

Advertising Deadline for the November issue of the Trader's Dispatch will be November 1st.

# Pesticide use: A hot-button issue

By Nirupa Gadi, Boston University

Pesticides are chemical substances widely used in modern agriculture as an effort to protect crops from different pestiferous organisms; insecticides, herbicides, and fungicides are common examples. The direct gains of pesticide use are the defense of cash crops, promoting high product yield and quality. In Montana, where agriculture is a major industry, high yield and quality of crops such as wheat, barley, canola, sugar beets, and other plants are an essential part of Montana's economy. Therefore, many farmers and growers rely on pesticides to control damaging organisms. For example, 2,4-D is a widely used herbicide that selectively kills broad-leaved plants by causing uncontrollable cell growth. Gaucho 600 is an insect neurotoxin commonly used as seed treatment on canola plants in Montana.

However, if not used with extreme care and caution, many pesticides can negatively affect the environment and the organisms within it, including humans. Although pesticides are only intended to affect targeted pest, their mode of action is seldom specific to one plant or animal, meaning they can be toxic to many unintended organisms, often humans. The main ingredient in Gaucho 600 is imidacloprid, a non-specific insecticide associated with declining honeybee populations. However, in higher doses, imidacloprid can also affect humans, causing growth defects and cardiovascular problems. Humans can be exposed to many toxic pesticides such as Gaucho 600 in the environment through inhalation, ingestion, or most commonly, dermal exposure through the eyes or pores. The World Health Organization estimates that there are over 3 million cases of general pesticide poisoning a year, causing over 200,000 deaths. A significant factor in the prevalence of pesticide poisonings is that as chemicals, pesticides can and will spread throughout an ecosystem. Exposure expands beyond growers who have direct contact with pesticides. Pesticides can percolate into the air, water systems, soil, and especially the produce itself. Pesticide residues can be characterized in the fruits, vegetables, meat, grains, and water that people consume and cannot be removed through either filtering or washing, contributing to secondhand chemical exposure. No segment of the population is completely protected from pesticides, as a recent study found residues in breast milk samples that contribute to prenatal exposure to dangerous compounds.

Studying the detrimental effects of pesticide use on the environment and human health first began with the book *Silent Spring* written by Rachel Carson in 1962. *Silent Spring* was a reaction to the use of the chemical DDT which was used to eradicate hundreds of insect types at once. During World War II, the United States used DDT to kill mosquitoes causing malaria and lice carrying typhus; it was extremely effective and saved millions of lives around the world. Carson was one of the few to question a pesticide that could exterminate every insect and proceeded to note DDT's impacts such as wiping out all insect populations for months, remaining toxic in the environment even after rainfall, decreasing bird populations, and even linking it to cancer and genetic diseases in humans. *Silent Spring* alarmed readers all across the world and brought about programs for environmental protection and pesticide regulations due to the lingering and percolating effects of these chemicals.

This spreading of pesticide compounds shows that there is not only an occupational hazard of pesticide use and exposure to growers, but also a second level effect on consumers. The United States Environmental Protection Agency (USEPA) reported that the United States alone uses over 1 billion tons of pesticides in a year. Of the 1 billion, the question of how many tons seep into the air, water systems, and eaten produce is a lengthy and daunting question to consider. Even with the EPA and other government regulations, serious concerns about health risks have been raised too often, inflicted by the injudicious use of aggressive pesticides. Curiously, chemicals as pesticides are available on the market before their effects are completely understood.

It is difficult to evaluate the impact that a pesticide will have on organisms and the environment, as pesticides are a mixture of chemicals – understanding exactly how each chemical will react with other components of the pesticide as well as with the environment itself is convoluted and complex. For example, the impacts of chemical toxicities, application methods, and dosage will bear upon the soil composition, weather, flora and fauna, etc. that are intently variable. This multifactorial quality of pesticide impact translates to a discord between published research findings

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# Pesticide use:

## A hot-button issue

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and real-life effects. Therefore, it is possible that the chemicals themselves of a pesticide are innocuous, but when combined with certain environmental conditions or reagents, can become dreadfully harmful.

Undoubtedly, pesticide use is a hot-button topic, as the possible implications on the environment and human health are substantial and legitimate. Many environmental groups have called for a total ban on pesticide use in agriculture, but such drastic measures would do more harm than good. Without pesticide use, it is estimated that global food production could drop to 60% of what it is now, triggering an epidemic of famine and hunger; with a growing world population, commodity surplus is needed, not a food shortage. Therefore, even after all the negative effects of pesticide use are discussed, these chemicals are often a necessary evil in the field of agriculture, as many times their pros out-weigh their cons. A majority of the negative effects discussed above are mainly possibilities from injudicious use or if an individual is overexposed to a certain chemical. However, with substitution using lower-risk pesticides and safety precautions, these chemicals do provide an effective, economical method of protecting cash crops without harming the environment and human health.

Gaicho 600, as discussed earlier, carries a neurotoxin that causes general insect death, including that of honeybees and other beneficial insects. At higher doses, it can even cause significant defects and problems in humans. This is an example of a pesticide that should be avoided when possible. Instead, a lower-risk pesticide such as neem oil can be considered. Neem oil comes from the neem tree *Azadirachta indica* and when sprayed on plants, is quite impressive in that it only affects insects that digest and harm that plant. This is due to neem oil's characteristic as an ingested toxin — as pollinators and spiders do not eat foliage, they are hence left unharmed. As for humans, neem is actually beneficial, as it can treat many illnesses from cough to leprosy. Using neem oil instead of Gaicho 600 is an excellent example of preventing environmental and human damage by using a low-risk pesticide.

Pesticides can be considered to be of low-risk when they leave no residue or when residue can be easily washed off. Furthermore, unambiguous modes of action, such as species-specific toxicity or toxicity through ingestion also decrease the chance of pesticides affecting non-pest organisms. Only chemicals with these factors should be used as pesticides, as broad-spectrum herbicides and insecticides have a wide toxicity range and can affect many species.

Even when using lower-risk pesticides, safety precautions are vital to avoid overexposure and contamination. Similar to a drug dosage, pesticides should not be overused or at higher concentrations, as this can contribute to development of insect resistance and a greater chance of left-over residue. These chemicals should never be stored or transported with food, animal feed, or fertilizer. Furthermore, pesticides should never be sprayed on windy or rainy days, as this increases the chances of chemical travel and run-off. After spraying, restricted area intervals where plant contact is avoided should be established and treated area signs should be erected.

Pesticides have played a key role in protecting cash crops from many damaging insects and plants, increasing product yield and improving commodity quality. Although pesticides are created to protect crops from certain pests, they are often too toxic or nonspecific and can harm the environment and other organisms, including humans. New and upcoming research has developed alternative methods of protecting cash crops, such as using beneficial fungi or predatory nematodes that ward off insect pests. However, these methods have yet to be proven successful, and until new developments are made to increase the effectiveness of these approaches, the main option is to use chemical pesticides. In the meantime, due to the serious health concerns that have been raised, lower-risk pesticides should be considered that are more specific to the pest organism and will not as easily seep and contaminate resources to better preserve the environment and global health.

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