases
allergic reactions	weeds, diseases
reduced growth of livestock	insects and diseases
distress to animals	insects, diseases
damage to meat and/or hides	insects

All farmers rely on a variety of pest control practices, especially mechanical (cultivation), cultural (crop rotation), biological (beneficial insects and pest diseases) and genetic (use of varieties with natural pest resistance). When these methods prove to be inadequate, many farmers chose to use a pesticide to provide the required level of pest control.

Pesticides are used because when they are chosen and applied properly, they are:

- **highly effective**
- **fast acting** - Insect and disease infestations are often unpredictable and thus not readily controlled by non-chemical means. When an infestation occurs, the pest can often devastate a crop before non-chemical control measures can take effect. Thus, pesticides are used to save the crop or to prevent an infestation from occurring.
- **broad spectrum** - Some pesticides generally control more than one species of pest. In contrast, biological control measures are usually effective against only one species of pest or a small group of closely related species.
- **less labour intensive** - It has been estimated that using organic farming methods (without modern pesticides) to produce crops requires about 10 percent more labour, per unit of output, than do conventional practices and could require more land to produce the same amount of food.
- **more energy efficient** - Controlling weeds without pesticides requires that a field be cultivated several times, resulting in the use of considerable amounts of fuel and the release of more exhaust fumes and greenhouse gasses into the atmosphere, as well as the release of soil carbon. As a result, the total energy consumption of chemical weed control, including manufacturing, distribution and application, is often less than that for a non-chemical approach.
- **safe** - When proper precautions are used, pesticides can be used with little risk to the applicator and negligible risk to the health of the consumer or the environment. Over the past 40 years, the characteristics of the pesticides used in Ontario have changed so that they now pose much less risk to human health or to the environment than did many of the products in use during the 1950's and 1960's.
- **economical** - When all of the above factors are considered, farmers use pesticides because the benefits they offer in terms of yield, quality and efficiency outweigh their cost. However, pesticides tend to be a costly input and are therefore only used when it makes economical sense.

Lesson 3 Checking Out the Facts

Teacher Preparation

Make sure that you have looked at each of the topics listed in Appendices 2a-e,so that you are aware of the article content. You will need to have one copy of each for yourself. Arrange your students, a-e to form a jigsaw or expert-in-the-group situation. They will be sharing their findings so that each student will have enough information about pesticides to begin to form a better/different/same opinion than they had at the beginning of the unit. It also saves them from researching every topic.
Be sure that you have copied for every student the **Self-Evaluation of My Contribution to Group Work**. (Appendix # 3).

ACTIVITY 3 CHECKING OUT THE FACTS

1. Arrange the groups so that all 5 topics are represented in each group.(i.e. every group should have an a-e member.) One student presents the main facts to the others, as each student takes notes as he/she listens. This allows each student to become the-expert-in-the group and all students will access information quickly. The group members may challenge the 'expert' during his/her reporting.

2. Ask specific questions related to each topic when the groups have finished presenting. Examples:
   - What causes chronic health problems with agricultural pesticides?
   - How is a pesticide approved and registered?
   - What is an ideal pesticide?
   - What is the Environmental Risk Assessment?
   - What's the difference between a no-till and conventional tillage system?

3. How did you assess your Fact Sheet? Did you use the **Techniques for Analyzing an Issue** guideline? How do you know that the facts are accurate? Let your students know that they are to keep all of their notes and assessments in an organized binder that you will be examining throughout the unit. You will give them a guide to assist them in getting a good mark for all future assignments.

4. Distribute **Self-Evaluation of My Contribution to Group Work** (Appendix # 3), and discuss what your expectations are. Teach the students how to keep their own record so that every time they work with a group they can track their own successes or work on their weaknesses. This is their guide to a good mark.

Appendix # 3

Self-Evaluation of My Contribution to Group Work

Name of student _____ Date of activity _____

Type of group work _____

To what extent did other members of the group listen to and understand your ideas?

(not at all) 1 2 3 4 5 (completely)

How much influence do you feel you had on the group's decision?

(not at all) 1 2 3 4 5 (completely)

To what extent do you feel committed to, and responsible for, the group's decision?

(not at all) 1 2 3 4 5 (completely)

To what extent are you satisfied with your group's performance?

(not at all) 1 2 3 4 5 (completely)

How much did you learn about the issue under discussion?

(not at all) 1 2 3 4 5 (completely)

Write a few sentences describing the way you now feel. How did you find working with this group and/or this topic? You can identify the highlights or your frustrations but please do not write other student's names that you'd like to blame or accuse of negatively impacting on the group.

_____

_____

_____

_____

_____

Teacher's Comments/Response (based on direct observation only)

_____

_____

_____

_____

Lesson 4 What is Stewardship?

Teacher Preparation

This is a computer lab activity. In this lesson, you want to give your students a better understanding of what it takes to work responsibly to protect people and the environment, particularly if you are in farming. The whole purpose of all of the activities in this unit is to encourage the youth of today to plan an action that will make an environmental difference to their school, their neighbourhood or our earth. They play the **Farmer Frank** game, from Crop Life, to realize just how much it takes to keep a farm running smoothly. On the same CD a video has been provided which describes how farmers have reduced their use of pesticides by 52% in the past 20 years. You will need a copy of the **Letter from a Farmer** (Appendix # 4) for each student.

For Your Eyes Only!

Stewardship is being introduced early in this unit so that your students realize that all of their discussions and activities are leading toward planning an action where they can participate in making the world a better place. They need to be aware of the many ways that farmers advocate for stewardship in their approaches and practices, so that they can internalize some of these ideas for their own personal action. Their final activity will demonstrate how they will work responsibly to protect people and the environment.

ACTIVITY 4 STEWARDSHIP FIRST

1. Start out by asking the students what stewardship means and why it is important to all of us. In which way do we, as people of the 21st century demonstrate stewardship in our schools, homes, neighbourhood, country and world? What kind of things do we need to do to improve and get this message out to all Canadians?
2. Explain that farmers have been vocal about the need for stewardship initiatives for years. Read the **Letter from a Farmer** (Appendix # 4). Discuss. Post the letter in a prominent place in the room so that you can refer to it throughout this unit. Return to this letter often to generate discussion.
3. Tell the students that to better understand what farmers are up against with managing their responsibilities, they will be watching a video called Pesticide Reduction and playing the Farmer Frank game where they will get an idea about the work involved in managing a farm.
4. Watch the Pesticide Reduction CD before they play the game. If possible, watch the video together using a projector and T.V. This CD is 7minutes long. You may want to ask the students: “What particularly caught your attention in this CD? How do you feel about Canada's safety regulations for both the environment and for people?” Discuss further insights from the video with the class.
5. Be sure that you know how to make the Farmer Frank computer game work so that all students can get started right away. Students will keep their own scores.
6. As the students are working through Farmer Frank, you may want to conference with the students to be sure that they have organized their binders appropriately and are clear about what you expect from them.
7. The students may need to return to the Farmer Frank game in another class if they did not have enough time to finish, but most of them will get the idea of the many skills that are required to operate a successful farm.
8. For homework they need to research the background on two organizations: CropLife and the Sierra Club. For the next lesson you have chosen one article from each of these organizations for discussion. Don't tell them which ones. The students need to come prepared with background information about each of these organizations, with their own opinions about these organizations. Encourage them to find the good and not-so-good points about any organization they research. No one is completely right or wrong. Encourage them to see the issues from both sides.

Appendix # 4

Letter From A Farmer

Hello:

Thank you for taking on this challenge!

The debate over agricultural pesticide use has gone on for decades. We've heard all sorts of crazy arguments, both for and against agricultural pesticide use over the years. I'd like to give you a farmers' perspective on the debate.

Here on the farm, our goal is to produce safe, high quality food for our consumers. We think we've done very well in meeting this goal. Canadians and our consumers abroad have access to a huge abundance and variety of safe, healthy food every day.

However, our farm is not merely an "asset" used to make a living, it's our home. We own this land, we live here, and we raise our families here. Therefore protecting the health of our soil, water, and air – the environment – is critically important to us. It's important to keep our farms productive (healthy soil = good crops) and our families healthy (safe water, clean air = healthy kids). Remember, on the farm we get our water from a well, which collects water from our own land.

In order to grow safe and healthy food, I have to protect my crops and livestock from pests and disease. There are many ways we do this – we can plow or till the soil (work it up) to remove weeds or we can plant crops that are resistant to certain pests, etc. However, sometimes we need to use pesticides to control pests.

I am often asked why don't I become an organic farmer and not use pesticides at all. First and foremost, organic food is not safer or better tasting than non-organic food, so I haven't felt the need to switch. The food I grow is safe, tested regularly by the government for pesticide residues. I eat the food I grow and I feed it to my family.

Organic farming has become quite successful for certain crops under certain growing conditions. However, there are many crops and growing conditions that make growing organically difficult. It's important to remember that not all families can afford the extra costs of organic food.

Pesticides cost money for us to buy, so trust me, we only use them when we need to! In fact we've been able to reduce our pesticide use on our farms thanks to many innovations in science and technology. The products we use today are also far safer than some of the products used in the past.

Farmers know that pesticides must be treated with respect. We have to take a course (The Grower Pesticide Safety Course) every 5 years in order to become certified to buy and use agricultural pesticides. We asked the government to provide this training because we wanted to ensure that we had access to the best information to protect our health, the health of our families, and the health of our environment.

We count on the scientists at Health Canada's Pest Management Regulatory Agency (PMRA) to ensure that pesticides are only registered for use if they can be used safely. Since we're the folks using pesticides, we need to know that the PMRA is looking out for our health. Throughout this challenge you will find out about the regulatory system that we all count on.

Surely you have heard a lot of negative things about pesticides in the media and from various interest groups. Unfortunately you rarely hear about the benefits of pesticide use. Pesticides have allowed us to provide an abundance of safe, affordable food for our consumers. They allow us to protect our crops from devastating pests and disease. For example, did you know that pesticides could have prevented the great potato famine in Ireland? The blight that killed the potatoes is a disease that we can now control using pesticides.

Farmers know that pesticides are useful, but we also know that we need to use them properly to protect our health and the environment.

Thanks again for taking on this challenge. With less and less of us farming these days, and with fewer and fewer teachers and reporters from farming backgrounds, we really appreciate any chance we get to tell students like you what we do on the farm!

Sincerely,

An Ontario Farmer

Lesson 5 Pesticide Articles: CropLife vs. Sierra Club

Teacher Preparation

In this lesson, the students will have a chance to read two articles, stating different opinions, about pesticides. Since they already have studied many aspects of this topic, they are now constructing new learning. Be sure to remind them to follow **Techniques for Analyzing an Issue** (Appendix # 1c). Again their response must be kept in their student binder. The articles about Pesticides, for and against are found in Appendix # 5a and b. Each student will need both copies for this lesson. You will also need to tape two sets of footprints on the floor. See part 2 in Activity # 4 below, for an explanation.

For Your Eyes Only!

Be sure that the students are not just picking up articles and believing everything they read. Remind them that they have had a good look at AGCare but what do they know about the Sierra Club or CropLife? These are opposing organizations and each believes their information is accurate. Their background search on these organizations will assist them when debating. Groups may have a bias, though they appear not to. For example, how do they fundraise? Do they need a scary "cause" to raise funds? Is their leadership dominated by any particular ideology (e.g. anti-corporation)?

Helping students decide their positions on controversial issues like Pesticide Use may require hearing what other organizations have to say. If this is the case with your class, there are additional readings provided in Appendix # 10 at the back of this resource.

ACTIVITY 5 PESTICIDE ARTICLES: CROPLIFE VS. SIERRA CLUB

Your students will be looking at the pesticide issue from all sides. We have provided 2 articles, offering for and against facts. Make copies for them, or have them locate them at the websites. One article is from the Sierra Club of Canada: **The Truth About Pesticides** at www.sierraclub.ca the other is from CropLife Canada: **Food for Thought** at www.croplifecanada.org These articles are also included in the appendix. Students will be exposed to a real difference of opinion here. In order to give you an advantage, we have included a sample Pro-Pesticide/Against Pesticide T Bar chart at Appendix # 5c. This is meant for your eyes only as it acts as a guideline for you, but also gives you an idea of what you can expect from your students as a response. The articles from CropLife and the SierraClub include some of the issues your students may present, but are by no means all inclusive. There are many others and their research should reflect that.

1. Give each student one article at a time. Examine these articles together with your students, using the questions outlined in **Techniques for Analyzing an Issue** (Appendix # 1c). This is a dry run before the actual debate. Make it playful. Have some fun with it.

2. Once the students have read the articles, allow time for discussion. Give them time to record their responses from each article so they will be prepared for the following activity. Have them put their background check information in front of them and their responses from the articles they just read. If they did their homework well, it will really help in the next activity. You want the students to be able to change perspectives quickly and easily. Pick two students who will demonstrate how the **From Your Shoes** activity works.

FROM YOUR SHOES

1. You will need two pairs of paper footprints. The footprints are attached to the floor so that they are facing each other. Each pair is given a topic. One partner is for the issue; the other is against.

2. Students stand in their footprints. They can take their homework and the article with them.

3. One student states the "pro" position on the issue, giving several reasons to back up the position. The other student takes the "con" position on the issue, giving several reasons to back up the position.

4. Students change places to stand in each other's footprints. They then paraphrase each other's position and reasons.

Now pick a few more students, to have a chance with the pesticide articles. If they are having trouble with this, try some of these ideas to ease them into it:

- Students should be paid for every A they achieve; students should not be paid.
- Cats make a better pet than dogs; dogs make better pets than cats.
- Trapping of wild animals should be banned; trapping animals should not be banned.

If there is time, have a few students stand under the opinion scale cards regarding the pesticide issue and select a few questions from the Lesson 1, page 6, part 3 a-g. Have their opinions changed? Why or why not?

For homework each student must complete a written response about each article. This response is part of their overall mark. Have them record their response with a Pro-Pesticide/ Against Pesticide T Bar style response. (similar to Appendix # 5c) Have them highlight the sentences that contain facts, and circle the sentences or ideas that are questionable or lean towards a bias. They will need both articles to compare.

Book the computer lab for the next class.

Appendix # 5a

Pesticides according to the Sierra Club of Canada

THE TRUTH ABOUT PESTICIDES

The Quebec Poison Control Centre and the Quebec Ministry of Environment and Wildlife released statistics on pesticide poisoning in 1996. They reported a staggering 1,650 poisoning cases. 79.4% of the cases were in private homes, and 46.1% of the victims were children under age five. 31% of these cases were due to oral ingestion, and 34.9% followed a pesticide application (1).

What are Pesticides?

Pesticides (herbicides, vermicides, fungicides, and rodenticides) are poisons designed to kill insects, plants, fungi, moulds and rodents. Pesticides contain "active" ingredients (the chemicals intended to kill), and so-called "inert" ingredients. These are considered trade secrets, and although in many cases they can be even more toxic than "active" chemicals, most consumers are completely unaware they exist. Even when used as directed, pesticides have many negative side effects on human health and the environment.

Does "Registered" Mean Safe?

Although pesticides used and sold in Canada are registered, this does **not** mean they are safe. Even the federal government regulators do not claim that registration equals safety. Pesticides are not tested in combination, although their synergistic effects may be amplified as much as 1000 times. While pesticides produce acute and long-term health effects, toxicity experiments (done on healthy animals) measure and account for only the acute effects. The pesticides that are deemed acceptable for use as a result of these tests do not take into account the possible chronic effects (2). "Acceptable" tolerance levels are set for an average adult male, and do not take into account the different situations of women and children.

Some Environmental Effects Some pesticides accumulate in the fatty tissues of mammals, amphibians, birds and fish, interfering with their growth, reproduction and behaviour. Pesticides poison the food chain, contaminate water supplies, and are implicated in the declining populations of certain species.

What are the Health Effects?

Acute Effects: The Canadian Centre for Occupational Health and Safety has identified acute health effects in humans including nausea, eye, skin, respiratory and throat irritation, muscle spasms, and even death (3).

Chronic effects: Repeated exposure to pesticides has been linked to neurological problems, brain and lung cancer, immune suppression (which creates environmental hypersensitivity), leukaemia, Parkinson's disease, kidney damage, non-Hodgkin's lymphoma and reproductive disorders, including endocrine disruption, low sperm count, and sterility(4).

Children are Vulnerable

Pound for pound of body weight, children consume considerably more pesticides than adults. Kids are especially vulnerable to the toxic effects because their metabolic systems don't process or excrete toxins the way adults' systems do. Children typically play in grass and dirt, and put toys and hands in their mouths, activities that significantly increase their exposure to pesticides. Children from homes where pesticides are used have been found to have four times the risk of soft tissue sarcomas (cancerous growths (5) and between six and seven times the rate of childhood leukaemia as other children (6).

Sweden Has Not Allowed 2,4-D Since 1989

2,4-D is the most commonly used herbicide in Canada. It was a major component of Agent Orange, and is still used in over 1,500 lawn-care products (including Killex and Weed 'n Feed). Cancer in dogs has been linked to their owners' use of 2,4-D (7).

" Insects...are the most important component of the ecosystem, an integral part of the food chain...without insects the vast majority of flowering plants would not be able to reproduce. A miniscule fraction of this huge group of animals are pests to human beings….spraying powerful poisons that kill all exposed insects is no more 'management' of pest than killing everyone in New York city would be managing urban crime." David Suzuki – *The folly of Chemical Pest Control*

The Pesticide Treadmill

Once you begin to apply pesticides, your lawn can become addicted to chemical treatment. Repeated applications can cause soil to become conditioned, which speeds up degradation of the pesticides. This results in the need to apply increasingly toxic chemicals at more frequent intervals to control the pest problem. Meanwhile, beneficial organisms are killed off, soil can become sterile, and pesticide-resistant insects breed to produce a species able to withstand the toxins and continue eating your grass!

Appendix # 5b

Pesticides Food for Thought: The Other Side of the Pesticides Story (according to CropLife)

March 14, 2005

Food for thought: The other side of the pesticides story
Canadian Newswire

TORONTO, March 14 /CNW/ - A major communications initiative is being announced today, designed to give the full picture about how pesticides help farmers provide Canadians with an abundant, affordable and safe variety of fruits, vegetables and other important foods.

"We're calling it 'Food For Thought' because that really sums up the goal," said Lorne Hepworth, President of CropLife Canada, the trade association of pest control manufacturers and distributors.

"We will provide Canadians with balanced, evidence-based scientific facts about crop protection technologies, pest control products and the food they put on their tables. For far too long, people have been given sensational and unfounded rhetoric instead of proven facts. Food For Thought is designed to change that," Hepworth said.

A recent national survey of Canadian women - the chief household decision-makers on food and nutritional matters - found that 73 percent have been left confused about the safety of foods grown using pesticides, as a result of information they have heard from various sources. Eighty-five percent said they want more factual and evidence-based information about pesticides, food and human health.(*)

"If people have been scared by some of the misinformation they've been given up until now, we'll show them why they don't need to worry. And we'll give them the supporting evidence so they can see the facts for themselves, so they can come to their own informed opinions," said Hepworth.

The Food For Thought initiative contains a number of elements: targeted ads will begin running this month in a number of family-focused magazines including Chatelaine, Canadian Living, Reader's Digest, Today's Parent and Canadian Family. There will also be a series of media announcements related to the science behind crop protection, and an informative and interactive web component (www.croplife.ca/foodforthought).

CropLife Canada is the trade association representing the developers, manufacturers and distributors of plant science innovations - pest control products and plant biotechnology - for use in agriculture, urban and public health settings. CropLife Canada stands for safety and innovation supported by a foundation of continuous research and a strong commitment to stewardship.

(*) National telephone survey of women 18 years and over, conducted for CropLife Canada by Pollara Inc. in February, 2005. Results are considered accurate to within +/- 4.5%, 19 times out of 20.

FOOD FOR THOUGHT: 10 FACTS YOU MIGHT NOT KNOW

1. If Canadian farmers were not able to use pesticides to protect crops from insects, rodents and disease, it is estimated that crop yields would be cut by 40%. That would dramatically reduce the variety and amounts of fruits, vegetables and other food items available to Canadians - and what would be available would be considerably more expensive. Family budgets and nutritional health would both be greatly affected.
2. Canadians enjoy some of the most affordable food in the world, thanks to modern farming methods including crop protection methods such as pesticides. On average, we spend about 10% of our income on food, compared to 64% in some developing countries.
3. The Irish Potato Famine of the 19th century was caused by a fungal disease called late blight. There has not been a similar catastrophic crop loss since the development of crop protection products.
4. Every pesticide must undergo as many as 160 government-required tests - many of which are focused specifically on any possible human health and environmental impact - before they are eligible for Health Canada's review, registration and label approval. The process from discovery to market can take as long as 10 years and can cost the manufacturer as much as $300 million.
5. Testing requirements are especially stringent when it comes to potential impact on the health of children. Exposure assessment includes factors such as a child's size, diet and child-specific activities that may lead to increased exposure - such as putting their hands in their mouth or crawling on a surface that might contain pesticide residue.
6. The federal government sets maximum residue limits for pesticide residue in food which may - and in most cases, there is none whatsoever (see No. 8 below) - be present on fresh produce and other foods. Maximum residue limits are based on the regulated use of the pesticide and must be below the Allowable Daily Intake (ADI) which is the limit that government scientists consider safe for consumption each day for an entire lifetime.
7. For example for a particular pesticide, it has been calculated that a 68 kg (150 lb) man would have to eat 3,000 heads of lettuce every day of his life to exceed the level of a pesticide's residue that has been proven to have no effect on laboratory animals. An 18 kg (40 lb) child would have to eat 534 apples or 13,636 kg (30,000 lbs) of carrots every day of his or her life to exceed that same level.
8. According to the Canadian Food Inspection Agency, 98% of all fresh foods inspected over a four-year period were within maximum residue limits. 74% had absolutely no detectable residues.
9. "The Canadian Cancer Society recommends that people eat 5 to 10 servings of vegetables and fruit every day to help reduce their risk of developing cancer. Using pesticides to protect our food from damage by weeds, bacteria, fungi and other organisms helps to ensure that a variety of affordable fruits and vegetables are available to Canadians. A diet rich in vegetables and fruit is believed to be one of the best defenses against cancer, heart disease and diabetes." - Canadian Cancer Society
10. "There is no convincing evidence that eating foods containing trace amounts of chemicals such as fertilizers, pesticides and drugs used on farm animals changes cancer risk. Exposure to all manufactured chemicals in air, water, soil and food is believed to cause less than 1% of all cancers." - American Institute for Cancer Research

Appendix # 5c

Facts Related to Pesticides

Pro Pesticides	Against Pesticides
In 1992, farmers developed the Environmental Farm Plan (EFP) program to help farmers assess environmental impact on their farms. (Ontario Farm Environmental Coalition)	Pesticide regulation in Canada is seen as inadequate by many, and pesticides are promoted as "safe"; their risk associated with their use minimized. The continued use of pesticides in Canada contributes to a build-up of harmful chemicals in the environment. (Sierra Club, 2005)
In Ontario, farmers have reduced pesticide use by 52% in the past 20 years. (Ontario Ministry of Agriculture and Rural Affairs)	At least 40 pesticides today are still considered hormone disruptors. (WWF, 2004)
In 2002, the Pest Control Products Act (PCPA) was amended in response to public outcry for increased safety and accountability regarding pest control products. (Pest Management Regulatory Agency)	WWF applauds the decision to allow municipalities to protect their own environment via municipal pesticide bylaw. (WWF, 2001)
Canadians can rest assured that we enjoy one of the safest and most thoroughly scrutinized food supplies in the world. (University of Guelph's Food Safety Network, 2005)	A total of 412 processed fruit and vegetable baby food samples were analyzed for pesticides, including insecticides, herbicides and fungicides. Pesticide residues were detected in both regular and organic branded baby foods. In many instances the pesticides were of a type associated with post harvest applications to enhance storage and shelf life. (CFIA, 2003)
If Canadian farmers were not able to use pesticides to protect crops from insects, rodents and disease, it is estimated that crop yields would be cut by 40%. That would dramatically reduce the variety and amounts of fruits, vegetables and other food items available to Canadians - and what would be available would be considerably more expensive. Family budgets and nutritional health would both be greatly affected. (Crop Life, 2005)	A new study shows organic production outperforms conventional in crop yield, soil fertility, pest reduction and economic return…productivity increases in successive years under organic management to equal that in conventional farms…organic grain crops can be successfully produced in the third year of transition and that additional economic benefits can be derived from expanded crop rotation. (The Institute of Science in Society, 2004)
98% of all fresh fruits and vegetables (domestic and imported) sold in Canada were within safe limits for pesticide residues based on a four-year analysis of inspections conducted by the Canadian Food Inspection Agency (CFIA). More than 70% had no detectable amounts of pesticide residues whatsoever. (Canadian Food Inspection Agency)	According to a 2003 report by The Centers for Disease Control, among those tested for pesticide residue in both blood and urine, the average person carried 13 pesticides in his/her body. (Pesticide Action Network, North America)

Lesson 6 What Others Think

Teacher Preparation

In this lesson, you will familiarize your students with the opinions of other organizations and individuals. This lesson would be best started in the computer lab. So far your students have been exposed to the research and opinions from AGCare, Pesticide Safety Canada, The Sierra Club and CropLife. Now it is time for them to examine several perspectives so that they can broaden their perspective. We begin to dig even deeper.

ACTIVITY 6 WHAT OTHERS THINK

1. Let the students know today they will examine various perspectives on pesticides. You will direct them to a few articles at websites. They must do their own background searches about the authors of these articles, on their own time, since their responses will work towards their overall marks for this unit. Up until now, most of the information that they have been examining has been in support of pesticides (except for the Sierra Club article). Today, they will be assigned articles to examine from organizations that are against pesticides. They must then include the important points from each article on a T Bar response paper. This paper will be of tremendous assistance when preparing for the debate. The websites are:

a. **Canadians Against Pesticides** at www.caps.20m.com, takes you to the home page where you will find an article titled **Toronto Slashes $ From Pesticide-Free Plan** by Janet Young from Toronto Environmental Alliance. (TEA)

b. You are locating this article at the same site too, except that it is easiest to reach it by going to www.caps.20m.com/sankeysafe.htm This article is called **Why Science Can't Prove a Pesticide is Safe** by John Sankey from the Pesticide Education Network. (PEN)

c. At the World Wildlife Foundation, (WWF) you can find a 9-page PDF article that is titled: **Fixing the Problems With Pesticides In Canada**. It can be found at wwwfcanada.org/satellite/prip/resources/presentation-fixing-problems.pdf. If you can't reach that article, have your students examine this site so they have an idea what WWF is about.

d. At the Canadian Association of Physicians for the Environment (CAPE) website look for the article titled **Pesticides** at: www.cape.ca/toxics/pesticides.html

e. The students complete this research on their own if they don't finish it in class, so that they are prepared to bring their completed research to next class. In the next class, they will be going over the **Creative Controversy Model** (Appendix #7a) that they will follow when supporting AND defending their ideas about pesticides. It will help them to assimilate their information as a T Bar response that reads: Pro Pesticide/Against Pesticide. This will give them facts at a glance both for and against the use of pesticides. Very beneficial when they need finger tip information for the debate. You may need to help them set that up so that it becomes an excellent tool when debating.

f. Let them know that you will be marking them in the next class, using the **Creative Controversy Evaluation** (Appendix # 7b) to see if they are well prepared and can present and advocate their position. Their preparedness will contribute to their overall mark.

Lesson 7

Creative Controversy:

Part 1: Present and Advocate Your Position
Teacher Preparation

This lesson will focus on getting students to advocate a position. In the next class, they will reverse perspectives. Many of us have a lot to say about what we believe to be true and can give examples why we are right. Be sure that you, as teacher review **Creative Controversy Model** (Appendix # 7a) so that you have a good idea how to help your students develop the skill of creative controversy. You will be covering parts # 1-3, from this model in this class. This model can be displayed as an overhead or you can make one copy for each student in your class. The students will be working in partners and then in groups of 4. You may want to have the partner/ groups chosen before the lesson begins. You will also need copies of the **Creative Controversy Evaluation** (Appendix # 7b).

ACTIVITY 7 PRESENT AND ADVOCATE YOUR POSITION

1. Ask the students to get out their Pro/Con research T bar on pesticides. Determine who will be partners and assign Partners A the pro position. Assign Partners B the con position.

2. Distribute/overhead the **Creative Controversy Model** (Appendix 7a). Discuss it, letting the students know that they will be only finishing # 1-3. Reversing their perspective will be taking place in the next class. Distribute/overhead the **Creative Controversy Evaluation** (Appendix # 7b) that you will use for marking each student. Discuss what your expectations are. Give them 10-15 minutes to prepare with their partner. They need to share and combine their information to drive their point home. This is their chance to plan together.

3. Have the debate begin with one side presenting first. The debating teams can position themselves in various parts of the room or you may need to book space in the resource centre/theatre area, with additional staff support to listen to the various groups and assist with the marking. Be sure that you have copies of the **Creative Controversy Model/Evaluation** for any staff member who helps you. It is possible to mark half of the class this time and the other half in the next class. You can accomplish this on your own, if you wish.

4. Complete tasks 1,2 & 3, without reversing perspectives. You will do this in the next class. Remind the students to bring their notes with them to continue the debate.

Appendix # 7a

Creative Controversy Model

PROCEDURE:

Research and Prepare Your Position:

Your group of four has been divided into two pairs. One pair has been assigned the pro position and the other pair has been assigned the con position. Research your position and get as much information as possible to support it. With your partner, plan how to present to the other pair the best case possible for your assigned position in order to make sure it receives a fair and complete hearing. Make sure that both you and your partner are ready to present.

Present and Advocate Your Position:

Forcefully and persuasively present the best case for your position to the opposing pair. Be as convincing as possible. Take notes and clarify anything you do not understand when the opposing pair presents.

Open Discussion:

Argue forcefully and persuasively for your position, presenting as many supporting facts as you can. Critically evaluate the opposing pair's arguments, challenge their information and reasoning, and defend your position from their attacks.

Reverse Perspectives:

Reverse perspectives and use your research for the other position. Present the best care for the opposing position. The opposing pair will do the same. Strive to see the issue from both perspectives simultaneously.

Synthesis:

Drop all advocacies. Synthesize and integrate the best evidence and reasoning from both sides into a joint position to which all members agree. Then:

finalize the group report;

present your conclusions to the class;

process how well you worked together as a group and how you could be even more effective next time;

individually continue to collate information in your binder for submission at the appropriate time, as outlined by your teacher.

Appendix # 7b

Creative Controversy Evaluation

Name of Student Observed _____

Because debates are spoken and heard, rather than written and read, they require a distinct set of criteria. Use this template for the debate. You will need one copy for each student. You have 2 pesticide lessons to get all of the students' evaluations completed.

Scoring	1 Poor	2 fair	3 good	4 very good	5 excellent

Characteristics	Score and Comments
The student stayed focus with clear ideas, with appropriate posture and gestures.	
The research information supported the main idea.	
The organization of your thoughts and facts were logical and easy to follow.	
Speech was at a reasonable volume and speed with clear pronunciation and emotion.	
You demonstrated an understanding of the issue, without showing bias or manipulation.	

Your score is _____ / 25

Lesson 8

Creative Controversy:

Part 2: Reversing Perspective
Teacher Preparation

The students will be reversing perspectives in this class and synthesizing and integrating the best evidence. The goal here is for them as a class to create a joint position so that all group members agree. You will need the **Creative Controversy Model** (Appendix 7a) and the **Creative Controversy Evaluation** (Appendix 7b) for this lesson. You will also need chart paper and magic markers.

ACTIVITY 8 REVERSE PERSPECTIVE

1. Remind the students about the **Creative Controversy Model** (Appendix 7a) and how you are marking them. Again with their same partner, give them 10-15 minutes to share and combine their information for the opposite perspective that they presented in last class. The opposing pair will do the same.

2. Position the debating teams where they are not easily distracted and let them present to their partners while you walk about and mark them.

3. Have each group now prepare a synthesis that forms a joint position to which all group members agree. Have one person in the group record their responses on a chart paper. When ready hang them up around the room.

4. Now all of the groups will work together for a class synthesis. Everyone can see each others charts and now you, the teacher, will lead the discussion to come to a class consensus. Keep the final chart posted in a place that can be reviewed over the course of the year. You will find that you can return to this chart many times, as it represents much more than just research. Brainstorm how you might celebrate how far they have come.

5. End this topic about pesticide by returning to the opinion scale and see where your students fall on that line now. This can make for very interesting discussion. Any changes in perspective? Who stayed the same and why? Who changed drastically and why?

Lesson 9 Media (and Your) Influence on Hot Topics

Teacher Preparation

Up until now, you have provided the sources for research activities. Those activities have all centered on the issue of pesticides. You have directed the students to websites and articles. It is now time to see if they can locate controversial information that interests them and offer educated responses with discerning language. Their selections should include various perspectives on hot environmental topics found on television, in newspapers, in scientific journals and on policy maker's agendas all over the world.

These articles must revolve around the idea of sustainability to ecosystems and/or ecosystems and human activity. In this lesson you will examine together some newspaper articles and determine the expectations for an informed response. The articles offered for this lesson should provide the kind of stimulating discussions that keep them begging for more. We have carefully suggested "hot topics". Understanding and acting on these topics are directly linked to becoming responsible citizens.

You will need **Presentation of an Action Assessment** (Appendix 9a) and **Controversial Issues Project Evaluation** (Appendix 9b).

ACTIVITY 9 MEDIA (AND YOUR) INFLUENCE ON HOT TOPICS

1. In Additional Article Section, there are many articles to choose from that have been included to assist you in an open discussion with your students. Choose whichever ones you want for open class discussions or small group discussions. Repeat this process regularly throughout this unit. Be sure to have copies for each student. You will also need copies of, **Presentation of an Action Assessment** (Appendix # 9a).

2. In choosing the articles, it helps if they offer different perspectives of the same issue. Once they have read the articles, follow the procedure outlined in (Appendix # 2) for analyzing an issue. Give them enough time to talk about any biases or manipulation they noticed.

3. Discuss any actions that individuals might take if they really oppose what is being covered and written about in the media or on the news. On a chart paper, brainstorm ideas that your students suggest so that you can always go back and review them throughout the year. Some of the actions may include:
   - Join an organization that works toward making changes on an issue that is important to you.
   - Write a letter of response to an editorial section of a newspaper, a politician or municipal representative.
   - Fundraise to financially support a cause that you feel is worthy.
   - Create your own club, at your school, to research and stay current with one or several environmental issues through discussions or debates.
   - Design an artistic response to an issue of your choice. Write a poem, a skit, a rap, a song, a dance, make a poster or paint a wall of your school to make your point clear.
   - Meet with the person in your school who makes daily announcements and find out when you can make Earth Alert announcements. Write a series of announcements, on different topics, for an awareness campaign.

- Invite a speaker to come into your class or school assembly. Plan the event, prepare the introduction and thank you and brief the audience so they are ready with questions. Conclude by planning an in class debate.
- Film an issue in action or create a slide show.

4. Once your students realize that they can make a difference, even if it is in a small way, explain to them that they will be preparing this part of the unit as a take home assignment. You may provide some in class time but they will have to work with their groups out of class as well. Their research will result in a presentation this time. They pick the topic, do the research, check sources to see that the author is credible and then design an action. The assignment will follow **Presentation of an Action Assessment** (Appendix # 9a).

5. Make sure that students understand that they are planning an action that will become a presentation that may include some of the ideas they brainstormed earlier or they can create a new idea for their presentation. The partner/group are planning an action/ presentation that will be marked following Appendix # 9a expectations. It is worth 60 marks.

6. Have another chart paper ready. Ask them: "What kind of issues connected to the sustainability of the ecosystem (or ecosystems and human activity), that you read about in the paper or hear about on the news, bothers you, makes you crazy or can make you very passionate about getting involved? Chart their answers. Some ideas to think about are:

   - Supplying food without further degradation to our soil will be a huge challenge. To maintain that supply will be a greater challenge. What should we do?
   - Food safety. What aren't we doing?
   - Air/water/noise pollution?
   - Genetics and biotechnology?
   - Marketing boards?
   - Nutrition/lifestyle issues?
   - Farm/corporate ownership?
   - Animal care?
   - Urbanization of farmland?

7. You need to decide if you want the students to work in pairs or groups. If you want to arrange the groups or partners, then give them that information now. If you plan on giving them any class time to work together, then have those dates set. What is the deadline for completion?

8. Let the students know that in a few minutes the partners/groups will get together to begin to discuss what their issue might be. They may need a few planning times together before they can actually agree on a topic that they will choose. Their presentation/action choice must be based on researching at least 3 sources about the same topic. These sources may come from newspapers, television, journals, documentaries, Internet, magazines etc. Once they have decided on the issue, they need to decide what action they would like to take. One person in the group agrees to act as secretary to record the topic, the procedure (stating what everyone's role will be) and the action/presentation. This proposal needs to be submitted to you for approval before they begin. Remind them that much of the information in the **Controversial Issues Project Evaluation** (Appendix # 9b) will pertain to the written notes and research the students keep. Write the websites below on the board to establish a starting point for looking.

9. Provide these websites for searching out some interesting reading to whet their appetites before they decide on a topic. These sites lead them to other links that generate new ideas for topics. Here are some excellent articles and websites:

   What Scientists Say at:
   www.farmissues.com/issues/facts/web/page2.asp?id=133

   Where's the Green Steel?, an article about forestry that is very interesting at:
   www.greenspirit.com/printable.cfm?msid=27

   Regulating Agricultural Biotechnology in Canada: Environmental Questions from the Canadian Food and Inspection Agency (CFIA) at:
   www.inspection.gc.ca/english/sci/biotech/enviro/envrege.shtml

   CBC News about "Critics reject doctors' call for end to Winnipeg mosquito fogging" from July 26,2005. Go to:
   www.cbc.ca/story/news/national/2005/07/26/Winnipeg-fogging-050726.html

   Why Africa Needs Agricultural Biotech by Florence Wambugu found at:
   www.monsanto.co.uk/news/99/july99/010799_isaa.html

Appendix # 9a

Presentation of an Action Assessment

Presentation Evaluation (5 = excellent, 0 = inadequate)

Name(s): _____

1. Preparation:						
overall readiness	5	4	3	2	1	0
knowledge of topic chosen	5	4	3	2	1	0
2. Audience Appeal:						
held and maintained audience's interest	5	4	3	2	1	0
makes use of the audience	5	4	3	2	1	0
3. Audio Visual/Props/Costumes:						
use is appropriate to topic and presentation style	5	4	3	2	1	0
original, creative, appealing	5	4	3	2	1	0
4. Information/Research:						
introduction-inviting, appealing	5	4	3	2	1	0
organized, sequential, logical	5	4	3	2	1	0
5. Presence and Presentation:						
clear voice and posture	5	4	3	2	1	0
clarity of presentation	5	4	3	2	1	0
conclusion, summary	5	4	3	2	1	0
passion shown about action chosen	5	4	3	2	1	0

Teacher's Comments: _____

_____

_____

_____

Score for your action/presentation is: ____ / 60

Appendix # 9b

Controversial Issues Project Evaluation

TOPIC: _____

NAME: _____ DATE: _____

ORGANIZATION

neat-easily read	1	2	
grammar and spelling	1	2	3
appropriate length (one 8x10 page minimum)	1	2	
well organized	1	2	
bibliography or info about organization or author	1	2	3
minimum of 2 sources used	1	2	

14 points

CONTENT

terminology explained	1	2	3
issue described	1	2	
fact/ fiction/biases/manipulation noted	1	2	3
different perspectives	1	2	3
action being taken	1	2	3
personal reaction/opinion	1	2	

16 points

TOTAL MARK 30 points

If you are having difficulty accepting this mark and would like to conference with me to see where you went wrong, please leave it on my desk or hand it to me and I will set up an appointment with you.

Student Signature_____

Lesson 10 The Presentation

Teacher Preparation

You need to have already conversed with the groups so that whatever space, equipment etc that is required is available for their presentations. You will need **Presentation of an Action Assessment** (Appendix # 9a) for each group performing.

For Your Eyes Only!

Congratulations. If you got this far, then your students have had some exposure to higher level thinking skills and constructivist learning principles. If even one student comes away with a better understanding about the importance of stewardship and actively becomes part of the solution, than it has all been worth it. Please continue to explore controversial topics and create situations where students can discuss, debate and question. They will go out into the world with informed opinions based on research from both sides, rather than believing everything they see or hear in the media. There are no easy answers, but they will always have lots of questions! Thank you for providing this opportunity for them.

The Presentations

1. Some groups may have chosen 'starting a club' as their action. That is fine, except that they cannot just talk about it. They could demonstrate what their first meeting might look like through a dramatization or song. Push the students to share their issue in a passionate, fun, interactive way. This is not a lecture but more like an infomercial for what they believe requires attention.

2. Most presentations should not be longer than 10 minutes. In the case of the group that is bringing in a speaker, you will need to plan this for another day. Do not exhaust the audience by organizing too many presentations in one period. Leave time for discussion. Also decide if you want to invite other staff, the principal or vice-principal, the secretary, parents or the media to become a part of the presentations. Do you want the school year book people or the newsletter committee to attend?

3. Find a way to celebrate when the presentations are over. Maybe some groups should present to other classes? Maybe you need to call in some organizers of corporate companies to come in and see what your class has accomplished? Maybe you just need to give them a spare or go for ice cream. What about a class party? Will Family Studies students help you plan a party?

Additional Articles

Teachers: These articles are for further reading to provide a more balanced approach for your students, and you, when considering the many sides of agricultural and environmental issues. You can decide if these articles are additional readings that you want to use. The first two articles, listed as A and B below, are intended for teachers' eyes only, but you may find that you have students who are advanced enough to handle the information. You decide who should read these:

For Your Eyes Only!

A) *Canadian Association of Physicians for the Environment* article. (C.A.P.E.)

B) *The Battle for Biotech-GM Crops Are Good for the Environment and Human Welfare by Patrick Moore.* (Greenspirit Strategies.)

For students and teachers:

The following articles may be appropriate for enrichment or for different viewpoints. They offer more environmental perspectives, if that is what you are looking for. Here is a list of the articles contained in this section:

10a) *General Information About Pesticides* from the Canadian Cancer Society.

10b) *Pest Management* Regulatory Agency Information Note.

10c) *Integrated Pest Management (IPM) Strategies* from the Canadian Horticultural Council.

10d) *Crop Protection* from the Canadian Horticultural Council.

10e) *Millions* Served by Lynn J. Cook. (Forbes).

10f) *Farmers Reduce Potential Risk of Pesticide* Use from OMAFRA.

10g) *Ontario Farmers Cut their Pesticide Use By More than Half,* from OMAF.

Teacher Article

For Your Eyes Only!

Pesticides

Canadian Association of Physicians for the Environment

Pesticides are among the most widely used chemicals in the world, and also among the most dangerous to human health. They are a leading cause of poisonings here in Canada and have been estimated to account for thousands of deaths each year globally.

Pesticides can also have chronic health effects both as sequelae of acute poisonings and from chronic exposure. Many studies have documented adverse health effects on humans. There are several areas of concern.

Many of the commonly used household insecticides are organophosphates. These have been linked in many studies to neurological damage in humans. In fact, chlorpyrifos, a pesticide from this class, was recently banned by the EPA in the US because a recent review of the science demonstrated that children have been routinely exposed to unsafe levels.

There is also convincing evidence that pesticides play a role in human cancers. For example, epidemiologic studies have linked exposure to insecticides in the home to development of brain cancer and leukemia in children.

Studies have also documented reproductive abnormalities such as an increased rate of miscarriage in people with chronic exposure to pesticides.

Of particular concern is the effect of pesticides on the health of children: there are several reasons why children are more vulnerable and more widely exposed to pesticides. A report from the National Academy of Sciences in the US (Pesticides in the diets of infants and children, 1993) examined the evidence and came to the conclusion that children have not been adequately protected from pesticides, and recommended changes to regulations and new research and testing to remedy this. The result was the Food Quality Protection Act, passed by US congress in 1996.

In Canada, little has been done to update the regulation of pesticides, despite evidence that it is sorely out of date. A study done by the Ontario College of Family Physicians and the Canadian Environmental Law Association reviewed the evidence and made recommendations about standard setting.

The study also provides an excellent summary of the scientific and medical evidence about pesticides and their human health effects.

The Canadian Association of Physicians for the Environment (CAPE) has been active in informing the public about the health effects of pesticides, and has worked with other groups to push for legislation that reduces the use of pesticides. CAPE's position paper on pesticides is available on its website.

More Information on Pesticides and Health:

The Ontario College of Family Physicians Environmental Health Committee has a brochure for family physicians on the topic. The OCFP also has a set of modules based on clinical cases that can be used for self-learning or for teaching other physicians. There are available online for free, including a module on pesticides.

The NPTN has fact sheets on specific pesticides. <http://npic.orst.edu/nptnfact.htm>

Extoxnet <http://extoxnet.orst.edu/faqs/index.htm> is a service provided by several US university toxicology departments with lots of information on pesticides. The US EPA <http://www.epa.gov/pesticides/> has information on pesticides, and has a whole pesticides program.

Several environmental organizations have excellent websites devoted to news, research and advocacy issues about pesticides. PANNA <http://www.panna.org/> is the American branch and PAN-UK is the UK branch of the Pesticides Action Network <http://www.pan-uk.org/>.

Source:
CAPE. "Pesticides". 2000. Canadian Association of Physicians for the Environment. 14 June 2006. < http://www.cape.ca/toxics/pesticides.html>

Teacher Article

For Your Eyes Only!

The Battle for Biotech - GM Crops are Good for the Environment and Human Welfare

Patrick Moore - Greenspirit

I was raised in the tiny fishing and logging village of Winter Harbour on the northwest tip of Vancouver Island, where salmon spawned in the streams of the adjoining Pacific rainforest. In school I discovered ecology, and realized that through science I could gain insight into the natural beauties I had known as a child. In the late 1960s I was transformed into a radical environmental activist. A rag-tag group of activists and I sailed a leaky old halibut boat across the North Pacific to block the last hydrogen bomb tests under President Nixon. In the process I co-founded Greenpeace.

By the mid 1980s my interest was in "sustainable development" that would take environmental ideas and incorporate them into the traditional social and economic values that govern public policy and our daily behavior. Every morning, 6 billion people wake up with real needs for food, energy, and materials. The challenge is to provide for those needs in ways that reduce negative impact on the environment while also being socially acceptable and technically and economically feasible. Compromise and cooperation among environmentalists, the government, industry, and academia are essential for sustainability.

Not all my former colleagues saw things that way, however. Many environmentalists rejected consensus politics and sustainable development in favor of continued confrontation, ever-increasing extremism, and left-wing politics. At the beginning of the modern environmental movement, Ayn Rand published Return of the Primitive, which contained an essay titled "The Anti- Industrial Revolution." In it, she warned that the new movement's agenda was anti-science, anti-technology, and anti-human. At the time, she didn't get a lot of attention from the mainstream media or the public. Environmentalists were often able to produce arguments that sounded reasonable, while doing good deeds like saving whales and making the air and water cleaner.

But now the chickens have come home to roost. The environmentalists' campaign against biotechnology in general, and genetic engineering in particular, has clearly exposed their intellectual and moral bankruptcy. By adopting a zero tolerance policy toward a technology with so many potential benefits for humankind and the environment, they have lived up to Ayn Rand's predictions. They have alienated themselves from scientists, intellectuals, and internationalists. It seems inevitable that the media and the public will, in time, see the insanity of their position. As my friend Klaus Ammann likes to hope, "maybe biotech will be the Waterloo for Greenpeace and their allies." Then again, maybe that's just wishful thinking.

On October 15, 2001 I found myself sitting in my office in Vancouver after Greenpeace activists in Paris successfully prevented me from speaking via videoconference to 400 delegates of the European Seed Association. The Greenpeacers chained themselves to the seats in the Cine Cite Bercy auditorium and threatened to shout down the speakers. The venue was hastily shifted elsewhere, but the videoconferencing equipment couldn't be set up at the new location, leading to the cancellation of my keynote presentation.

The issue, in this case, was the application of biotechnology to agriculture and genetic modification. The conference in Paris was a meeting of delegates from seed companies, biotechnology companies, and government agencies involved in regulation throughout Europe. Surely these are topics covered by the rules of free speech.

Had those rules not been violated, I would have told the assembled that the accusations of "Frankenstein food" and "killer tomatoes" are as much a fantasy as the Hollywood movies they are borrowed from. I would have argued that, if adding a daffodil gene to rice in order to produce a genetically modified strain of rice can prevent half a million children from going blind each year, then we should move forward carefully to develop it. I would have told them that Greenpeace policy on genetics lacks any respect for logic or science.

In 2001, the European Commission released the results of 81 scientific studies on genetically modified organisms conducted by over 400 research teams at a cost of U.S. $65 million. The studies, which covered all areas of concern, have "not shown any new risks to human health or the environment, beyond the usual

uncertainties of conventional plant breeding. Indeed, the use of more precise technology and the greater regulatory scrutiny probably make them even safer than conventional plants and foods." Clearly my former Greenpeace colleagues are either not reading the morning paper or simply don't care about the truth. And they choose to silence by force those of us who do care about it.

The campaign of fear now waged against genetic modification is based largely on fantasy and a complete lack of respect for science and logic. In the balance it is clear that the real benefits of genetic modification far outweigh the hypothetical and sometimes contrived risks claimed by its detractors.

The programs of genetic research and development now under way in labs and field stations around the world are entirely about benefiting society and the environment. Their purpose is to improve nutrition, to reduce the use of synthetic chemicals, to increase the productivity of our farmlands and forests, and to improve human health. Those who have adopted a zero tolerance attitude towards genetic modification threaten to deny these many benefits by playing on fear of the unknown and fear of change.

The case of "Golden Rice" provides a clear illustration of this. Hundreds of millions of people in Asia and Africa suffer from Vitamin A deficiency. Among them, half a million children lose their eyesight each year, and millions more suffer from lesser symptoms. Golden Rice has the potential to greatly reduce the suffering, because it contains the gene that makes daffodils yellow, infusing the rice with beta-carotene, the precursor to Vitamin A. Ingo Potrykus, the Swiss co-inventor of Golden Rice, has said that a commercial variety is now available for planting, but that it will be at least five years before Golden Rice will be able to work its way through the byzantine regulatory system that has been set up as a result of the activists' campaign of misinformation and speculation. So the risk of not allowing farmers in Africa and Asia to grow Golden Rice is that another 2.5 million children will probably go blind.

What is the risk of allowing this humanitarian intervention to be planted? What possible risk could there be from a daffodil gene in a rice paddy? Yet Greenpeace activists threaten to rip the G.M. rice out of the fields if farmers dare to plant it. They have done everything they can to discredit the scientists and the technology, claiming that it would take nine kilos of rice per day to deliver sufficient Vitamin A. Potrykus has demonstrated that only 100 grams of Golden Rice would provide 50 percent of the daily need.

Golden Rice is not the only example of civilization being held hostage by activists. Since its introduction to Chinese agriculture in 1996, G.M. cotton has grown to occupy one third of the total area planted in what is northern China's most important cash crop. This particular variety, called Bt cotton, has been modified to resist the cotton bollworm, its most destructive pest worldwide.

On June 3, 2002 Greenpeace issued a media release announcing the publication of a report on the "adverse environmental impacts of Bt cotton in China." In typical Greenpeace hyperbole, we were advised that "farmers growing this crop are now finding themselves engulfed in Bt-resistant superbugs, emerging secondary pests, diminishing natural enemies, destabilized insect ecology," and that farmers are "forced to continue the use of chemical pesticides."

Let's examine these allegations one at a time:

- Bt-Resistant Superbugs: There is not a single example or shred of evidence in the Greenpeace report of actual bollworm resistance to Bt cotton in the field. There is evidence from lab studies in which bollworms were force-fed Bt cotton leaves, but any scientist knows that this kind of experiment will eventually result in selection for resistance. Greenpeace, however, is claiming selection for resistance has actually happened to farmers in the field. According to Professors Shirong Jia and Yufa Peng of the Chinese National GMO Biosafety Committee, "no resistance of cotton bollworm to Bt has been discovered yet after five years of Bt cotton planting. Resistant insect strains have been obtained in laboratories but not in field conditions." So much for the superbugs.
- Emerging Secondary Pests: Greenpeace points out that there are more aphids, spiders, and other secondary insect pests in fields of Bt cotton than in conventional cotton.This is called an "adverse" impact in their report. The fact is, because Bt cotton requires much less chemical pesticide than conventional cotton, these other insects can survive better in Bt cotton fields. For the scientifically literate, this reduction of impact on non-target insects is actually considered one of the environmental benefits of G.M. crops. How Greenpeace figures this is "adverse" is beyond comprehension.

- Diminishing Natural Enemies: The Greenpeace media release states that there are fewer of the bollworm's natural predators and parasites in Bt cotton fields compared to conventional cotton, and calls this an "adverse impact." Again, a careful read of the report comes up with no evidence for this claim. And again, according to Professors Jia and Peng, "as of today, there are no adverse impacts reported on natural parasitic enemies in the Bt cotton fields." And after all, isn't it a bit obvious that if using Bt cotton reduces bollworm populations, that bollworm parasite populations will also be reduced? Will Greenpeace now embark on an international campaign to "save the bollworm parasites"?
- Destabilized Insect Ecology: This one is a hoot. To speak of "insect ecology" in a monoculture cotton field that was sprayed with chemicals up to 17 times a year before the introduction of Bt cotton is ridiculous. The main impact of Bt cotton has been to reduce chemical pesticide use and therefore to reduce impacts on non-target species.
- Farmers Forced to Continue Using Chemical Pesticides: This claim gets the Most Misleading and Dishonest Award. No, Bt resistance does not provide 100 percent protection. Because secondary pests sometimes need to be controlled, farmers using Bt cotton usually use some pesticides during the growing cycle. Professors Jia and Peng sum it up this way: "The greatest environmental impact of Bt cotton was...a significant reduction (70-80 percent) of the chemical pesticide use. It is known that pesticides used in cotton production in China are estimated to be 25 percent of the total amount of pesticides used in all the crops. By using Bt cotton in 2000 in Shandong province alone, the reduction of pesticide use was 1,500 tons. It not only reduced the environmental pollution, but also reduced the rate of harmful accidents to humans and animals caused by the overuse of pesticides."

The Greenpeace report is a classic example of the use of agenda-based "science" to support misinformation and distortion of the truth. Once again, Greenpeace demonstrates that its zero tolerance policy on genetic modification can only be supported by distortions and false interpretations of data--in other words, junk science.

A hunger strike led by Greenpeace finally ended in Manila on May 22 after 29 days. Activists were protesting the introduction of Bt corn into the southern Philippines. In order to whip up media attention, activists have spread scare stories that G.M. corn "would result in millions of dead bodies, sick children, cancer clusters and deformities." Thankfully, the government did not give in to these fools and stood by its decision, based on three years of consultation and field trials, to allow farmers to plant Bt corn. Already there are indications of higher yield and improved incomes to farmers who chose to use the Bt corn.

For six years, anti-biotech activists managed to prevent the introduction of G.M. crops in India. This was largely the work of Vandana Shiva, the Oxford-educated daughter of a wealthy Indian family, who has campaigned relentlessly to "protect" poor farmers from the ravages of multinational seed companies. In 2002, she was given the Hero of the Planet award by Time magazine for "defending traditional agricultural practices."

Read: poverty and ignorance. It looked like Shiva would win the G.M. debate until 2001, when unknown persons illegally planted 25,000 acres of Bt cotton in Gujarat. The cotton bollworm infestation was particularly bad that year, and there was soon a 25,000 acre plot of beautiful green cotton in a sea of brown. The local authorities were notified and decided that the illegal cotton must be burned. This was too much for the farmers, who could now clearly see the benefits of the Bt variety. In a classic march to city hall with pitchforks in hand, the farmers protested and won the day. Bt cotton was approved for planting in March 2002. One hopes the poverty-stricken cotton farmers of India will become wealthier and deprive Vandana Shiva of her parasitical practice.

Until recently the situation in Brazil was far from promising. A panel of three judges managed to block approval of any G.M. crops there. Meanwhile, the soybean farmers in the south of the country have been quietly smuggling G.M. soybean seeds across the border from Argentina, where they are legal. The fact that Brazil was officially G.M.-free has allowed European countries to import Brazilian soybeans despite the E.U. moratorium on the import of G.M. crops. But recently things have changed.

With the election of President Luiz Inacio "Lula" da Silva of the Workers Party in 2002, the Green elements within the party pressed the government to enforce the ban on genetically modified organisms. There was something ironic about a "workers party" enforcing a policy that will damage farmers who have come to enjoy the benefits of biotechnology. In the end, the Brazilian farmers rebelled like those in India. In 2003 the government relented and allowed G.M. soybeans

to be planted. The soybean farmers of southern Brazil have become prosperous, bringing benefits to the environment and their local communities.

Surely there is some way to break through the misinformation and hysteria and provide a more balanced picture to the public. Surely if reasonable people saw the choice between the risk of a daffodil gene in a rice plant versus the certainty of millions of blind children, they would descend on Greenpeace offices around the world and demand to have their money back. How is it that these charlatans continue to stymie progress on so many fronts when their arguments are nothing more than wild, scary speculation?

The main reason for the failure to win the debate decisively is the failure of supporters of G.M. technology to act decisively. The activists are playing hardball while the biotech side soft-pedals the health and environmental benefits of this new technology. Biotech companies and their associations use soft images and calm language, apparently to lull the public into making pleasant associations with G.M. products. How can that strategy possibly hope to counter the Frankenfood fears and superweed scares drummed up by Greenpeace and so many others?

Just from a brief scan of the Monsanto, Syngenta, and Council for Biotechnology Web sites, it is clear that these companies and organizations are trying to project positive, clean, and calming thoughts. This is all well and good, but it is no way to turn the tide. Stronger medicine is needed. Imagine an advertising campaign that showed graphic images of blind children in Africa, explained Vitamin A deficiency, introduced Golden Rice, and demonstrated how Greenpeace's actions are preventing the delivery of this cure. Imagine another ad that showed impoverished Indian cotton farmers, explained Bt cotton, and presented the statistics for increased yield, reduced pesticide use, and better lives for farmers--followed by the clear statement that activists are to blame for the delayed adoption of the technology.

How about an ad that graphically portrays the soil erosion and stream siltation caused by conventional farming versus the soil conservation made possible by using G.M. soybeans? And another one that shows workers applying pesticides without protection in a developing country versus the greatly reduced applications possible with Bt corn and cotton? What if all these ads were hosted by a well-known and trusted personality? Wouldn't this change public perspectives? The biotechnology sector needs to ramp up its communications program, and to get a lot more aggressive in explaining the issues to the public through the media. Nothing less will turn the tide in the battle for the minds, and hearts, of people around the world.

Patrick Moore is chairman and chief scientist of Greenspirit Strategies, an environmental consulting agency.

Source:
Greenspirit. "The Battle for Biotech - GM Crops are Good for the Environment and Human Welfare". February 2004. Patrick Moore. 14 June 2006. <http://www.greenspirit.com/printable.cfm?msid=62>.

Article 10a

General Information About Pesticides

Canadian Cancer Society

Do pesticides cause cancer?
Researchers do not fully know why cancer develops. Nobody knows exactly why cancer develops. It can take 20 years or more for cancer to develop after exposure to a risk factor, and people may be exposed to multiple risk factors in the course of their daily lives. Exposure to many different risk factors may increase a person's risk more than the risk associated with each individual chemical. This makes it difficult to determine to what extent exposure to any chemical contributes to the development of cancer. However, over the years, scientists have made huge leaps forward in understanding how cancers grow. What we do know is that cancer is caused by a complex mix of heredity, lifestyle factors and cancer-causing substances in the environment called carcinogens.

The International Agency for Research on Cancer (IARC) was established by the World Health Organization to conduct research into the causes of cancer. Since then, it has reviewed more than 800 substances and types of exposure to identify those cause cancer. Based on the strength of the evidence, IARC experts classify substances according to 1 of 4 categories:

- Class 1 agents are **known carcinogens**. (That is, they are known to contribute to the development of cancer.)
- Class 2a agents are **probably cancer causing**.
- Class 2b agents are **possible carcinogens**.
- Class 3 agents are **not classifiable** because of insufficient scientific information.
- Class 4 agents are **probably not cancer causing**.

Most studies that evaluate exposure to substances or agents are based on occupational exposure. Because the level of risk is related to the degree of exposure, people who work with pesticides on a regular basis are at higher risk than the general population, who are usually exposed to smaller amounts of the chemicals for less time. For example, some studies have found that people who apply some pesticides as an occupation are at higher risk than the average population of developing non-Hodgkin's lymphoma and leukemia.

Some studies also show an association between occupational exposure to pesticide and prostate, kidney, brain and lung cancers.

While some studies suggest that a link between exposure to environmental carcinogens and cancer exists, the exact percentage of cancers related to this type of exposure is a matter of some debate. Whenever possible, exposure to occupational carcinogens should be eliminated or reduced to the lowest achievable level.

How does the risk of exposure to pesticides compare with other cancer risks?
The Harvard Report on Cancer Prevention (1996) summarized what was known about the factors that increase a person's risk of developing cancer. As shown in the list below, this report estimates that environmental pollution is responsible for 2% of cancer deaths. Many scientists believe that with further research, the proportion of cancer deaths related to environmental carcinogens will be in the range of 5-10%. The ornamental use of pesticides (that is, pesticides used on lawns and gardens to improve their appearance) would cause a small proportion of the cases and deaths attributed to environmental pollution. These pollutants can also enter the earth and water and end up in the food chain.

% of cancer deaths attributable to established causes of cancer

tobacco	30%
adult diet/obesity	30%
sedentary lifestyle	5%
occupational factors	5%
family history of cancer	5%
viruses/other biological agents	5%
perinatal growth factors/growth	5%
reproductive factors	3%
alcohol	3%
socioeconomic status	3%
environmental pollution	2%
ionizing/ultraviolet radiation	2%
prescription drugs/medical procedures	1%
salt-other food additives/contaminants	1%

Source: Harvard Report on Cancer Prevention, Volume 1: Causes of Human Cancer (1996)

Types of exposure and their risk
All types of exposure are important but some routes pose higher risks than others. Types of exposure include:

- absorption through the skin
- inhalation (breathing through the lungs)
- swallowing (eating or drinking)

In some cases skin contact leads to the highest exposure. For example, a child sitting or playing on a lawn after spraying will experience a higher exposure level than they will by inhalation (breathing through the lungs). Swallowing can happen indirectly when the chemicals enter food or drink.

Swallowing pesticides or pesticide residue, especially by children, is very dangerous and should be avoided at all costs. Because of this risk, all pesticides should be carefully stored and handled safely according to manufacturer's advice.

How to minimize the risk associated with exposure to pesticides
Avoid exposure to pesticides that have been classified as known, probable or possible carcinogens by the International Agency for Research on Cancer.

In addition, take the following precautions to minimize the risks of pesticide use:

Carefully read product information and follow the directions on the label.

If spraying pesticides, it is advisable to do so on a windless day when the temperature is below 25 degrees Celsius.

Wear protective garments as recommended on the label and remove contact lenses before spraying. Clothing worn during pesticide use should be washed before wearing again. When the clothes are washed, they should be washed alone.

Don't smoke, drink or eat when handling pesticides. Do not rub your eyes or touch your mouth while working with pesticides. Wash your hands immediately after using pesticides.

Never store pesticides near food or drink and never transfer pesticides into another container for storage.

Pesticide containers should be disposed of in the manner indicated on the label.

Store pesticides out of children's reach, and do not use around children or pets.

Stay away from treated areas that have been exposed to pesticides for a minimum of 24 hours, especially children and pets.

Post signs warning people that an areas has been treated with pesticides.

Some cities/towns have banned the use of pesticides and recommend non-chemical methods to control pests.

Disposing of pesticides that are not going to be used

Contact the municipal authorities in your area about disposing of unused quantities of pesticides.

Ontario College of Family Physicians review of pesticides research
On April 23, 2004, the Ontario College of Family Physicians released a report looking at the impact that exposure to pesticides has on health. The report reviewed the scientific evidence linking pesticide exposure to cancer and found there is an association between pesticide exposure and leukemia, non-Hodgkin's lymphoma, brain cancer, prostate cancer, kidney cancer and pancreatic cancer, among others.

Source:
Cancer.ca. "General information about pesticides". 14 February 2006. Canadian Cancer Society. 14 June 2006. <http://www.cancer.ca/> Path: Prevention, Environmental Contaminants, Pesticides.

Article 10b

Roles of the Three Levels of Governments Regarding Pesticides in Canada

Pest Management Regulatory Agency

The use of pesticides on lawns and gardens is being debated in municipalities across Canada. Some municipalities have enacted restrictions on pesticide use on public and private property, while others are exploring the possibilities of doing so. Consequently, questions have risen concerning pesticide regulation and the roles of the federal, provincial and municipal governments in Canada.

Federal Responsibilities

Pesticides must be registered before they can be imported, manufactured, sold or used in Canada. The Pest Management Regulatory Agency (PMRA) is responsible for administering the Pest Control Products Act (PCPA) on behalf of the Minister of Health. Registration under the PCPA requires a thorough scientific evaluation to determine that new pesticides are acceptable for a specific use and that registered pesticides remain acceptable for use once on the market. If Canadians choose to use pesticides, they can only use a pesticide registered by the federal government for the pests and treatment areas listed on the label, and use them according to the label directions.

The federal jurisdiction in pesticide regulation rests mainly on the federal parliament's criminal law power. The PCPA requires the federal government to determine that Canadians' health, safety and environment are protected. To do so, the federal government must use a science-based approach to determine that the pesticide does not pose an unacceptable risk to human health and the environment as well as that the product demonstrates value to the user.

Provincial Responsibilities

Provinces and territories rely on non-criminal legislative authority instead of criminal law power. Their decisions can consider public concerns and general welfare, which may include scientific proof. The provinces and territories are able to enact regulations to restrict or prohibit the use of products that are registered under the PCPA in their jurisdictions. These regulations can be more restrictive than the PCPA or other federal regulations, but not less restrictive than any federal requirement. For example, provinces and territories may be involved in the following:

- Require pesticide use permits and impose additional use restrictions
- Regulate the transportation, sale, use, storage and disposal of pesticides
- Regulate the training, certification and licensing of pesticide applicators and vendors
- Respond to spills or accidents

Municipal Responsibilities

Provincial and territorial governments may also allow cities, towns and municipalities to enact bylaws to set further regulations, including use restrictions, on pesticide use based on local considerations.

Source:
Pest Management Regulatory Agency. “Roles of the Three Levels of Governments Regarding Pesticides in Canada”. 11 January 2005. Health Canada. 14 June 2006. <http://www.pmra-arla.gc.ca>

Article 10c

Integrated Pest Management (IPM) Strategies Canadian Horticultural Council

IPM is defined as a decision-making process that uses all necessary techniques to manage pests effectively, economically and in an environmentally sound matter.

The first Canadian Apple IPM program was put in place in Nova Scotia apple orchards in the 1940's. A Canadian IPM strategy was developed by Agriculture Canada in 1985. In 1997, the IPM concept was integrated in the British Columbia Pesticide Control Act.

The implementation of an IPM program is a six-step process:

- Managing the ecosystem to prevent pests (e.g. sanitation, cultivar, rotations, fertilization)
- Identifying friend and foe (know what's in your fields and the potential impact)
- Monitoring and evaluating the situation (e.g. environmental conditions, pest and beneficials' populations, crop development)
- Using action thresholds
- Integrating control methods (e.g. preventative and curative; biological, mechanical, cultural, genetic, chemical)
- Evaluating the effects and efficacy of management decisions (e.g. post-treatment scouting, crop quality and yield monitoring, record keeping)

IPM is used:

- To reduce pesticides application and costs (mainly during first years of adoption)
- To produce safe, high quality food (with less pesticide residue)
- To remain in the business and access new markets (consumers' demand, green labeling - e.g. Wegmans IPM brand)
- To reduce pesticide resistance (by integrating control methods with various mode of action)
- To reduce risk for human health and the environment (which includes your own family and surroundings) and much more…

Current IPM initiatives in Canada

- Ontario's Food System 2002
  - Funding plan for development and implementation of IPM and other more sustainable pest control programs

- Ontario's Environmental Farm Plan Program (since 1993)
  - Grower driven, with government funding
  - Helps growers to evaluate and improve their agro-environmental practices
  - Involved until now approx. 21,000 farms
  - Similar program expected in the Maritimes and Alberta

- Québec's Pesticide Reduction Strategy (established in 1992)
  - Driven by MAPAQ and supported by all stakeholders, including growers
  - Aims at reducing by 50% the amount of pesticides in agriculture by year 2000
  - Promotes the adoption of IPM by growers
  - Communication and training

- Clubs d'encadrement techniques et clubs agro-environnementaux
  - Government funded program, supporting implementation of sound agricultural practices by grower groups (scouting, etc.)
  - Involves currently more than 1,500 farms

- BC has a long experience in IPM strategies
  - IPM started during the mid 1960's, using counts of both predaceous and damaging levels of mites
  - BC was the first province practicing IPM due to pesticide resistance problems
  - The rate of adoption of IPM is over 75% in the tree fruit industry
  - BC orchardists have been involved in the Sterile Insect Release Program since 1990 (to eliminate the coding moth)

- BC's *Greenprint* Food Production System (1998)
  - Certification program managed by the Professional Pest Management Association of BC and BCMAF
    - Aims at producing food with high standard of safety, sound environmental production practices and the use of IPM

- Nova Scotia has been involved with IPM since the 1940's
  - A high percentage of Nova Scotia growers use some measure of IPM:
    - First Level 1 IPM: 95%
    - Second Level and Third Level 3 IPM: 25% - 40%

- PMRA's IPM Working Groups (WG)
  - Involve all stakeholders, on a voluntary basis
  - Aim at developing national and/or regional IPM strategies
  - Identify needs and help develop, access and implement new IPM-compatible pest control tools
  - Past and current WG in horticulture
    - Potato late blight
    - Colorado potato beetle
    - Apple
    - Cranberry
    - Methyl-bromide replacement in food processing
    - Urban landscape (incl. Healthy Lawns in Action Plan)

- World Wildlife Fund Canada's Plan for a Sustainable Agriculture Fund
  - Proposes a national target of 50% of Canadian farm acreage under reduced pesticide use by the year 2010
    - 40% in bio-intensive IPM (vs. 6%)
    - 10% under certified organic (vs. 1%)
  - Recommends an investment of $180 million annually over 10 years

Adoption of IPM in Canada

- Expert Committee on Integrated Pest Management Survey of IPM in Canada (1997)
  - Covered apple, canola, carrot and potato
  - A fairly large proportion of growers applied IPM strategies and techniques, but these varied from province to province and crop to crop
  - Baseline for further assessment

Article 10d

Crop Protection

Canadian Horticultural Council

The horticultural sector is unique in that most of the crops are minor crops, therefore crop protection tools are considered minor use products. A minor use of a pesticide is defined as a necessary use of a pesticide for which the anticipated volume of sales is not sufficient to persuade a manufacturer to register products for sale in Canada. By definition, the term pesticide includes herbicides, insecticides, fungicides, rodenticides, sanitizers, plant growth regulators and biological control products.

Modernization of Production Practices

- Canada's horticultural sector has embraced sustainable development in agriculture by adopting good management practices for the benefit of all Canadian citizens.
- Environmental concerns and producer needs have necessitated the development of new, safer, reduced-risk products over the past number of years, thereby resulting in improvements to pest management practices.
- Producers recognize that the safety of products, environmental concerns, and other issues will continue to grow in importance with respect to how fresh fruits and vegetables are produced.

Horticulture and Crop Production: Issues and Realities

- The 1996 enactment of the United States Food Quality Protection Act (FQPA) established new standards for the evaluation of food-use pesticides. This act has had significant impact on agricultural production in Canada as a similar re-evaluation of pest control products was implemented. The loss of older products has a negative impact on Canadian growers as access to newer, safer chemistries replacing older products is generally nonexistent.
- In 2000-2001, a total of 22 minor use registrations were approved in Canada, of which 18 were for food use and 4 for non-food use. During the same period, over 1,200 minor use registrations were approved for the United States, of which 500+ were for food use and 700+ were for non-food use.
- Canada's regulatory system must be adapted to ensure access to new products and safeguard the sector's ability to compete. Regulatory processes must not be a drag on innovation.
- Integrated Pest Management (IPM), biopesticides and reduced-risk pesticides are tools that must be available in Canada for producers to adapt crop management practices to address environmental concerns, reduce the application of crop protection materials and minimize pest and disease resistance.
- In order to remain competitive, Canadian producers must have equal access to the same pest management solutions and at the same time as their U.S. colleagues. Joint product reviews and complete harmonization of the registration processes between Canada and the United States are critical.
- The current regulatory process presents so many disincentives that many registrants (ie: manufacturers) refrain from submitting applications.
- Failure to harmonize the registration processes will result in significant trade barriers and/or irritants between Canada and the United States. The ability to compete on a level playing field will be diminished. It is important to note that $3 out of $4 Canadians spend on produce is allocated to imported products.

Solutions

- The federal government must recognize and acknowledge that there is a problem with the pesticide regulatory process in Canada.
- Government must commit to fundamental changes to the current process, and develop and implement an action plan to encourage and foster submissions for the registration of new products.

Public Good

- Access to new pest management solutions will allow producers to protect natural resources, prevent the degradation of soil, water and air quality, and conserve Canada's biodiversity.
- Progress will assure overall benefits to Canadian citizens, who will continue to have access to safe, Canadian-grown fruit and vegetables at a reasonable cost.

Source:
Canadian Horticultural Council. “Crop Protection”.

Article 10e

Millions Served

Lynn J. Cook, Forbes Magazine

While the West debates the ethics of genetically modified food, Florence Wambugu is using it to feed her country.

Civil war in Angola and Sudan and drought in Eritrea mean that the continent is on the brink of another mass famine like the one that swept Ethiopia in the early 1980s. **Florence Wambugu** knows the kind of hunger that swells the stomach and dulls the eyes. She grew up with it. Now she has the makings of a cure. Wambugu was born in 1953, just a few miles away from Treetops, Kenya's famed game reserve. (That was the same place where, a year earlier, England's Elizabeth II was on holiday when her father, King George VI, died during the night and she awoke as queen.) But proximity to the posh highlands resort and the titled travelers who lodged there didn't spare Wambugu and her nine brothers and sisters from going a day or two at a time without eating. When Kenya's colonial government crumbled in 1963 Wambugu's father was rounded up--like so many young men--and trucked off to work on a white settler's farm. That left her mother and ten kids to scratch a life from the land. They stayed alive on sweet potatoes, a rich source of calories, vitamin A and beta carotene.

"The sweet potato is a woman's crop, a security crop," Wambugu says. "If we didn't have sweet potatoes, we had nothing." But pests love it as much as people need it. Growing underground, it is prone to infestation by the feathery mottle virus and worms. Africa's year-round tropical temperatures offer no winter to freeze off disease cycles, so each year nearly half the sweet potato crop fails. In Africa the sweet potato harvest averages two and a half tons an acre; the global average is more than twice that. African yields rank dead last in every major crop harvested, from corn to cotton.

Today the dismal yields are improving, thanks to Wambugu's decade-long effort to genetically modify crops to withstand pests. Into the sweet potato she has spliced in a gene from the pyrethrum, a white flower whose ingredients are fatal to insects and the feathery mottle virus.

This shuffling of genes is a hit-and-miss, years-long affair. First Wambugu isolates the gene that codes for the production of insecticidal pyrethrins in the pyrethrum flower and extracts them. Next, tens of thousands of copies are made and mixed together with tungsten balls just one micron in diameter. Thousands of genes stick to each ball, and the combination is loaded into a "gene gun," which consists of two small stainless steel chambers and a vacuum pump. Using compressed helium, the gun shoots the microscopic gene-bearing balls into sweet potato leaves. Some of the genes migrate off the tungsten and into the nuclei of the leaves' cells, and are absorbed into the collection of DNA that defines the plant.

It was a breakthrough 25 years in the making. From the time Wambugu entered the University of Nairobi's plant pathology program as an undergraduate in 1975 until she earned her Ph.D. in plant virology from the University of Bath, U.K. in 1991, she tried various conventional hybridization techniques to outbreed the viruses that wipe out the otherwise drought-resistant and energy-rich tuber. Nothing worked--nor did her experiments over a decade-plus at the Kenya Agricultural Research Institute. Then, in 1992, the U.S. Department of Agriculture offered her a grant to study transgenetics in St. Louis in collaboration with Washington University and **Monsanto**, the agrochemical giant. For three years Wambugu labored in Monsanto's labs, trying to splice genes for viral resistance into the sweet potato. It took another two years to test the transgenic tubers in greenhouses and yet another two years to obtain the necessary permits from Kenya to plant the crops for field testing. Now halfway through field trials, the results are astonishing.

The sweet potato is sub-Saharan Africa's first genetically modified crop, and its yields so far are double that of the regular plant. Potatoes are bigger and richer in color, indicating they've retained more nutritional value. On a continent where population growth outstrips food supply growth by 1% a year, Wambugu's modified sweet potato offers tangible

hope. According to the World Bank, biotech crops could increase food production in the developing world by 25%.

Wambugu overcame long odds even to get the education she needed for this venture. When she was 13, with food scarce and every child's hands needed to work the family plot, her mother sold the family cow to pay for Wambugu's boarding school 10 miles away. Her mother needed a dispensation from the village council to sell the animal; most thought she was crazy for educating a daughter when it would be easier to marry her off.

Today Wambugu, who lives and works in Nairobi, faces a different sort of obstacle. Groups from Greenpeace to the Union of Concerned Scientists fret that Africa is being manipulated by multinational corporations, in effect serving as one big--and potentially dangerous--genetic experiment. Some Africans are so freaked by plant technology that Zambia's government would rather have its citizens starve than accept donated food that includes genetically modified corn. Concerned with the misunderstanding about transgenic corn, Wambugu created A Harvest Biotech Foundation International to serve as a pan-African voice on the issue.

Wambugu concedes that GM crops are experimental but insists the potential good far outweighs the risks. It's like penicillin, she says. Some people are allergic to it, but the medicine has cured far more people than it has hurt. "This is not a question of export to Europe or America," she says. "If they don't want it, they don't have to have it. We have local demand. We're dying, so can we eat first?" Her former boss, **Cyrus Ndiritu**, former director of the Kenya Agriculture Research Institution agrees. "I would like to make something very clear. It is not multinationals that have a stranglehold on Africa. It is hunger, poverty and deprivation. And if Africa is going to get out of that, it has got to embrace GM technology."

If tissue-culture technology, a predecessor to genetically modifying organisms, is any indicator, the payoff for Africa could be huge. Wambugu won the World Bank award for global development in 2000 after introducing the tissue-culture banana to Kenya. In this process a piece of tissue is cut from a healthy plant and grown in a sterile environment into several plantlets that root in pasteurized soil before being transferred to the field. It turned what was once a subsistence crop into a major income earner for women farmers, more than doubling average banana harvests to 20 tons per acre.

Wambugu's next challenge is getting the funding to help Kenyan farmers pay for the modified sweet potato and tissue-propagated banana plants. To that end she is working with government researchers to loan out $15,000, with a repayment rate of 96%, but has no great benefactor on the horizon.

That has not deterred her from her next project: reforesting acres stripped by those in search of firewood.

Source:
Cook, Lynn J. “Millions Served”. Forbes. 23 December 2002. <http://www.forbes.com/forbes/2002/1223/302_print.html>.

Article 10b 10f

Farmers Reduce Potential Risk of Pesticide Use

Farmers have reduced the potential risk of agricultural pesticide use by 52-61 per cent since 1983, according to the recently released Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) study *"Evaluation of the Changes in Pesticide Risk"*.

Last year OMAFRA reported that farmers had reduced their pesticide use by 52%, as measured in amount of active ingredient, however it was unknown how much this may have reduced the potential risk of pesticide use. This study confirms that with the availability of new, lower risk pesticides, the potential risk to the environment, farmers, consumers, and non-target species has also been reduced.

The OMAFRA study looked at three different measures used to evaluate the potential risk of pesticides to humans and the environment; the Environmental Impact Quotient (EIQ), the Environmental Health Index (EHI), and the Priority Substances List (PSL) score. (The three scoring systems use different methods of calculating potential risk with different results; therefore we are presenting risk measurements as ranges.) All three scoring systems found that the reduction in potential risk was greater than the reduction in use, all reporting a reduction in potential risk per kg of pesticide used.

The Ontario Survey of Pesticide Use has been conducted every five years since 1973. OMAFRA's *Food Systems 2002* program began in 1987 with a goal of reducing agricultural pesticide use by 50% of the amount used in 1983. The three main components of the program were 1) a mandatory pesticide education program, as requested by farmers (the Grower Pesticide Safety Course), 2) hiring of Integrated Pest Management (IPM) staff, and 3) approximately $800,000 per year in research to develop new methods to reduce pesticide use.

The primary objective of the *Valuation of the Changes in Pesticide Risk* study was to assess the potential risk associated with pesticide use on agricultural crops in Ontario in 2003 to determine if the Food Systems 2002 goal of 50% reduction in agricultural pesticide use was matched by at least a 50% reduction in potential risk.

There are many reasons why farmers have been able to reduce both pesticide use and potential risk. The Food Systems 2002 program itself has had an impact via grower education, IPM programs, and the development of new technologies.

Better crop rotation practices have played a major role, made easier via the introduction of new varieties of soybeans adapted to Ontario's climate that led to a large shift in field crop acreage from corn and grains to soybeans. For example, better crop rotation practices are a major factor in the 71% reduction in atrazine (a herbicide) use and the 97% reduction in insecticide use on corn.

The introduction of new technologies has also allowed reduced pesticide use and potential risk. Several new pesticides are applied at rates of grams per ha instead of kg per ha. Improvements in pesticide application (using electrostatic sprayers, improved sprayer calibration, and banding) have also led to significant reductions.

The introduction of IPM programs, particularly in the fruit and vegetable industries, has also contributed to reductions in both use and potential risk. The study states that IPM programs can reduce pesticide use on individual crops by 23-61%.

Biotechnology has also played a role. The introduction of Bt corn (corn which has been genetically modified to protect it from certain insect pests), which accounted for 32% of the corn planted in the province in 2002, further reduced the need for insecticide use on corn. The use of glyphosate-resistant soybeans appears to have contributed to the reduction in potential risk because glyphosate (a herbicide, e.g. "RoundUp") has a lower hazard score than other herbicides previously used in larger quantities on conventional soybeans.

The combination of education, support, research, and technological advances brought real environmental improvements in agriculture. Farmers respond well to these programs. It's important to note that these improvements were not brought on by regulation.

Article 10g

Ontario's Farmers Cut their Pesticide Use by More Than Half

Ontario farmers have once again shown exceptional leadership in environmental stewardship, reducing their use of pesticides by 52% over the past twenty years.

The Ontario Ministry of Agriculture and Food (OMAF) released the results of its pesticide use survey, which has been completed every five years since 1973. Since 1983, these surveys have shown a consistent decline in agricultural pesticide use, as measured by total active ingredient (a.i.), due to advancements in education, science, integrated pest management (IPM), and biotechnology.

In the past twenty years, there have been many changes in agriculture in Ontario that have contributed to this reduction in pesticide use. There have been important scientific advances, for example broad-spectrum pest control products are being replaced by more target specific technology, with low amounts of a.i. used per acre. There has been a great deal of increased interest in IPM techniques during this time period. The mandatory Grower Pesticide Safety Course was created in 1988, thus increasing education and awareness about pesticide use in growers. Genetically modified (GM) corn, soybeans, and canola came onto the market during the mid-nineties and GM acreage has been on the rise year after year since.

The report states that farmers are utilizing every mitigation strategy possible to control pests in an environmentally and economically sustainable way because society and low profit margins demand it.

Overall pesticide use in fruit and vegetable crops decreased by 20% in the last five years alone. Specifically, insecticide use in fruit declined by 57%, while fungicide use in both fruit and vegetables was reduced by 54%. Increased adoption of IPM and alternative pest control strategies such as border sprays for migratory pests, mating disruption, alternate row spraying, and pest monitoring are listed as major reasons for these large declines.

Pesticide Terminology

Active ingredient
That ingredient of a pesticide that actually controls the targeted pest.

End-use product
A control product that has been manufactured, packaged and labelled in a form that is usable by the consumer.

Formulant
Ingredients that serve a purpose other than the actual control of the targeted pest (e.g., solvents to dissolve solids, emulsifiers to prevent the settling of liquids in the container, carriers to deliver the active ingredient uniformly to the site, etc.).

Guarantee
The amount of active ingredient contained in a product, expressed as either a percentage or a weight. The PCP Act requires that the guarantee be stated on the label.

Label
The product label that is approved as part of the registration process contains the conditions of registration that, along with the PCP Act and Regulations, govern the use of the product. In effect, the label is a legislative document. Use of a product in a manner that is inconsistent with the directions or limitations on the label is prohibited. Any control product offered for sale in Canada must bear the approved label. Advertisements for the product must relate only to the claims carried on the label.

PCP Act registration number
A four or five digit number assigned to each registered pest control product by the PMRA. Unless expressly exempt by regulation under the Act, all pest control products must be registered and be issued a PCP Act registration number before being permitted for sale, import or use in Canada.

Pest
Any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal.

Pesticide or pest control product
Any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, mitigating, attracting or repelling any pest. Control products include active ingredients used in the manufacture of end-use products and the end-use products themselves. Includes herbicides, insecticides, fungicides, antimicrobial agents, pool chemicals, microbials, material and wood preservatives, animal and insect repellents, and insect- and rodent-controlling devices.

Registrant
An organization or individual that holds the certificate of registration and is thereby responsible for the product. A registrant can be a chemical company, federal or provincial agency, importer or any person wishing to market a pest control product in Canada. The registrant's name and address must appear on the product label.

Uses
The specific pest(s) the product is designed to control and the sites where the product can be used. Each pest and site combination constitutes a use (e.g., dandelions on lawns, fleas on cats, fungi on potatoes, etc.).

For more information please refer to the PCP Act and Regulations, available through the website www.pmra-arla.gc.ca

AG Care

CropLife CANADA
representing the plant science industry
représentant de l'industrie de la phytologie

Ontario Agri-Food Education Inc.

Agricultural Adaptation Council

Canada

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

0825 0807