Agriculture and the Environment: An Historical Perspective

It is often perceived that modern technologies and farming practices have destroyed the harmony between agriculture and the environment that existed in the past. The reality is much more complex. Modern agriculture has improved on some of the old farming practices that were not environmentally sustainable. At the same time, intensive agriculture puts new pressures on the environment.

Before the advent of chemical pesticides, crop rotations and tillage were the main technology for pest control. With increased emphasis on soil productivity, erosion control and integrated pest management, we are returning to crop rotation as an important key to sustainable agriculture.

Lack of technology and knowledge in earlier times led to the burning of crop residues, such as cereal straw. With increased understanding of the benefits of crop residue and a variety of equipment available that can manage it, burning is a practice of the past.

In the past, leachate from manure piles, over application of manure and unrestricted livestock access to streams were not viewed as environmental threats. These problems still exist today, but with the expansion of the livestock industry and with increased livestock management technologies, the problems associated with livestock production are being acknowledged, investigated and rectified.

With the recent establishment of major vegetable processing facilities, there has been an increasing demand for primary agricultural products. Increased productivity was achieved through the mechanization of agriculture and with the introduction of chemical fertilizers and pesticides in the 50’s. To keep up with the rapidly changing agricultural industry substantial financial inputs were required by the farmer. In turn, the farmer needed to produce more to pay for the new equipment and infrastructure. Over time, production became concentrated in the hands of fewer farmers and individual farms became bigger and tended to be more specialized.

This change in the agricultural industry introduced one big advantage for the consumer. Increased yields have allowed food prices to decrease dramatically. The percentage of the family income attributed to food has decreased significantly in Canada in the last 30 years, but this may have occurred at the cost of the farmer, our environment and the public treasury.

At the end of the 70's it was obvious that the environmental impacts of some intensive production systems and practices were not acceptable, and the economic impact of soil degradation was being felt at the farm level. Fields were consolidated, eliminating fence lines. Soil erosion increased significantly. The degrading soil conditions in the fields became evident with variable yields and increased input costs. Initially, it was believed that chemical fertilizers could make up for any loss in soil productivity. This, of course, proved to be wrong. Deterioration of water quality also became apparent with increased sediments in the waterways. Algal blooms and lifeless ponds were indications that the surface waters were being contaminated with nutrients. Weeds and pests also became increasingly difficult to control even with the use of chemical pesticides. And public concern increased with better knowledge of the actual or potential impact of some inputs or practices. Misinformation, in some situations, also exacerbated the concerns.
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Since the beginning of the 80's agriculture has been undergoing many significant changes. It is now recognized that environmentally sound soil and crop management practices are essential to the sustainability of any production system. Improved tillage practices have been adopted and no-till technologies are being experimented. Reducing the number of tillage operations also reduces the use of fuel and may reduce the associated air emissions. Integrated soil and pest management practices are being encouraged to increase the efficiency of fertilizer use and the effectiveness of pest control. Wind breaks have been planted in areas that are at risk of wind erosion. Structures such as water diversion systems (commonly known as terraces) and grassed waterways have been implemented; and practices such as cross-slope tillage and strip cropping have been adopted for water erosion control. Buffer strips are also being left along watercourses to protect the quality of our water supplies. More and more, cattle are being fenced out of the streams and alternate water supply systems are being installed. Safer manure storage and application technologies have also been developed and are being adopted.

Sustainable agriculture means economic as well as environmental viability. The competitiveness of our farms and the future of our communities is intimately linked to the management of all of our resources. As research progresses, more options will be made available to farmers that will allow them to improve their resource management capabilities. However, farmers are not solely responsible for developing an industry that is economically viable and environmentally sustainable. Cooperation between the farming community, the public, and government institutions will be fundamental to successful development.

We are committed to take a strong leadership to build an industry that is environmentally and economically sustainable.
Environmental Challenges in Agriculture

Water Quality

Many farms have already adopted more environmentally friendly practices or technologies. Some farms are well on their way to achieving environmental sustainability. However, there are still many areas that can be improved upon. In some cases solutions to environmental problems exist. In others, there is information on how to reduce the impact to acceptable levels.

Atlantic Canada has an abundant fresh water supply on most of its territory. The richness of our freshwater supplies is the envy of the world. We depend on this water for our families, communities, industries, livestock, fish, and wildlife. Water is the common property of all citizens. Farmers and rural dwellers, as well as municipalities and businesses all must commit to water protection to ensure that future generations will inherit our wealth in water. Agriculture can play a strong positive role to protect the quality of water supplies by adopting appropriate technologies and management practices.

New Brunswick, Nova Scotia, and Newfoundland use both ground and surface water as sources of drinking water. Prince Edward Island, on the other hand, depends on ground water alone.

There are five major agricultural factors that have the potential to contaminate water. These include sediments, fertilizers, pesticides, livestock wastes, and fuels.

Sedimentation - soil erosion by water

Soil erosion by water is a major problem in several areas of New Brunswick, Prince Edward Island, the Annapolis Valley of Nova Scotia as well as other areas in the Atlantic Canada region. The sloping topography, in conjunction with intensive cropping practices that result in little ground cover, leaves the soil very susceptible to erosion by water.

The water not only carries away precious topsoil, it also transports agricultural chemicals, nutrients, and where manure has been applied, bacteria. Often, these things are carried into waterways. The impact of water erosion can be multiple. We are not only losing irreplaceable topsoil and

"Best management practices" manuals have been developed in Atlantic Canada and in other Canadian provinces and countries. These documents propose a wide range of practical solutions for various environmental issues. Many of the solutions involve low investments or are based on a better management of inputs and operations. Most solutions are also economically profitable. Some changes, however, may require substantial investments and adequate product prices or public support.

Environmental concerns in Atlantic agriculture can be summarized in four areas:

- water quality
- soil quality
- air quality
- protection of ecological resources
**Water Quality**

Soil erosion is the most important environmental issue in Atlantic Canada. Risking the contamination of drinking water, but we may be clogging ditches and destroying fish and wildlife habitat along the way.

Furthermore, it is essential to protect surface water from inadvertent contamination from livestock. Livestock hoof traffic can have negative impacts on streambank erosion, slumping and compaction. This will cause sediment to enter the stream, affecting the fish and wildlife habitat.

Streambank erosion and compaction due to Livestock hoof.

Cropping practices can be adopted that will minimize the loss of valuable soil which will, in turn, protect freshwater supplies. Crop rotation, cover crops, mulching, conservation tillage (residue management) and strip cropping are some of the options to consider.

As well, structures that will carry rain and meltwater off the field, in a manner that will reduce soil loss, can also be constructed. Grassed waterways and water diversion terraces are examples. Terracing is common throughout the sloping potato producing areas of New Brunswick and Prince Edward Island. The effectiveness of the terraces can also be enhanced by integrating crop rotation and residue management practices.

Streams and ponds located within the farm can be protected with the use of buffer strips. Buffer strips not only filter sediments but the vegetation of these areas can take up excess nutrients. In designated watersheds (where surface water is used for human consumption), additional protection measures may be required. Leaving a buffer strip along a watercourse or a ditch is also an important safety measure when travelling with farm equipment.

Alternate watering systems for livestock can enhance both water quality and herd health.
**Water Quality**

Providing an alternate water source (e.g. nose pump) for the animals, away from streams and ponds, can have numerous benefits for water quality. Biological contamination of the water from the animals' manure will also be reduced and may, in turn, have a positive impact on herd health if this water is the source of their drinking water.

**Fertilizers**

Nitrogen is one of the essential plant nutrients to ensure adequate crop growth. Nitrogen can be applied as an organic amendment such as manure or a legume crop, or as a commercial fertilizer. If nitrogen is applied in excess, it can enter our ground water in the form of nitrate (NO$_3^-$). Nitrate may pose a threat to children and livestock if consumed. Excess soil-nitrate is at a high risk of leaching through to the ground water because it is very soluble. Nitrogen may also be lost from the field through drainage tiles or in surface runoff. In these cases, the fertilizer may end up in streams and rivers.

Fertilizer management practices can be designed to address both soil fertility requirements as well as environmental concerns. Soil testing and leaf analysis are some of the tools strongly recommended for fertility management. Ground water contamination with nitrate can be reduced by applying nitrogen fertilizer at rates that will meet the crop's requirements *when* the crop needs it. Split application will help increase the efficiency of nitrogen uptake, and application rates must be based on economic and environmental yields, rather than maximum yield. Fertilizer placement techniques may also reduce the potential for nitrate contamination of ground water.

Cropping strategies could also be adopted so that excess nutrients are used by the next crop. Establishing cover crops in the fall after harvest is an example of this. The nutrient value of the cover crop should then be accounted for in the next years fertilizer requirements.

**Livestock and Poultry Wastes**

Manure is a valuable source of organic matter for soil, and nutrients for crops. If handled incorrectly however, it has the potential to harm the environment. The transport of nitrate, phosphates, organic matter and bacteria from manure to surface or ground water can pose a threat to our families and communities, as well as to fish and wildlife populations.

The environmental threats posed by manure are greatly reduced when it is managed appropriately. Manure storage that is designed and constructed to accommodate each operation's needs will prevent nutrient leaching and runoff. Various storage structures are available. Earthen lagoons may be effective on clay soils whereas concrete lagoons may be more appropriate on coarser textured soils. Any holding

Phosphate fertilizer also has the potential to pollute our waterways. Unlike nitrate, most of the phosphate binds to soil particles and is retained in organic matter making it insoluble. For soil-bound phosphate to reach our waterways it must be transported with these materials. This occurs during periods of runoff and erosion.

Nutrient contamination of surface water results in algal blooms that consume the oxygen required by aquatic organisms. Decreasing soil erosion will decrease both the sediment and the nutrient loads that enter our surface waters.

Manure runoff can pose a threat to surface water.
**Water Quality**

tank must be properly sized to ensure adequate capacity to cover late fall and winter months, even in the worst weather scenario. Roofing the lagoons can protect the nutrient value of the manure by preventing dilution as well as nitrogen losses to the atmosphere. Keeping the rain out keeps the volume of manure to a minimum which will also mean a reduction in transportation and application costs.

Implementing a more environmentally sound manure storage and management system may mean significant investments for the farmer. This is an area where public financial support could have a positive impact.

As is the case with commercial fertilizers, land application of manure must be carefully planned to reduce any negative impact it can have on the environment. Soil and manure tests, rate and time of application, and equipment technologies (i.e. banding) can be selected to optimize manure efficiency and reduce environmental risks. Issues such as runoff and leaching should be taken into consideration. Manure should not be spread on frozen or wet ground, flood-prone areas, or sloped land near watercourses.

Milkhouse washwater is a source of phosphate which has the potential to contaminate surface water if disposed of inappropriately. It should be treated as a waste and incorporated into the farm's waste management plan. Drainage systems that release milkhouse waste directly into ditches and streams are unacceptable and should be redesigned. Dead livestock are also a source of biological contamination. The disposal of dead animals should always be carried out keeping in mind the potential hazard of disease transmission.

**Crop waste**

Crop waste which may originate directly from the farm, packing houses or processing plants may be considerable in some years. For example, a normal potato collage rate at the farm, varies from 5 to 20%. Under adverse growing seasons, this rate can be much higher. Improper disposal of such waste can be a threat to the environment and a source of infection for many crop pests.

Under normal conditions, the livestock industry can consume most of the crop waste produced. Sound waste management techniques need to be defined when a high volume of waste needs to be disposed off.

**Pesticides**

Pesticides allow producers to control the weeds, diseases and insects which threaten crop productivity. Pesticides, however, can be harmful for our families, communities and the environment if they are handled inappropriately. If pesticides enter our water, the impact will depend on many factors, including toxicity, persistence, concentration, the dilution factor, water temperature. Other environmental problems, such as erosion, can increase the risk of runoff in surface water. Pesticides that are very persistent (i.e. atrazine) will remain in our water for a long time.
Water Quality

Several measures can be adopted to ensure the safe and efficient use of pesticides. A properly designed pesticide storage will considerably reduce the accidental and environmental hazards associated to pesticides. Mixing pesticides should take place away from the farm well or any open water source. This should also be an area that will contain any spill that may occur until it can be cleaned up. The use of mobil water tanks and chemical injection technology can reduce the risk to the environment. Empty pesticide containers should be rinsed thoroughly and disposed of in accordance with provincial regulations. In many instances in Atlantic Canada farmer organizations, in cooperation with pesticide companies, organize collection days for containers which are then directed to recycling.

Collection days are organized by industry organizations to collect and recycle empty pesticide containers.

Application of the pesticide should be conducted so that the target organism is controlled. The method of pesticide application should minimize drift and should be far enough away from open water not to threaten it. Proper nozzle selection and equipment calibration can reduce pesticide drift.

The risks associated with pesticide use can be reduced by decreasing the quantity of pesticide used. Excessive application of pesticide may increase the risk of having produce enter the market with unacceptable levels of residue on its surface. It may also encourage resistance among the target organisms making pest control more difficult and costly for the farmer. An integrated pest management approach can provide effective pest control while reducing the risk of resistance and the quantity of pesticide required. Crop rotation is an effective means of reducing pest risk.

Crop scouting for pests is also important because the pesticide can be applied to specific areas where the organism is present, and it can be applied when it will be most effective.

Regular sprayer calibration reduces contamination risks.

Fuel

Improper storage and handling of motor and heating fuel can threaten ground water quality, particularly well water. Most Atlantic provinces have adopted regulations for the removal of old, in-ground fuel tanks and guidelines for the installation of new ones. Fuel oil, gas, or diesel may be carried to surface water in runoff but it can also move easily through soil to the ground water. Proper storage and management of fuel is important as it takes only one litre of oil to make up to 2 million litres of water unsuitable to drink.