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Saving the Ozone Layer: Alternatives to Methyl Bromide

by *Jacinda Fairholm*



Agricultural worker spraying pesticides on crops

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One of the main threats to the Earth's ozone layer today is a potent pesticide called methyl bromide that plays a pivotal role in Southern cash-crop economies. However, a recent report by [Friends of the Earth](#), an international environmental organization, suggests that viable alternatives to methyl bromide exist and can be adopted at minimal cost to producers.

The report, entitled *The Technical and Economic Feasibility of Replacing Methyl Bromide in Developing Countries*, presents the results of an international research project that examined methyl bromide use patterns in Zimbabwe, Thailand and Chile; compared the costs and yields of alternatives; identified the most technically feasible ones, where possible; and assessed the barriers and opportunities for adopting cost-effective substitutes. The study was funded by the International Development Research Centre (IDRC), the US Environmental Protection Agency, Environment Canada, Swiss Agency for Development and Cooperation, Friends of the Earth USA, Friends of the Earth Canada, and Agriculture and Agri-Food Canada.

Highly toxic fungicide

Methyl bromide is a highly toxic fungicide and the second most widely applied pesticide in the world. It is primarily used on "high value" export crops bound for North America, European, and East Asian markets, such as tomatoes, peppers, grapes, strawberries, tobacco and flowers. Methyl bromide is also used to protect stored grains. The pesticide is effective against a wide range of pests including insects, worms, and pathogenic microorganisms.

However, methyl bromide has a dramatic environmental impact. After being sprayed on crops, the pesticide drifts into the upper atmosphere where it damages the ozone layer, which blocks ultraviolet (UV) rays from reaching the Earth's surface. Although a shorter-lived substance than chlorofluorocarbons (CFCs) — a better-known family of ozone-depleting compounds — methyl bromide destroys ozone molecules at 50 times the rate of CFCs. In a 1994 scientific assessment, the [World Meteorological Organization](#) concluded that phasing out this chemical is the single largest step that governments can take to protect the ozone layer.

Phase-out schedules

In 1995, industrialized countries agreed to phase out their production and consumption of methyl bromide by the year 2010, under the United Nations [Montreal Protocol on Substances that Deplete the Ozone Layer](#). However, Southern nations have been more reluctant to commit to phase-out schedules, because of the importance of this chemical to their agricultural economies. The dilemma faced by Southern exporters is that foreign markets will only import agricultural commodities that have been treated for pests and pathogens.

The study found that in Zimbabwe, methyl bromide is used on 98% of the nation's tobacco crop, which had an export value of US\$530 million in 1994-95. The pesticide is also used to grow flowers, paprika, fruits and vegetables. In Chile, methyl bromide is mainly used on tomatoes and peppers.

Replacing methyl bromide

The Friends of the Earth report noted that there is no single replacement for methyl bromide, but rather a variety of options, depending on the crop or application. For some fruit and vegetable crops, farmers could adopt a system of integrated pest management involving tools such as pest-resistant plant varieties, crop rotation, natural plant-based pesticides, and beneficial microbes. In other cases, steam treatment may be more appropriate. Studies have shown that this technique — which involves heating water to 150 degrees Celsius and applying it to soils — can be as effective as methyl bromide, at half the price.

For shipping purposes, the report recommends the use of controlled atmospheres that filter all of the gases found in air except nitrogen, thus killing insects by asphyxiation. Other options include the use of hot water dips, steam, hot dry air, or cold treatments for protection against fungal and other infestations.

Environmental and economic benefits

The report suggests that the adoption of alternatives to methyl bromide would not only benefit the environment but may also generate economic growth. "One of the major opportunities is the development of new industries in developing countries to supply local and export markets with alternative products and services," it states.

Jacinda Fairholm is a student and member of the Canadian Environmental Network Youth Caucus, who lives in Vancouver.

Sidebar:

[Human and Economic Costs of Ozone Depletion](#)

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Related IDRC articles and publications:

[Integrated Pest Management for Colombian Small Farmers](#), by David Mowbray

[Return to Resistance: Breeding Crops to Reduce Pesticide Dependence](#)

[Women and Integrated Pest Management](#)

Additional resources:

[Campaign Against Methyl Bromide: Ozone-killing Pesticide Opposed](#)

[Methyl Bromide](#)

[Methyl Bromide and Stratospheric Ozone Depletion](#)

[The Ozone Secretariat WWW Home Page](#)

[Selected References on Pesticides and Pest Management](#)

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Human and Economic Costs of Ozone Depletion

A decrease in the amount of ozone in the upper atmosphere results an increase in the amount of ultraviolet (UV) radiation at the Earth's surface. Additional UV-B (the most harmful wavelengths) is expected to have negative effects on human health, health services, farm animals, crop production, forest production, fisheries and tourist industries. Examples of likely effects of additional UV-B, identified by the World Health Organisation (WHO) and United Nations Environment Programme (UNEP) Environmental Effects Panel, include:

- reduced immune responses, which may increase the incidence of infectious disease and reduce the efficacy of vaccination programmes;
- disrupted growth processes in some plants, leading to reduced yields for certain crops and forest trees; and
- disrupted development in fish, estimated to reduce ocean fish stocks by several million tonnes per annum.

Source: The Technical and Economic Feasibility of Replacing Methyl Bromide in Developing Countries

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Integrated Pest Management for Colombian Small Farmers

by *David Mowbray*



Integrated Pest Management (IPM) test plot in Colombia

Gerardo Sota farms on some of the most difficult terrain on earth -- the precipitous slopes of the Andes mountains in Colombia. No farm machine can negotiate the steep hillsides and narrow furrows. Every carefully terraced row must be plowed by hand. Every bean pod, ear of corn, or potato that grows is picked or dug by hand. He, his sons, and now his grandsons work year-round to keep their hectare-and-a-half farm productive.

Despite the demanding conditions for farming, Sota loves his land. To him, every square metre is precious and, if treated well, will give something back. "Agriculture is my profession," Sota explains. "My father taught me how to farm the land. Farming is what I most like doing."

Staple Food

Sota grows potatoes, carrots, corn, and -- most importantly -- beans. Beans are a vital food crop in the Andean region of South America. In Colombia, Ecuador, and Peru, beans provide both calories and protein in the diets of the rural poor. Many Andean families eat beans three times a day. By the turn of the century, demand is expected to exceed supply by 30%. Beans have been grown in rotation with corn on the mountain slopes for thousands of years. The stalks left from the harvested corn form climbing poles for the beans. The nodules on the bean roots take nitrogen from the air to fertilize the soil for the next corn crop.

Gerardo Sota had always farmed without using chemical pesticides. More than 20 years ago, his father had warned him of their dangers. For years, he saw no need for them. But 15 years ago, the situation changed. "I started to use them ever since I lost a bean crop," he recalls. "The crop was attacked by a pest. The

beans had already developed pods and suddenly that pest attacked. The pods turned black."

Vicious Cycle

Sota lost his crop and any chance of making ends meet that year. He determined never to let it happen again, deciding that the risk of sickness from the insect spray was worth it. Now Sota and the other bean farmers of the Andean region are caught in a vicious cycle of ever increasing pesticide use.

The indiscriminate use of the sprays killed not only the pests but beneficial insects too. As a result, what had been insignificant pests, such as the leafminer, were left with no natural enemies and began devastating bean crops. So farmers had to spray more. Today, in some bean-growing areas of the Andes farmers spray every week.

"We farmers have a fault," explains Sota. "If we see that a tablespoonful works to kill the insects, then we say, 'Well let's add another tablespoonful so it will be even more effective!'"

Cause for Alarm

Practices such as these were alarming [Dr Cesar Cardona](#), an entomologist at [CIAT, the International Centre for Tropical Agriculture](#) based in Cali, Colombia. "We detected a very serious situation of insecticide abuse among small bean farmers in the Andes of Colombia, Ecuador, and Peru. We found that the levels are extremely high, that the crop is becoming uneconomic because of the excessive use of chemicals," Cardona says.

In the past, Cardona himself had advocated the use of pesticides to improve crop yields. "I was trained to use pesticides 20 or 25 years ago. I did it for a while but I have been convinced that we can produce safer products at lower cost without using so many chemicals."

Participatory Research

Cardona determined that a program of integrated pest management, a strategy that had worked with many other crops to reduce the need for spraying, could work on the tiny mountainside plots if enough farmers could be convinced to use it. The key to his idea was to involve farmers in the research itself.

With funding from IDRC and the cooperation of the national agricultural research systems of Colombia, Ecuador, and Peru, Dr Cardona initiated a program of farmer participatory research to find out which insect management strategies would work.

Implementing IPM

The whole goal of integrated pest management (IPM) is to reduce pesticide use to the minimum necessary by introducing practices such as destroying crop residues that harbour the eggs of next season's pests. The crops are regularly inspected and then sprayed using only the chemical that is appropriate for the particular pest. The various components of the IPM approach had worked well in other situations but this was the first time anyone had tried to use them with small farmers in such difficult terrain and with a crop like beans.

Cardona's research team selected farmers willing to set aside some of their fields for the tests. Each farmer had two similar plots -- one which he or she maintained in the usual way, spraying whenever it was considered necessary. In the adjacent plot, the scientific teams used the more environmentally sound, integrated approach.

If IPM techniques worked, the scientists thought the farmers participating in the tests would see the results

right away. For the most part that was true. But the researchers also learned from the farmers. Not all the ideas tested at the research stations were acceptable to the farmers. For example, the scientists thought that sticky yellow traps coated with fuel oil would reduce the insect population. To trained scientific eyes they did kill millions of bugs. But the scientists had not considered the extra work involved in maintaining the traps on the steep mountain slopes. The extra trips down the mountain to town to get new oil, and the cleaning of the traps demanded too much labour to be worthwhile. Moreover, although the traps were full of dead bugs, the farmers still saw thousands of live insects on their bean plants.

Simple Monitoring Techniques

Another part of the IPM strategy is to monitor the bean plants for signs of insect infestation. But many of the farmers have little formal education. The careful record keeping and arithmetic that served well at the research stations could not succeed with the farmers. So the researchers who were working with farmers on the test plots in Ecuador came up with a straightforward monitoring and counting technique that every farmer could understand and use. It required just a glass jam jar and a pocketful of beans. For every damaged bean pod the farmer spots, a bean goes into the jar. If the jar fills slowly, there is no need to spray.

Cesar Cardona says the results on the test farms throughout the region are impressive. Crop quality has been maintained, pesticide use dramatically reduced and the profitability of the bean crop increased because the farmers spend less on pesticides.

"If most of them start implementing IPM, insect population levels will gradually decrease in the area," Cardona says. "Now they do see the better economic returns and lower cost. There is no need to use so many chemicals. They can produce the same with at least 60 or 70% less insecticides without losing a penny -- or even make more money."

Everybody Wins

In the towns and on the farms of the Andes, it is an approach by which everybody wins. Consumers get a healthier product, farmers expose themselves and their families to far fewer potentially damaging chemicals, and the land carries a lower toxic burden into the future. Eventually, it appears possible to restore the equilibrium that existed thousands of years ago when the indigenous people of the region first understood the close relationship between beans and corn and never used a drop of insect spray.

The next phase of the project will develop methods of getting the technology from the test farms to everybody's farm. Gerardo Sota does not think this technology transfer will be especially difficult. "It favours farmers and it's less risky for us not to use toxic chemicals. Consumers are in less danger of being harmed by these products. I would recommend it because it gives such good results."

David Mowbray is an Ottawa-based film-maker and writer, reporting from Colombia.

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The CIAT-Canada Connection

Canada has had strong links with CIAT, the International Centre for Tropical Agriculture based in Cali, Colombia for a quarter of a century. CIAT is one of 16 international research centres in the developing world devoted to improving food security for the world's most impoverished people. It was founded in 1967 and since 1971 both the Canadian International Development Agency and IDRC have been major donors to the operations and the research programs of the renowned Centre.

Robbin Ruggles, a Canadian recently on CIAT's professional staff, points out that Canada was instrumental right from the beginning in getting CIAT's renowned cassava improvement program off the ground. Cassava, a root crop that originated in South America, now serves as a food staple for half a billion people, primarily in South America and Africa.

Canadians Benefit

Canadians farmers have also benefitted directly from work done at CIAT. In addition to its research work to improve beans, cassava and other crops, CIAT holds one of the world's major germplasm collections in its gene bank. A navy bean variety called ExRico 23 was developed by the national research program of Colombia. CIAT introduced it to North American farmers. It is resistant to white mould disease and its use has saved Canadian farmers millions of dollars. Other CIAT bean lines with resistance to potato leaf hoppers will soon find their way onto Canadian farms.

As for the future Ruggles feels there are areas for cooperation between Canada and CIAT that remain to be tapped. He would like to see CIAT linked with more agriculture and environment departments at Canadian universities. "CIAT can act as a bridge for Canadian universities to partner with national organizations in developing countries."

Links to explore ...

Related IDRC articles and publications

[In the Tangerine Grove: Pesticide Use in Thailand](#), by Daniel Girard. *A multidisciplinary research team examines the high incidence of pesticide poisoning and damage to humans and the environment in Thailand.*

[Return to Resistance: Breeding Crops to Reduce Pesticide Dependence](#) Raoul Robinson describes how to use a long-neglected plant breeding technique to create hardy new plant varieties that are naturally resistant to pests and disease.

[Women and Integrated Pest Management](#), by Margarita T. Logarta. *Reseachers in the Phillipines have been introducing a new system of integrated pest management to rural women.*

Additional resources:

[Cooperative Research Centre for Tropical Pest Management Internet site](#)

[IPM Net Internet site](#) *Information for international agricultural interests from the Consortium for International Crop Protection.*

[Selected references on pesticides and pest management](#)

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WOMEN AGAINST CROP PESTS

INTEGRATED PEST MANAGEMENT IN THE PHILIPPINES

MARGARITA T. LOGARTA

Rural women in the Philippines are slowly beginning to realize that they actually do 'hold up half the sky'. Studies indicate that women are vital participants in rice farming.

Although they provide less than one-fifth of the actual labour needed for rice production, they have a major role in decision making on the farm. For example, besides running the farm household, bearing children, and augmenting the family income, they also make important decisions about the purchase of agrochemicals.

A recent project funded by IDRC shows that these women can act as effective agents for the adoption of integrated pest management (IPM) -- an environmentally and economically sound way to control agricultural pests (see box).

Under the project, Filipina researchers introduced IPM to five communities in Calamba, Laguna, 50 kilometres south of Manila. "At first, the men denied any participation of their wives in the farming process," observes Dr Candida B. Adalla, an entomologist working on the project. "But in further discussion, some revealed that the women were responsible for choosing and buying pesticides during their trips to market."

Dr Adalla and her predominantly female staff from the nearby University of the Philippines at Los Banos found such information significant. "More than ever, it convinced us of the need to educate women as well as the men," she says.

Two groups of cooperators participated

in the experiment: 51 rice farmers working 80 hectares, and 26 vegetable growers cultivating seven hectares. The fields were divided into experimental plots for testing IPM and 'control' plots (for comparison) where current farming techniques, including liberal use of pesticides, were followed.

The farmers actively managed both IPM and control plots, but they were required to consult the project staff before applying pesticides in the IPM control area.

For IPM to succeed, certain conditions must exist. One Filipino agriculturist described these as "all the right type, all the right amount, all in the right sequence, all when the stage of the plant, the weather, and the pest are right to achieve significant control for the least cost". Like most technologies, IPM must be fine-tuned and adapted to specific locations.

In considering their results after the first year, the researchers agree the project is succeeding and should continue. "IPM practices began to greatly influence the farmers' way of thinking," says Dr Adalla. "If they didn't spray in the IPM plot, they wouldn't spray the non-IPM plot as well."

More than three-quarters of the rice farmers obtained higher yields in the IPM portion. If not for a series of bruising typhoons which struck the Philippines last October, IPM yields could have been even higher, say the researchers.

More IPM experiments are currently being conducted on the vegetable plots since last year's results proved inconclusive.

A much misunderstood technology, IPM was initially seen by people as risky. Cooperators were difficult to attract. "We

were cynical about the project," Mereng Manzanero, a woman rice farmer, admitted. "We had been the victims of too many government projects in the past. Researchers came and went without even telling us of the results of the experiments."

Alejandro Muya, a school teacher who also manages a farm, said, "We thought that any insect had to be eliminated. We didn't know that 'friendly insects' help destroy pests."

Project coordinators won over the farmers by promising to reimburse them for whatever differences in returns between the two plots. Aware of the people's fears, Dr Adalla and her colleagues quickly established their presence in the communities. "We worked with them in the fields, lecturing and demonstrating IPM," she recalls. Their efforts paid off. "The people praised us for being *ma-charisma* (convincing)," she chuckles.

The staff employed various methods to bring the IPM message to the farmers and their families. They held regular meetings to share ideas and problems. Since few women attended the sessions because they were busy with household chores, the staff visited them at home to solicit their opinions.

The researchers also learned that the women were eager for new ways to earn extra income. Seminars in mushroom culture, accounting, and beekeeping were arranged. And now there are plans to organize a cooperative store stocked with basic goods such as soap, canned food, and coffee.

A team of communicators, headed by Dr Teresa M. Stuart, developed a four-week

HITTING THE ENEMY FROM ALL SIDES

Integrated Pest Management (IPM) is fast becoming a popular alternative to the widespread -- and often indiscriminate -- use of chemical pesticides in agriculture.

IPM controls pests using a combination of techniques -- biological control (using the natural enemies of a pest as weapons against it), special cropping patterns, and the planting of pest-resistant varieties. Chemical pesticides also have a role in IPM, but they are used minimally.

The hit-them-from-all-sides approach of IPM has proven effective in lowering the risks to human health and the environment that pesticides pose. It has also led to higher yields and profits for farmers.

"A beautiful ecological balance between prey and predators in rice ecosystems has evolved over centuries," said Dr Merle Shepard at a recent briefing in Washington for representatives of international agricultural research centres. Dr Shepard is former head of the entomology department of the International Rice Research Institute in Los Banos, Philippines. "Pesticide misuse upset that balance in many areas. But researchers hope to restore it through integrated pest management."

In Asia, four countries have adopted IPM as official policy on crop protection: the Philippines, Indonesia, India, and Malaysia. "Wide scale IPM adoption should reduce pesticide use on rice by 50 percent," according to Dr Shepard. That could save the Philippines about US\$5 to 10 million per year, and Indonesia as much as \$50 to \$100 million.



IPM advocates frequent monitoring of fields to reduce spraying of chemicals.



Education of field workers is the key to spreading integrated pest management techniques. Photos by Arthur de la Rosa.

radio course on IPM. The program aired before the project was implemented in May 1988. More than a thousand farmers enrolled. "Most often their wives would sit beside them while they listened to the program," says Dr Stuart. The regular radio program *Balitang Pambukid (Farm News)* over station DZLB continues to provide supportive information and motivation for IPM cooperators and other clientele.

IPM activities were documented through pictures and video tape and exhibited at every opportunity. "It made the people feel good to see themselves on screen," says Dr Stuart. Under her supervision, students of development communication designed an informative comic book, leaflets, and posters on IPM.

The staff hit upon the idea of creating IPM 'scouts' when many farmers complained that monitoring pest populations and recording it with paper and pencil took up too much of their time. (Some farmers pleaded poor eyesight!) Thus, seven young boys, aged 12 to 15, were trained to do the job for four pesos (about 22 Canadian cents) an hour.

Puppets for IPM

Dr Stuart's team also produced a puppet show on IPM entitled "The Verdict", the story of a farmer who files a court case against insect pests. A one-day puppetry workshop was subsequently conducted for the scouts to groom them for future presentations.

When it comes to making agriculture a healthier and more profitable profession, it seems clear that women and youth can be successful agents of change, permanent change. Mereng Manzanero, a mother of two, is one whose life has been so touched. "IPM has truly been a big help to us," she says. "Even if Dr Adalla and her group were to leave this place tomorrow, we would still continue to use IPM."

Margie Logarta is an investigative reporter with the Manila Chronicle in The Philippines.

INFORMATION AS ANTIDOTE

FRANCES DELANEY

The curly-haired boy in his striped pajamas slept peacefully. What misfortune could have brought him to this hospital bed in Cairo? The shocking response was that this eight-year-old Egyptian had attempted suicide by poisoning. But he would survive, as would the two-year-old who arrived in her mother's arms a few moments later, the victim of an accidental ingestion of pills.

These children were among the lucky ones. They had been brought to the Cairo Poison Control Centre where a team of qualified clinical toxicologists works with limited resources to save lives. In this busy city of 12 million people, the centre has a herculean task to perform, but it has only 14 beds at its disposal. In 1988, it treated more than 3600 people for poisoning.

Six thousand kilometres to the southeast, in the Indian Ocean island nation of Sri Lanka, physicians grapple with the same problem. More than 25 000 poisoning cases two-thirds of them from pesticides and many of them attempted suicides are admitted to the country's state hospitals every year. Now the second leading cause of death in hospitals after heart disease, poisoning takes the lives of nearly 4000 Sri Lankans annually.

On the other side of the globe, staff of the *Centro de Información y Asesoramiento Toxicológico (CIAT)* in Montevideo, Uruguay, worry about the growing problem of poisoning. The number of cases now numbers more than 6000 annually an alarming rate for a country of only three million people.

The rise in the incidence of poisoning in the developing world coincides with the increasing availability of pharmaceutical, industrial, and agricultural chemicals of both foreign and domestic origin. For countries whose economies are dominated by agriculture, poisonings are mainly the result of overuse and misuse of pesticides and fertilizers. In many instances, the daily users of such agrochemicals are illiterate or containers are labelled in a language other than their own.

Physicians treating poisoning victims need ready access to detailed information about the substance ingested. It can mean the difference between life and death for their patients. An estimated 60 000 man-made chemicals and one to two million products that are mixtures of these chemicals are in common use in the industrialized countries. It is impossible for a physician to remember all the toxicological details of even a tenth of these products. Yet in many developing countries, where information on chemicals and appropriate treatment is not so readily available, it would appear that perfect recall is expected of physicians.

Fortunately, more and more countries are recognizing the importance of ready access to information such as the names, composition, manufacturers, and management of the toxic substances in their own markets.

In Sri Lanka, the National Poisons Information Centre was set up by the government in 1986 at the General Hospital in Colombo with financial assistance from IDRC. It has already compiled several thousand "index sheets" on various poisoning agents. Recently the centre acquired a microcomputer which will streamline the compilation and provision of relevant data.

IDRC support will also enable the Cairo Poison Control Centre and CIAT to strengthen their poison information service to health professionals and communities. In turn, this will increase public awareness of the threat of poisoning.

But what about other countries that may want to establish their own poison information centres but are short of resources? To address this, IDRC is supporting the establishment of a poison information package for developing countries. The project is coordinated by the International Programme on Chemical Safety of the World Health Organization, in cooperation with the Canadian Centre for Occupational Health and Safety and the *Centre de Toxicologie du Québec*.

The package, to be produced in English, French, and Spanish, will consist of monographs on the major generic substances commonly involved in poisonings, guidelines for collecting and storing information about the local situation, and a standardized format for recording case data. Both computerized and hard copy versions will be produced.

The war against poisoning in the developing world is an arduous one. Arming doctors and communities with the right information at the right moment helps save lives. In the long run it will also make for better informed communities generally thereby preventing poisonings from happening in the first place. Then, little children will sleep peacefully at home in their own beds rather than in hospital.

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