Global Pesticide Campaigner

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# Having Faith
## An Ecologist's Journey To Motherhood

*by Sandra Steingraber*

*The following article consists of two excerpts from a newly released book by poet, ecologist and mother Sandra Steingraber.* Having Faith *is a tremendous contribution to the growing dialogue around the world about chemicals in our bodies. How should we think and talk about the chemical "body burden" we all carry? What does it mean that we are passing persistent chemicals along from one generation to the next?* Having Faith *addresses these questions a very personal way: throught the lens of one woman's experience of pregnancy, childbirth and breastfeeding. Sandra weaves her warm story of discovery as a new mother with stark truths about the impacts of an environment laced with chemicals. The result is both a beautiful read and a compelling call to arms. By the book's end, readers know without a doubt that something this beautiful simply should not — and can no longer — be marred by chemical contamination. We applaud and thank Sandra for this remarkable book.*

*— Kristin S. Schafer, Program Coordinator, PANNA*

By month three of pregnancy, a human placenta is two inches in diameter. The attached umbilical cord is about four inches long. It will eventually grow into a curly, 22-inch-long, half-inch-wide rope. The placenta will expand into a disc that is eight

*continued on page 12*

CONTENTS



# Pesticide Exports from U.S. Ports, 1997–2000

*by Carl Smith*

The general scarcity of precise, up-to-date information about production, trade and use of pesticides is a serious impediment to the efforts of policy makers attempting to protect public health and the environment. International regulatory efforts can take decades; in view of this reality, an accurate picture of the global "dose" of a suspect chemical is an essential first step.

Unfortunately, exact details relating to production and trade are generally allowed the status of "confidential business information." It remains to be seen how this dynamic will evolve when agreements such as Prior Informed Consent and Persistent Organic Pollutants[1] enter into force, and researchers, public interest groups, policy makers, intergovernmental agencies and others want—or need—to know if the global burden of dangerous toxics is actually decreasing.

In 1991, the Foundation for Advancements in Science and Education (FASE) began a project intended to document the volume of trade in hazardous pesticides. The U.S. EPA has no mandate to collect comprehensive data on pesticide exports, and does not have permission from the Department of Commerce to access the information in export declarations.[2] As a result, it became apparent that commercial transcriptions of U.S. Customs shipping records were the most comprehensive source of export information available in the public record.[3]

Despite significant data gaps (for example, the specific compound shipped could be determined for only 25% of the shipments studied), a review of three months of records for 1990 found that extremely toxic and U.S.-banned pesticides were being exported at a rate of nearly 60 tons per day.[4]

A FASE survey of 1991 pesticide exports found that this rate had increased to 80 tons per day.[5] Again, the identities of about three-fourths of the compounds exported could not be readily determined. A review of

*continued on page 8*

Pesticide Action Network NORTH AMERICA

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PAN is an international coalition of citizens' groups and individuals who advocate adoption of ecologically sound practices in place of pesticide use. Established in 1982, PAN currently links over 400 organizations in some 60 countries, coordinated by five Regional Centers. Because PAN is a network, no individual can direct or represent the entire coalition. Participants are free to pursue their own projects to further PAN's objectives, and benefit from their access to the collective resources of the network.



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# The First Word

*by Kristin Schafer and Susan Kegley*

The U.S. Environmental Protection Agency (EPA) is gradually implementing the Food Quality Protection Act (FQPA, 1996), slogging through the process of reassessing the risk that pesticides pose to human health and the environment. Pesticide Action Network North America (PANNA) frequently reviews these risk assessments and submits comments to EPA. A handful of recent examples—lindane, malathion, endosulfan and atrazine—have made it painfully clear that the risk assessment process is being manipulated to support decisions that don't protect public health. In short, the process is not working.

Risk assessment is an inherently flawed process to begin with, one with the goal of finding out how much exposure is "acceptable," instead of how little of the chemical is necessary. For every chemical that is evaluated, assumptions are made about how people are exposed, how much they are exposed to, and what the adverse effects are likely to be. Depending on the assumptions, estimates of a "safe" level of use can easily vary by as much as a factor of 1,000. This pseudo-science is then further amplified by pretending that people are exposed to only one substance at a time, that people always read and follow directions on a pesticide label, that no accidents happen, and that health effects we are just beginning to understand (such as endocrine disruption) can be ignored.

Unfortunately, the problems with EPA's risk assessment process go well beyond the basic weaknesses of a risk-based approach. To do a "proper" risk assessment, EPA would conduct a comprehensive review of the scientific literature, look carefully at all potential exposure pathways, consider exposure to chemicals which have the same mechanism of toxicity as the one under review (as required under FQPA), and incorporate an extra margin of safety for children and infants, since there are still so many unknowns regarding fetal and developmental toxicity.

EPA is not doing any of these things. In assessing the risks of lindane and endosulfan, for example, the extensive literature on endocrine disruption was not considered—postponed instead for a separate "Endocrine Disruptor Screening Program" which is not yet underway.

Does EPA consider all potential exposure pathways? No. Occupational exposure pathways are consistently measured separately, rather than cumulatively—as if farmworkers or workers in pesticide manufacturing only get the chemicals on their hands or breathe the chemical, not both. Both lindane and malathion assessments completely ignored exposure from headlice treatments, since this use of the chemicals is regulated by the Food and Drug Administration rather than EPA—though this hardly matters to a child whose head is doused with chemicals.

In dietary assessments, infant exposure to contaminated breastmilk is not included, despite studies showing the presence of pesticides in human milk, blood and fatty tissues.

In some cases, it appears that data are being actively manipulated to support continued use of a dangerous pesticide. During the cancer assessment for malathion, one conscientious EPA toxicologist wrote over 20 memos objecting to the process by which malathion was evaluated. Ultimately, the objections had little effect. EPA's initial cancer rating of "Likely to be carcinogenic to humans" was quickly downgraded to "Suggestive evidence of carcinogenicity" when industry objected and brought their own pathologists in to help "interpret" the data.

We need a process that works. A process that includes a combination of alternatives assessment—evaluation of non-chemical methods of pest control—and precaution. These principles have been embraced by some countries in Europe, where lindane and atrazine were both recently banned. Meanwhile, the courts appear to agree that EPA is not quite doing its job. In late October, a petition that will force EPA to implement the FQPA in a timely manner—filed by Natural Resources Defense Council, PANNA, United Farm Workers, Pesticide Watch, CALPIRG, Physicians for Social Responsibility and the Breast Cancer Fund—was upheld on appeal. Perhaps we need another court order to force EPA not just to do its job in a timely way, but also to do its job well.

*Kristin Schafer is a Program Coordinator and Susan Kegley is a Staff Scientist at PANNA.*

# Sea of Pesticides Surrounds China's Organic Farms

*by Jessica Hamburger*

China's widespread adoption of Green Revolution seeds and agrochemicals has boosted food production over the last 50 years, but this heavy reliance on pesticides has come at a huge cost. The world's most populous nation has become the world's largest pesticide user, with consumption averaging 250,000 tons of active ingredient per year from 1995–2000.[1] Chinese demand for pesticides is projected to reach 300,000 tons in 2005, then climb to 350,000 tons in 2015.[2] While chemical companies prosper, farmers watch pesticide expenses eat into their profit margins and pesticide-resistant insects decimate their crops. Yet rising from the sea of pesticides are safer, greener and even organic farms. Although "organic" is still a new concept in China, some farmers and government officials are beginning to see the potential to cash in on the growing domestic and global market for cleaner food.

## The price of pesticide use

Hongxin Village in mountainous Sichuan Province has not escaped China's rising tide of pesticide use. In fact, residents of neighboring towns try to avoid buying produce from Hongxin because of its reputation for having dangerously high pesticide residues. These residue levels will have to decrease if local farmers are to compete in domestic markets, let alone the global marketplace they are facing now that China has entered the World Trade Organization. (See "China: Land of Vegetables and Pesticides," page 4.)

According to a survey conducted by PAN North America and the Chinese non-governmental Center for Community Development Studies, pesticide and chemical fertilizer use in Hongxin has increased rapidly and steadily since 1980. (See "Pest Management and the World Bank-Funded Anning Valley Project," page 5.) Initially, rising chemical inputs brought increased yields and profits. However, the pesticides also killed beneficial insects and farmers found themselves facing more and more pests that had previously been kept in check by predators and parasites. Crop losses due to ecological disruption and pesticide resistance have become severe.

Cotton farmers in the northwestern region of Xinjiang have also paid the price of pesticide use and the resulting loss of natural enemies. This year, aphids and red spiders attacked over one million hectares of cotton fields. While drought and cold air coming from Siberia made the situation worse, the major cause of the severe pest outbreak was the use of highly toxic pesticides that killed beneficial insects.[3] A local official in Shihezi City expected losses to climb to US$85 million.

Pesticides also take their toll on human health and the environment in China. The health effects of China's excessive pesticide use are largely undocumented and existing reports contain widely varying estimates. A report published in 2000 reported pesticide poisoning affected from 53,300 to more than 123,000 persons each year in China in the 1990s.[4] The report attributes about half of the poisonings to pesticide use in crop production.

The same report stated that, in a "normal" year, about 300–500 farmers die due to improper use and overuse of pesticides in crop production.[5] However, experts in Yunnan Province believe that is an underestimate, since over 100 farmers are killed each year by pesticide poisoning in Yunnan alone.[6] The statistics are complicated by the fact that many farmers, especially women, commit suicide by drinking pesticides. Chinese death statistics indicate that 250,000 people committed suicide each year during the 1990s, and drinking pesticide was the most common method.[7]

Pesticide residues in food also result in poisonings, but the number of consumers poisoned by pesticide residues is unknown. A study of fruit and vegetables sold in Beijing revealed that 49% contained residues in excess of state standards for banned organophosphate and carbamate pesticides.[8] A similar study conducted in the cities of Kunming and Baoshan in Yunnan Province showed that 50% of the sampled produce exceeded maximum residue limits for methamidophos and isocarbophos, organophosphate pesticides that are strictly banned for use on fruits and vegetables by the central and local government.[9] Chronic

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Jessica Hamburger

A member of the Yunnan Entomological Society releases parasitic wasps in a cabbage field in Tonghai County, Yunnan Province, where farmers sell 90% of their vegetables outside the county. In order to keep its crops unpolluted and retain its market share, Tonghai County has adopted a policy of training farmers in biological control and fining shops that sell banned pesticides.

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effects of pesticides on the health of consumers are suspected, but little research has been done in this area.

Reliable statistics on the ecological effects of pesticide use in China are even harder to find. Pesticides, along with industrial pollution, have severely contaminated rivers and lakes, and threaten China's remaining biodiversity. Many farmers report having seen rivers once teeming with fish become barren over the last decade, while many economically valuable species of lake fish have become extinct.[10] DDT, known for its devastating impacts on birds, has been banned for agricultural use but is still used to control malaria-carrying mosquitoes in China.

## The benefits of "backwardness"

Chinese farmers' awareness of pesticide risks is growing, but escaping from the pesticide treadmill, a cycle of increasing chemical dependence and escalating pest outbreaks, is easier said than done. That is why China's poor farmers in remote regions who could never afford to use pesticides in the first place are in the best position to meet the country's growing demand for organic food. Their soils are usually uncontaminated by industrial pollution and they often retain knowledge of traditional farming methods, such as crop rotation and intercropping, that naturally increase soil fertility and reduce pest infestations.

For the farmers of Wuyuan County in Jiangxi Province, isolation and what many government officials term "backwardness" turned out to be the secret of their success. The county is located high in the mountains at the head of six rivers, and factories are banned there. After the county's green tea passed the rigorous organic certification tests of the European Union (EU) in 1997, the county's tea company, renamed Wuyuan Organic Foods, secured EU certification for organic mushrooms, fungus and Chinese medicinal herbs. Their organic exports topped US$3 million in 2000.[11] Wuyuan Organic is now seeking certification for bamboo shoots, peaches and pears.

Export companies are largely responsible for developing approximately 200 Chinese organic products. Most organic products are exported to Japan, Europe and the U.S. but some are sold in China's big cities, where specialized supermarkets now stock everything from organic soy sauce to lychees.[12]

Some of the urban demand for organic produce is being supplied by China's version of a "back to the land" movement. Unlike a previous generation of city dwellers who were "sent down" to the countryside against their will during the Cultural Revolution, these new urban farmers are self-selected. One of these is Yu Huimin, a former aeronautical engineer in China's top research institute. She began by growing vegetables for Beijing's upscale restaurants, and now sells her produce in a supermarket in downtown Beijing. Most of her customers are Japanese businesspeople living in China, but she expects that will change as Chinese consumers' awareness of pesticide contamination grows.[13]

Already, food contamination scares have begun sparking consumer interest in products certified as safe. Last year, the Organic Food Development Center (OFDC), associated with China's State Environmental Protection Agency, began certifying farms based on the standards of IFOAM, the International Federation of Organic Agriculture Movements. OFDC has certified tea gardens in remote areas of Anhui, one of China's poorest provinces.[14] Local tea producers' associations were

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## China: Land of Vegetables and Pesticides

When Chinese farmers regained some control over what crops they could grow under the economic reforms of the 1980s, many switched from grains to more pesticide-intensive vegetables and cash crops and captured a large share of the world market. At the same time, liberalization of the pesticide market allowed the emergence of unauthorized pesticide companies producing cheap, counterfeit products. Struggling to compete with these outlaw firms, established Chinese pesticide factories continued to churn out legal but highly toxic pesticides.

### Vegetables

- China produced 42% of the world's vegetables in 2000.
- One-third of the world's vegetable exports come from China.
- China's annual production of vegetables is 330 kilograms (728 pounds) per capita, over twice the global average and 7.5 times what it was a decade ago.

### Pesticides

- Chinese pesticide production jumped from an estimated 230,000 tons active ingredient in 1995 to 424,000 tons in 1999 and remained at over 400,000 tons in 2000.
- China exported 147,000 tons of pesticides in 1999, an increase of more than 35% over the previous year.
- Pesticide imports were estimated at 48,000 tons in 1999.

Studies have shown that Chinese farmers often double or triple the dose of pesticides recommended by experts, either because they overestimate the potential crop losses or because they believe they must do so to compensate for the possibility that the pesticides are fake. Most of the residues that could harm consumers are from older, high toxicity pesticides, like methidathion and dicofol, produced by domestic pesticide companies.

New, less toxic pesticides are more expensive to produce because companies have to pay patent fees. Often state-owned, older pesticide firms lack the funds to make the transition to producing less toxic pesticides and the government provides no incentives for them to do so. In addition, government agencies responsible for taming China's pesticide use send mixed messages. For example, county plant protection stations are responsible for both selling pesticides and promoting ecologically based pest management.

*Sources: FAOSTAT Agricultural Data, United Nations Food & Agriculture Organization, Rome, Italy, 2001. "China: World's Largest Fruit and Vegetable Producer," FarmChina.com Web site.* Agrow: World Crop Protection News, *February 4 and April 14, 2000. State Report on Environmental Status (annual),China Environmental Protection Network, 2000 (Chinese) and Analysis and Perspective of Chinese Pesticides Trade, China Pesticides Information Network, 2001 (Chinese). Huang Jikun et al., Farm Pesticide, Rice Production, and Human Health, Working Paper, Center for Chinese Agricultural Policy, Beijing. Hu Ruifa et al., Situation Analysis of the Systems of Production, Usage and Marketing of Pesticide Management in the Provinces of Hubei and Zhejian, P.R. China, Volume I: Report, Berlin, Beijing: Deutsche GTZ-ICAMA, July 1998.*

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created to make sure whole villages would go organic, and the Huang Ya Tea Association now handles their marketing in China's growing domestic market. OFDC products have met with some resistance in foreign markets because OFDC is not accredited according to the standards of the International Organization of Standardization (ISO Guide 65) and China does not have a national organic regulation. Some growers have sought to improve their access to foreign markets by working with internationally recognized organic certifiers, such as Organic Crop Improvement Association, Ecocert and the German certifier BCS.

The relatively clean soils of poor regions in western China may prove to be fertile ground for organic production, as China pursues a policy to "Develop the West." However, well-known production areas in highly developed regions in eastern China may choose to go organic as well to protect their reputations. When the Shanghai branch of the State Quality Inspection Bureau released a study of 61 types of China's most famous teas, 19 of the teas did not meet the lowest quality standards for metal and other chemical contents, 13 of them because of high levels of lead.[15] The company producing China's famous Dragon Well tea saw sales plummet as a result, according to Chinese news reports. Around the same time, new EU regulations reduced pesticide tolerances for tea by 100 times, effectively excluding half of China's tea exports to the EU. This rejection caused more than US$125 million in losses to tea farmers in Zhejiang, China's main tea-producing area.[16] Zhejiang officials responded by setting up their own organic certification program. Although their organic scheme may not be recognized abroad, it may help reduce contaminants to levels that will boost domestic sales and allow export.

As organic demand grows, so will the incentive for conversion from chemical-dependent Green Revolution techniques back to ecologically based farming systems. Organic conversion will be difficult because most communities have lost their traditional agricultural knowledge, and China has few experts or technical staff specialized in organic farming who can train them. Nevertheless, some pioneers are forging ahead. For example, the Nanjing-based Organic Farming Development Project, which cooperates with experts from agricultural universities and local government, began re-introducing techniques such as intercropping, biological pest control and green manure to farmers in Yuexi, Anhui Province in 1998.[17] Three years later, farmers from one of the villages had organized China's first association of organic kiwi growers to provide technical support and jointly market their products. They have developed their own requirements and internal documentation system, and farmers who participated in the project since its inception have now received organic certification.

## Many paths to pesticide reduction

Southwest China's Yunnan Province, home to half of all of China's plant and animal species, has made a special effort to control pollution and pursue a "Green Economy" that is compatible with nature conservation and tourism. However, officials and farmers are undecided about whether to pursue sustainable agriculture by embracing international organic standards or by adopting Chinese Green Food or *wugonghai* ("unpolluted") standards. The Chinese Green Food system has two levels: Grade A for food produced without harmful chemicals, and Grade AA, which has become more and more similar to international organic standards over time, but is still not widely accepted abroad. Part of the resistance to accepting Green Food as organic comes from the fact that government agricultural agencies certify and market Green Food, conflicting with the principle of third-party monitoring. Wugonghai was an informal term used to market relatively clean food until China's Ministry of Agriculture recently promulgated official wugonghai standards.

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## Pest Management and the World Bank-Funded Anning Valley Project

PAN North America and the Chinese non-governmental Center for Community Development Studies (CDS) monitored pesticide use and its impacts in the World Bank-financed Anning Valley Agricultural Development Project area in July 2001 as part of an ongoing effort to improve implementation of the World Bank's pest management policy.

With the help of local forestry station staff and farmers, CDS project manager Lu Caizhen surveyed 100 households in Hongxin Village about their pest management. She also asked them whether the World Bank project was meeting their needs, particularly with respect to training in ecologically based integrated pest management, as required by World Bank policy. Group discussions with farmers revealed extremely high rates of pesticide use on vegetables, with adverse effects on sales, beneficial insects, farmers' health and the environment. The villagers had received no training in integrated pest management, and minimal instructions regarding how to reduce their exposure to pesticides. Many reported feeling sick after using pesticides, and one man had fainted and was rushed to the hospital when he ate a tomato without washing his hands after using pesticides. PANNA and CDS also met with local officials, who acknowledged the problems with pesticides and described their efforts to promote biological control and other ecological methods.

CDS staff and farmers from Hongxin presented these findings at a seminar hosted by Chinese officials who manage the World Bank-funded Anning Valley Agricultural Development Project in September 2001. At the conclusion of the seminar, Chinese officials made commitments to comply with the policy by designing and implementing a farmer-led, ecologically based pest management plan. A few days later, the government decided to go beyond World Bank requirements and convert the Anning Valley region into Sichuan's primary producer of "unpolluted" fruit and vegetables.

We hope our efforts can serve as a model for promoting local empowerment and sustainable farming practices throughout the World Bank and other agricultural development projects in China. Based upon our experiences in China as well as similar work in Indonesia and Mexico, PANNA will advocate for reform of World Bank agricultural lending practices throughout the developing world and a strengthening of the World Bank's commitment to IPM.

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By the end of 1999, the Green Food Office in the Yunnan Agriculture Bureau had labeled 28 products from 18 enterprises as "green," meaning that they are safe and healthy. The province currently has seven organic producers. Although the public does not necessarily trust the Green Food label, Kuang Rongping, Director of the Yunnan Entomological Society, believes the Grade A Green Food standard is more practical for some parts of China, at least for now. In a presentation to the Yunnan People's Consultative Conference, he advocated that the government promote organic farming in relatively clean and natural areas and promote Green Food in more polluted areas, such as the suburbs of big cities.

Tang Baokun, a vineyard manager in Yunnan, is hedging his bets by experimenting with both organic and Green Food approaches on different plots of land. Mr. Tang lives in Mile County, an "Eco County" in Yunnan Province. China's Ministry of Agriculture set up one hundred Eco Counties across the country to encourage integrated agriculture, forestry, energy use and environmental protection in rural areas.[18] Mr. Tang received a subsidy from the provincial government to convert to Green Food production, and expects to get certification for his 80 hectares by next year.

At the same time, Mr. Tang has heeded the advice of the Yunnan Environmental Protection Bureau, which encouraged him to choose organic rather than Green Food certification for his next venture. The environmental bureau's certification system meets international standards, which are increasingly important because of China's recent entry into the World Trade Organization. Mr. Tang has leased an additional 330 hectares of land on a hillside far from any polluted areas, where he plans to construct an organic vineyard.

Even for farmers who don't go organic, economic and environmental gains from reduced pesticide use are well within reach. Studies of farmers who received training in ecologically based integrated pest management show that these farmers developed an understanding of the rice ecosystem, and are able to use their knowledge to maintain yields and increase profits while reducing their use of pesticides.[19] (See "Participatory IPM in China.")

Sometimes simple changes in farming practices can enable farmers to drastically increase yields without using chemicals. For example, researchers in Yunnan Province found that intercropping sticky rice with standard rice varieties dramatically decreases the incidence of rice blast, allowing farmers to stop using fungicide within two years.[20] The experiment covers 100,000 acres and involves tens of thousands of farmers. In another success story, researchers helped poor farmers in Shandong and Anhui Provinces increase sweet potato yields as much as 30% to 40% without additional fertilizers, pesticides or genetic improvements. The crops were produced by extracting tiny bits of disease-free plant material from infected plants and re-growing them under sterile conditions. Farmers in Shandong and Anhui currently grow about 30 million tons of virus-free sweet potato annually on 800,000 hectares (1.97 million acres).[21]

Back in Hongxin Village, farmer Lai Zhongshan said he wished he could reduce his pesticide use. "If we could get a higher price for our vegetables, maybe we could afford to switch to ecological methods," he said. Mr. Lai may not have long to wait. The Sichuan government has decided to turn the local pesticide crisis into an opportunity by converting the region into a production center for "unpolluted" fruits and

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## Participatory IPM in China

The Sichuan Agriculture Department's Provincial Plant Protection Station has been promoting participatory integrated pest management (IPM) since 1989. Experts from the UN Food and Agriculture Organization (FAO), which provides technical and financial support for IPM in several provinces, consider Sichuan's IPM program to be one of the best in China. The program utilizes the "farmer field school" approach, a participatory learning process through which villagers apply critical thinking skills to agroecosystem analysis. The establishment of IPM in Sichuan is especially important because the large, fertile Sichuan Basin produces much of China's grain. IPM activities have primarily focused on rice to date, although a new project in oranges is underway, and farmers as well as officials are interested in developing IPM methods for vegetables.

Farmer field schools involve weekly meetings of a group of farmers. Instead of just listening to lectures and learning from textbooks, the farmers observe conditions in their rice fields and conduct experiments on pest-predator relationships. Research has shown that farmers exposed to this ecology-based paradigm of IPM learn and retain more than those who learn to base pesticide application decisions on economic thresholds.[1] Farmers trained in farmer field schools apply less pesticides and experience no significant differences in yields compared with their counterparts trained in the economic threshold approach.

Women now comprise 70% of China's agricultural labor force because men have been leaving the countryside for jobs in urban areas. A farmer field school in Xinshi Township taught 25 women how to identify pests and natural enemies and how to manage insect populations using *Bacillus thuringiensis* (Bt), a beneficial organism used in organic farming. After the course was over, the village agricultural technician tried to sell the people in the village a highly toxic insecticide. The women who had participated in the training course not only refused to buy it, but also convinced everyone in their village to switch to Bt instead.

Graduates of a three-year course in Tumen Township formed a community group to continue teaching farmers in their village about ecological pest management. They said that before the course, they used highly toxic pesticides that caused health and ecological problems. Every year, two or three people would have to go to the hospital to be treated for pesticide poisoning. Several pigs died after eating fodder contaminated with pesticides. The fish and frogs living in the rice paddies and irrigation ditches all died, and bird populations declined. Now that the farmers have switched to less toxic pest management methods, no more poisoning incidents have been reported and frog and bird populations are on the rise.

The programs in both Xinshi and Tumen Townships show the potential for participatory IPM to empower farmers to achieve impressive reductions in the toxicity and frequency of pesticide use.

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# Genetically Engineered Crops Expand in China

*by Emily Price and Jessica Hamburger*

In 1988, China's genetically engineered (GE) tobacco became the first GE crop in the world to be grown commercially. Production of the crop was halted in the mid-1990s, however, due to rejection of GE crops in export markets. Undeterred by this false start, Beijing has recently forged ahead into the brave new world of biotechnology, testing over 100 genetically engineered crops since 1997. Despite recent regulation of GE crops and products, government-supported research continues as China looks for ways to achieve self-sufficiency in food production and gain an edge in the growing biotech industry.

China's biotech industry is dominated by government research institutes and universities, some of which are developing state-owned enterprises to market their products. Only a few foreign firms have contracted with Chinese institutes to conduct biotech research because of China's loose intellectual property laws. Several foreign seed companies have formed joint ventures with Chinese state owned enterprises, a requirement for selling seeds of major food crops in China. Most are currently focused on the conventional seed market, but Monsanto and Delta and Pine Land have established a joint venture with the Hebei Provincial Seed Company to sell GE cotton seed.

Transgenic Bt cotton is the most widely grown GE crop in China, with estimates ranging from over 700,000 hectares to one million hectares, or about one-third of the total cotton crop. GE proponents in China point to the success of Bt cotton in greatly reducing pesticide use, and reducing overall production cost for farmers by 20%. However, according to some reports, the cotton bollworm has already developed resistance to Bt in two provinces in China.

Other commercial GE crops include tomatoes, sweet peppers and petunias. Recent biotech research and development in China has spawned many more not-yet-commercialized products, including two species of Bt rice engineered to be resistant to the pyralid moth. In July, China announced development of genetically engineered tomatoes, eggplants and hot pepper plants that could be irrigated with seawater. Additional research is targeting rice, canola and wheat. By transferring genes of salt-tolerant plants like the mangrove into fresh-water crops, Chinese scientists claim that transgenic plants have survived seawater irrigation for four generations.

In May 2001, the government issued new regulations for genetically engineered products that require mandatory labeling and safety assessment. The Ministry of Agriculture is responsible for certifying non-GE exports and approving GE imports, and has the authority to ban production, processing and trading of any GE product that is proven hazardous. So far no GE imports have been banned.

Rejection of GE products by European markets and governments was the most direct cause for the new GE labeling restrictions in China. In 2000, Britain banned the import of Chinese soy sauce containing GE soybeans—soybeans grown in the U.S. but processed in China. This year, U.S. soybean shipments were delayed for months due to industry uncertainty about whether China would accept them. U.S. President George W. Bush eventually pressured the Chinese government into accepting the U.S. safety assessment for GE soybeans until it has completed its own regulatory review.

*Sources:* San Francisco Chronicle, *April 3, 2001.* The New York Times, *October 7, 2000. Agence France Presse, July 11, 2001. People's Daily Online, June 7, 2001 and July 20, 2001.* BIOWATCH: Genetic Engineering Newsletter, *No 18, January 2001.* South China Morning Post, *April 18, 2001. Asiaweek.com, January 21, 2000. Public and Private Collaboration On Plant Biotechnology In China,* AgBioForum, *2(1), 48-53. Rooster News Network, October 24, 2001.*

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vegetables. A few years from now, Hongxin Village may be reaping the benefits of a healthier and more profitable way of farming.

*Jessica Hamburger is a Project Coordinator at PAN North America.*

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*continued from page 1, Pesticide Exports from U.S. Ports*

exports during the three-year period between 1992 and 1994 found at least 25 million pounds of domestically banned pesticides[6]; a subsequent survey of exports in 1995 and 1996 showed exports of at least 21 million pounds of pesticide products forbidden to be used in the U.S.[7]

Before discussing the most recent findings, it is worthwhile to underscore several points. The figures in this article must be understood as the best estimates possible given the limitations of public-record information, and the current predilection for restricting public access to such data. As discussed in earlier FASE reports, many shippers have requested that their names be omitted from the transcriptions used in this work. Over the ten-year period that data has been collected, the shipper's name is omitted from records for almost half of all shipments, trade representing more than three billion pounds of chemicals.

The exact business address of the shipper is often omitted as well, though it is possible to say that at least 90%—and possibly as many as 96%—of the shippers have business addresses in the U.S. Nothing in the records indicates whether the shipper is also the manufacturer.[8]

It was possible to identify the specific compound shipped for 46% of the shipments during this period (by volume). Descriptions for the remaining 54% ranged from "organophosphate pesticide" to "weed killing compound," in addition to ambiguous chemical descriptions, truncated UN shipping code numbers and other baffling terminology. In view of this, it would not be unfair to insert the preface "at least" before most of the following figures.

## Findings

According to Customs records nearly 3.2 billion pounds of pesticide products were exported between 1997 and 2000. This is an average rate of nearly 2.2 million pounds per day, or 45 tons per hour. This average rate is a 15% increase over the rate of 936 tons per day noted in the years 1992–1996.[9]

According to Customs records, glyphosate accounts for between 22% and 27% of all pesticide exports in the years studied—a rate significantly higher than any other chemical. Although glyphosate is among the "new" generation of pesticides with lower toxicity and less persistence, recent research has raised the possibility that exposure to glyphosate can increase the risk for developing non-Hodgkin's lymphoma.[10] The high rate of export is also of interest in view of the fact that some glyphosate products are teamed with seeds engineered to be resistant to the chemical, with the idea that this combination will reduce pesticide use.[11]

## Domestically forbidden products

According to Customs records, nearly 65 million pounds of pesticides were exported between 1997 and 2000 that are either forbidden or severely restricted in the U.S., an average of more than 22 tons per day. (See table this page.)

By the year 2000, no instances of the export of banned products were noted. In the 1997–1999 period, shipments of several banned pesticides[12] were found in Customs records: captafol (24.6 tons total), chlordane (4.2 tons), EDB (104 tons), isazofos (196 tons), mercury-based pesticides (9 tons), mevinphos (37.7 tons), mirex (1084 tons), monocrotophos (714 tons), ompa (21 tons), silvex (21.5 tons) and sodium penta (205 tons).

Fifty-seven percent of these products were shipped to destinations in the developing world. Nearly half of the remaining 43% were shipped to ports in Belgium and the Netherlands. Though it is not possible to make a final determination from available data, it is likely that the final destinations of a large number of these shipments were also in developing countries.

Products that have never been registered in the U.S. were exported at an average rate of 16 tons per day during the four years examined. As noted in earlier reports, the total for such products could be much larger. The largest volume chemicals were butachlor (nearly 14 million pounds total) and carbosulfan (10.2 million pounds).

A recent field study examined how one unregistered product, cadusafos, was treated by regulators in Honduras. The chemical was registered in Honduras on the basis of communications from EPA stating that cadusafos was "registered" under Section 7 of FIFRA (Section 7 requires producers to provide production figures), and that tolerances for residues on food had been established. Further examination underscored the fact that the resources necessary to evaluate the safety of a never-registered product did not exist in the country. "There is no reason to believe that these grave shortcomings are unique to Honduras among the Central American States," the author notes. "On the contrary, these flaws appear to be the status quo in the region.[13]" (Nearly 678 tons of cadusafos were exported between 1997 and 2000.)

## Highly toxic exports

In the four-year period studied, at least 89,395,597 pounds of pesticides were exported which have been designated "extremely hazardous" (Class 1a) by the World Health Organization.[14] This is an average rate of more than 30 tons per day.

### U.S. Export of Banned, Severely Restricted and Never-registered Pesticides

| | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|
| Banned | 2,319,126 | 1,453,776 | 1,069,556 | 0 |
| Severely restricted | 7,576,935 | 4,420,205 | 3,149,300 | 4,650,482 |
| Never registered | 10,522,303 | 7,169,132 | 11,311,960 | 11,231,044 |
| **Total** | **20,418,364** | **13,043,113** | **15,530,816** | **15,881,526** |

## Restricted Use Pesticide Exports

(high-volume compounds)

| | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|
| acetochlor | 12,544,708 | 13,447,422 | 18,463,619 | 9,489,135 |
| alachlor | 12,682,496 | 15,420,735 | 13,037,018 | 7,571,781 |
| atrazine | 1,709,296 | 722,213 | 1,583,367 | 3,256,031 |
| chlorothalonil | 10,112,203 | 9,469,986 | 7,202,013 | 7,030,966 |
| chlorpyrifos | 9,612,313 | 9,453,163 | 7,919,491 | 8,570,694 |
| methyl bromide | 989,948 | 1,473,341 | 1,726,483 | 2,335,977 |

Among the most toxic of these is aldicarb, which has an oral toxicity (LD50) of less than one mg per kg of body weight. Total exports in 2000 were almost 90% more than the 1997 total, increasing from 4.7 million pounds to 8.9 million pounds. Over the four-year period, the average rate of export was just over 8.5 tons per day.

The following is a description of the personal protective equipment recommended for workers applying aldicarb: "Coveralls over short-sleeved shirt and short pants; Waterproof gloves; Chemical-resistant footwear plus socks; Protective eyewear; Chemical-resistant apron when cleaning equipment, mixing, or loading; Chemical-resistant headgear for overhead exposure; Approved respirator."[15] More than 70% of aldicarb exports were destined for developing countries—including El Salvador, Peru, Argentina, Brazil, Guatemala and Colombia—where it is extremely unlikely that this level of protection will be available to applicators.

In the system utilized by the U.S. EPA, the highest toxicity rating is "Class I," which is roughly equivalent to combining the UN classes 1a (extremely hazardous) and 1b (highly hazardous).[16] Total exports for these products are significantly higher than "1a" exports alone, a total of 140,202,845 pounds for the four-year period. This is an average rate of just over two tons per hour.

### Restricted use products

In the U.S., "restricted use" pesticides (RUPs) may only be purchased and used by state-certified applicators or persons working under their direct supervision because of their toxicity and/or environmental hazards.[17] However, the FAO found that pesticide traders advertise restricted use pesticides to the general public in nearly two-thirds of Latin American countries.[18]

Total exports of RUPs over the four-year period examined were 284,590,511 pounds, an average rate of four tons per hour. Total exports in 2000 were more than six million pounds less than in 1997.

Among the restricted-use compounds exported in high volume, methyl bromide is notable in that 2000 exports appear to be 68% higher than 1997 exports. (See table this page.) This increase is at odds with the general trend of decreasing exports of RUPs—and out of step with both global concerns regarding the ozone-depleting properties of this chemical[19] and the U.S. EPA's plans for an accelerated phaseout of domestic production, importation and use.[20]

### Adverse health effects: cancer

Between 1996 and 2000, nearly 1.1 billion pounds of pesticides were exported that have been identified as known or suspected carcinogens.[21, 22, 23] This is an average rate of almost 16 tons per hour.

Proposition 65, an initiative approved by California voters, requires the Governor to publish an list of chemicals that are known to the State of California to cause cancer, birth defects or other reproductive harm. This list is admittedly more precautionary (and inclusive) than the list generated by the U.S. EPA; nonetheless, it draws attention to a group of chemicals that might be encompassed by proactive export policies. A total of 166,834,625 pounds of pesticides that are noted as "known carcinogens" on the most recent Prop 65 list[24] were identified in shipping records for the period between 1997 and 2000, an average export rate of nearly 2.4 tons per hour.

These figures have particular import in regard to children in developing countries. According to the International Labor Organization, 65% to 90% of the children estimated to be working in Africa (80 million total), Asia (152 million) and Latin American (17 million) are working in agriculture.[25] Evidence that children have heightened susceptibility to the carcinogenic effects of pesticides[26, 27] has even greater significance for developing countries. There, children live and work in conditions that involve almost continuous exposure, ranging from contact in fields to contaminated water, pesticide-contaminated clothing and storage of pesticides in homes.[28, 29]

### Recommendations

The fact that no exports of banned products were noted in 2000 is encouraging. On the other hand, from a public health or environmental protection perspective, exports of hazardous pesticides—including extremely toxic pesticides, and products associated with cancer—remain unacceptably high.

There can be no "double standard" for protecting health and the environment. Export of banned pesticides should be prohibited, as should exports of pesticides that EPA has never registered. If EPA does not have certainty that a product poses no unreasonable risk, it should not be exported.[30]

Exporting countries should assume proactive, precautionary stance in regard to pesticides. A suspect chemical can remain in use for decades before it is banned. Decades can also pass before epidemiological studies confirm the poisonings that can be predicted when highly toxic pesticides are used in developing countries.

Whatever the limits of law might be, ethical responsibility for hazardous exports cannot end at our borders. Congress must ensure that EPA has the resources to fully evaluate the hazards posed by pesticides leaving the U.S., and the authority to act on its findings.

The quality and quantity of information regarding pesticide production, trade and use must be improved. A system for electronic filing of

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export declarations (the Automated Export System or AES) already exists in the U.S., though it is not mandatory for shippers of products such as agricultural chemicals to use it. AES should be implemented for shipments of pesticides, and the EPA should have full access to this data. Details such as chemical identities, quantities exported and countries of destination should be a matter of public record.

Hazardous pesticides should be phased out when safer alternatives exist. A "substitution principle" enacted in Swedish legislation forbids the use of chemical products for which less hazardous substitutes are available. Under such a scheme, if a new pesticide is registered that is safer than an older one, the older one automatically loses its registration. Implementing such a system domestically would have far-ranging effects if the export of unregistered products were prohibited.

Aggressive efforts should be made to implement alternatives to chemical-intensive agriculture. A recent report from the World Resources Institute raises serious questions about the likelihood that ecosystem-damaging practices such as pesticide-intensive agriculture offer a long-range means to feed the world.[31]

In cases where pesticide use cannot be eliminated altogether, Integrated Pest Management (IPM) strategies can dramatically reduce pesticide use. While biotechnology is sometimes characterized as "IPM," field-based programs have pointed to more cost-effective solutions that could be broadly implemented in developing countries.[32]

It has been a quarter of a century since the international community began to address the problem of continued use of banned and extremely hazardous pesticides in developing countries. The PIC and POPs agreements are the most significant steps that have been taken to date, but the realization of their promise depends on the determination of exporting countries to protect workers and the environment in developing countries as if they were their own.

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# Plan Colombia Update—More Farmland Fumigated

*by Phillip Cryan*

In December 2000, a U.S. Senator who is skeptical about U.S drug war policy traveled to Colombia to investigate the aerial fumigation campaign firsthand. He was taken on a guided tour of the affected area by Colombian military and police officials. They took him to a place where illicit crops (coca and heroin poppy) were grown and said that they would demonstrate the "pinpoint accuracy" of the herbicide fumigation missions. Environmental organizations and human rights advocates have repeatedly attacked the fumigation program for spraying food crops and homes that are near targeted drug crops. As the Senator and other U.S. and Colombian government officials stood watching, a crop-duster plane closed in and dumped its payload of herbicide onto the entire delegation.[1]

## Fumigation campaign attacked

The aerial fumigation campaign in Colombia has come under increasing attack in recent months, not only from human rights and environmental advocates but also from within the U.S. Congress. When the bill to renew funding for Plan Colombia—now called the Andean Regional Initiative—arrived on the Senate floor in mid-October, traditional "tough on drugs" speeches were drowned out by questions and criticisms regarding the eradication approach. Senators questioned the efficacy of a strategy that relies on forced eradication without providing farmers funding and infrastructure for alternative development. They criticized ongoing cooperation between the U.S.-funded Colombian military and AUC (United Self-Defense Forces of Colombia) paramilitaries, who are responsible for thousands of killings and kidnappings of civilians each year.[2] In addition, the critics maintained that no new funding should be supplied for fumigations until a study of their health effects has been conducted.

Last August, the U.S. Department of State announced plans to conduct such a health study. According to the *Washington Post*, the study "will examine 100 farmers in Putumayo, where eradication efforts of the U.S.-assisted Plan Colombia are concentrated, to assess their health before spraying begins, and reexamine the same 100 people after fumigation … occurs nearby."[3] That is, the study will use Colombian farmers as experimental subjects to assess the health effects of a pesticide.[4]

## Funding cut but spraying continues

The Senate debate resulted in an agreement to cut funding for the Andean Regional Initiative by 22% from the US$731 million requested by the Bush Administration, with new provisions to prioritize alternative development, assess the health effects of fumigations and make aid to Colombian military units conditional on their human rights records. Although these are all positive steps, civil society groups warn that promises of human rights monitoring and support for alternative development programs have been made in Colombia before, with little follow-through. Moreover, the bulk of funding for militarization was still approved, and spraying continues. Restrictions on funding apply only to future purchases of herbicide, so the sprayings will continue as long as current supplies last.

A new wave of fumigations in Putumayo was announced by Colombian officials on November 15, 2001—over 3,700 acres were sprayed in the first three days.[5] Roundup Ultra (a glyphosate-based Monsanto herbicide) with chemical additives has been dropped on over 200,000 acres of Colombian farmland so far this year.[6] The damage to legal crops—either because they are grown directly alongside drug crops or because of "drift" under windy conditions and pilots' failure to deliver "pinpoint accuracy"—has been catastrophic. Thousands of Colombian farmers, who had previously sought to eradicate drug crops or who had stayed out of the drug trade entirely, are now planting coca or heroin poppy crops in a last-ditch effort to feed their families. As Octavio Rodríguez, a farmer from the southern Colombian province of Caquetá, put it, "We're not getting rich off this. We don't grow coca because we want to. The state has abandoned us."[7]

Impoverished farmers in Bolivia have likewise sought the right to grow small quantities of coca until plausible alternatives are made available. In recent months they have conducted peaceful demonstrations at Bolivian military bases in the Chapare region, and last year they obstructed traffic on Bolivia's highways for days. During debate over the Andean Regional Initiative, one U.S. Senator commented that "it makes no sense to take away a farmer's livelihood, provide him no alternative, and expect him not to plant illicit crops again."[8]

## Other recent developments

In early November 2001, health officials from Carchi, a province in Ecuador that borders the Colombian provinces being sprayed, announced that five Ecuadorans—two adults and three infants—had suddenly died of mysterious ailments. The officials suspect that the illnesses were brought on by exposure to the herbicide sprayings. An Ecuadorean medical team was sent to the San Marcos community, where the deaths occurred, to determine whether pesticide poisoning was responsible.[9]

The governors of the six southern Colombian provinces where fumigations have been concentrated announced in September 2001 their joint opposition to the campaign and their insistence on manual eradication strategies with adequate funding for alternative development.[10] Similar statements by Colombian governors, members of Colombian Congress and the Human Rights Ombudsman, made since the beginning of Plan Colombia fumigations in 1999, have been routinely ignored by the Colombian president and military, the U.S. Embassy in Bogotá and the U.S. State Department.

The small progress made by the U.S. Senate may be undermined by an extension of the U.S. "War on Terrorism" to Colombia. The "War on Drugs" has included some limitations on activities funded by the U.S.: Plan Colombia funds could purchase Blackhawk helicopters (US$15 million each) and training for the Colombian military, but the military units receiving this support had to prove that they were engaged in counter-narcotics, rather than counter-insurgency, operations. Now, the "War on Terrorism" may allow for more direct intervention in Colombia's civil war. Francis X. Taylor, head of the State Department's Office of Counterterrorism, announced on October 16, 2001, that U.S.

*continued on page 25*

*continued from page 1, Having Faith*

inches wide and an inch thick and weighs slightly more than a pound—about the size and shape of a single-layer cake. In all species, the placenta is expelled with the fetus during birth. We are the only mammal that does not eat it.

The placenta is a biological mystery. It is an evolutionary shape-shifter. It dodges the mother's immune system while immunologically guarding the fetus. It is the flat cake that feeds us all. It is another brain that is slowly overriding my own. It is a blood-drenched forest. It is the sapwood of pregnancy.

**When it comes to toxic chemicals, the placenta is not really a barrier at all.**

At least three places in the human body possess an ability to block harmful substances from entering areas particularly sensitive to toxins. One is in the brain. One is in the testicle. One is in the placenta. These barriers are all functional rather than anatomical. That is, no special wall, ditch, moat, or partition stands between, say, brain cells and the capillaries that feed them. There are only the usual cell membranes, but these membranes are specially equipped with ion pumps and other subcellular gadgets that allow them to exert some control over which blood-borne molecules are allowed to pass through them.

The placental barrier is located in the skin of the placental branches. It consists of a four-layer, semipermeable membrane interposed between maternal and fetal circulation. When we say something crosses the placenta, we mean it passes through this membrane. Inside a placenta are only capillary-filled fetal branches soaked by spumes of mother's blood. That's it. The placental barrier does an admirable job of keeping out bacteria, which are usually too large to pass into the placental branches. Those that do slip by are swiftly dispatched by special immune agents called Hofbauer cells. Also, certain adrenal hormones not needed by the developing fetus are deactivated by placental enzymes.

When it comes to toxic chemicals, however, the placenta is not really a barrier at all. Chemical substances carried in the mother's circulation are sorted by the placenta primarily on the basis of molecular weight, electrical charge, and lipid solubility. In other words, small, neutrally charged molecules that readily dissolve in fat are afforded free passage regardless of their capacity for harm.

Consider pesticides. Those with low molecular weights cross the placenta without restriction. For them, there is no barrier. Pesticides made of bigger, heavier molecules are partly metabolized by the placenta's enzymes before they pass through, but sometimes this transformation makes them more toxic, placing the fetus at even greater risk. Or consider mercury, that meddling destroyer of brain tissue. When mercury is attached to carbon, it is called methylmercury. Even if the mother's blood is contaminated with only trace amounts of methylmercury, the placenta will still actively pump it into the fetal capillaries as though it were a precious molecule of calcium or iodine. As the pregnancy continues, the mercury levels in umbilical cord blood will eventually surpass their levels in the mother's blood. In the case of methylmercury, the placenta functions more like a magnifying glass than a barrier.

More profoundly, chemicals don't even have to cross the placenta to cause harm. Some lodge in the placenta and create injury there. For example, nicotine damages the placenta's amino acid transport system, which is used to ferry proteins from the mother's blood into the baby's. This helps explain why the babies of smoking mothers weigh an average of seven ounces less at birth. (Nicotine also passes through the placenta and into the body of the fetus.) Similarly, the industrial pollutants called PCBs alter the placenta's blood vessels in ways that reduce their flow, and the heavy metal nickel, a component of car exhaust, interferes with the placenta's ability to make and release hormones. In short, the placenta not only fails to keep the fetus out of harm's way, it cannot even prevent itself from being damaged. Like any other living tissue, it is fragile.

So where did the idea of an impermeable, all-protecting placental barrier come from?

Not from the ancients, certainly. Aristotle and Hippocrates both thought that the placenta was the place where the mother's blood was funneled directly into the fetal umbilical cord. So did Thomas of Aquinas in the twelfth century. All of them were wrong, of course, but their mistake led to the mostly correct assumption that whatever passes into the mother's body passes also through the placenta. Even in ancient Carthage, newlyweds were forbidden alcohol to prevent damage to wedding-night conceptions. Then, in the fifteenth century, Leonardo da Vinci was among the first anatomists to observe that the blood of the mother and baby do not seem to commingle. Years later, this suspicion was confirmed in a ghastly experiment that involved the injection of melted wax into the uterine artery of a dying pregnant woman. A postmortem examination showed no wax in the fetal tissues. The death of this unfortunate mother gave birth to the placental barrier concept.

* * * * *

Summer 2000 in upstate New York is one of the coldest and wettest on record. Even by August, the area lakes haven't warmed up enough for swimming. So when a hot, sunny Saturday finally arrives, Faith and I head for the county 4-H fair. It's one of my better ideas.

When I was a kid, I loved 4-H Club ("I pledge my Head to clearer thinking, my Heart to greater loyalty, my Hands to larger service, and my Health to better living") and had a fairly illustrious career as a member. I received blue ribbons for both my rock collection and my sewing project—a princess-style minidress complete with hand-sewn buttonholes and flat fell seams. But I always knew that, whatever my achievements in geology and sewing, they could not compete with the prestige of the agricultural projects. The annual 4-H fair was, first and foremost, a showcase for the farm kids, whose projects had titles like "Feeding and Fattening for Market a Beef Steer."

Little has changed. A trickle of visitors is viewing the tables of wood carvings and canned peaches, while crowds are to be found at the pole barn at the end of the fairgrounds. The building's moo-ing sounds immediately attract Faith, so we walk there ourselves. Plenty of cows, sheep, and even the occasional llama graze the pastures near our cabin, but Faith has never met them up close. She's ecstatic. What she notices first about the cows is their Big Poops. The next thing she notices is even more exciting: Big Nums. Big Big Big Nums! The goats are similarly equipped, as are a couple of the sheep. Soon she's checking all of the animals for mammary glands.

"Bunny nums?" she asks as we peruse the ribbon-adorned rabbit hutches. I assure her that mommy rabbits do have them, but they're very small.

"Chicken nums?" she asks at the poultry display.

I hesitate, and then launch into a quick discussion of vertebrate taxonomy, introducing the concept of mammals. She looks bewildered. I've explained too much. Meanwhile, the proud preadolescent owner of three champion hens asks if we want to feed them some cracked corn. Faith watches silently as they frantically peck up the kernels.

"No nums," she finally says in a whisper.

We make another loop around the stalls where the large animals are quartered. Suddenly, she stops.

"Mammal?" she asks, pointing at a brown Jersey named Daisy. "Mammal?" she asks again, pointing at her calf.

"Mammal?" she inquires of the goats.

Her eyes light up. "Mommy a mammal!" she declares, pointing at me.

Then, in a moment of epiphany, like Helen Keller learning the word "water," she looks down her own shirt.

"Faith a mammal!" she announces triumphantly to all within earshot. "Faith a mammal!"

Any discussion of breast-milk contamination, either in the popular press or in the scientific literature, is almost invariably followed by a reassuring statement to the effect that breastfeeding is, nevertheless, the best method of infant nourishment. In other words, if you piled up all the positive, health-promoting virtues of mother's milk, as described in Chapters 10 and 11 of this book, and balanced them against all the known and possible dangers created by its burden of toxic chemicals, as described in this chapter, the scales of health would still tip in favor of the breast. If forced to agree or disagree with this statement, I would agree: I believe that, in most cases, breastfeeding is better than not breastfeeding. Were this not my credo, I would not have nursed my daughter for two years.

I also believe these kinds of risk/benefit analyses are an unhelpful approach to the problem of chemical contaminants in breast milk. They offer no solutions. The usual recommendation that follows from them—"Just keep nursing because the benefits outweigh the risks"—means that we nursing mothers should take no action until our milk becomes so contaminated as to pose as many risks as formula. In other words, until breast milk, like formula, kills 4,000 U.S. infants a year. (This figure is the experts' best estimate of the annual number of infant deaths—from infectious diseases and other causes—attributable to lack of breastfeeding.) Risk/benefit analyses imply that as long as one danger (breastfeeding) is less than another (failure to breastfeed), we should accept the lesser danger—even though it still necessitates endangering our children. The narrow duality of the equation leaves no room for the proposition that feeding our infants industrial poisons is unacceptable. Period.

Furthermore, the scientific knowledge on which risk/benefit assessments rest is scanty. One of the earliest risk assessments compared lives saved from infectious diseases with an estimate of the number of additional cases of cancer that might be caused by the exposure to carcinogenic chemicals in breast milk. Lacking data on other health endpoints—immune functioning, hormone disruption, altered brain development—the authors considered no other health risks besides cancer. Their conclusion was that fewer children would die from breast milk-induced cancers than from formula-induced infections; therefore breast is best. A noble effort at quantifying lives saved and lost, this study is still widely cited. However, it has been wrongly interpreted by many as meaning that breast milk is perfectly safe, which was neither the intent nor the conclusion of the study.

Later risk assessments tried to account for problems other than cancer, but they assumed that the high levels of exposure during the brief period of breastfeeding would be counterbalanced by lower levels of exposure later in life. These assumptions have now been questioned. One recent report states: "Consideration must also be given to whether the effects of short periods of very high exposure differ from those of prolonged periods of much lower exposure, particularly when the former occur during a critical period for infant neurological, physical, and intellectual development."

**An emerging body of evidence suggests that some common chemical contaminants interfere with human milk production.**

The more variables scholars attempt to incorporate into their analyses, the more uncertain the outcome of the analysis becomes. Thus, recent researchers who attempt to balance risks against benefits come to much more troubled conclusions than their predecessors: "Arguments for ignoring contaminated breast milk are no longer valid," says one. "Officially, it is said that breast milk is safe. However, there are still many unknown factors regarding the effects of dioxin on growth and development," says another. Of course, in the United States, where we keep no systematic records on breast-milk contaminants, risk/benefit assessments cannot even be attempted. A 2001 review of the situation came to the following conclusion: "Although we can draw inferences from breast milk data from other countries, the paucity of breast milk data from the United States limits the confidence in our ability to access infants' exposures, risks, and benefits from breast-feeding . . . [and] to compare these risks and benefits to formula-feeding."

Beyond the lack of simple monitoring data lie further complications. For example, an emerging body of evidence suggests that some common chemical contaminants interfere with human milk production (possibly by inhibiting prolactin). In studies conducted in both North Carolina and Mexico, women with the highest levels of DDT in their breast milk had "poorer lactation performance," meaning that they weaned their infants sooner than mothers whose pesticide levels were lower. Similar findings come from the Netherlands, where mothers with high levels of PCBs in their breast milk had significantly lower volumes of milk during the first critical three months of nursing. Further supporting these studies are animal experiments showing that PCBs interfere with the ability to lactate.

How would we include poor lactational performance in a risk/benefit equation? The problem here is not that the contaminants pose a direct, quantifiable toxic threat to the infant (which they might also do), but that the contaminants threaten to deprive the infant of mother's milk altogether. I think most nursing mothers would find any threat to our ability to make milk a serious threat indeed—whether risk assessments can account for it or not. And so far, they have not.



*To learn more about Sandra Steingraber, visit http://www.steingraber.com.*

# Victims of Mexican Pesticide Disaster Left to Fend for Themselves

*by Phillip Cryan*

*Seventeen years ago, on December 3, 1984, Union Carbide Corporation's pesticide factory leaked poisonous gases into the city of Bhopal, India. In one night, over 3,000 residents were killed and thousands injured, many of them permanently. Bhopal has been called the worst commercial industrial disaster in history. While few are on the same scale as Bhopal, accidents continue to occur regularly at pesticide and chemical factories around the world. The following article documents one such accident in Mexico—and the impact it has had on the lives of those who live and work near the plant.*

On the evening of September 12, 2000, the residents of Salamanca, a city in the Mexican state of Guanajuato, heard a loud explosion and watched a yellow-gray cloud form 500 meters over their homes, producing foul odors. Everyone knew that the cloud must have come from the TEKCHEM chemical manufacturing plant in town. They would later learn that the cloud was composed of malathion, a dangerous insecticide which often contains even more dangerous "impurities." The cloud quickly condensed in the sky, and the chemicals began to fall as rain.[1]

By the time the wind rose and carried the cloud away (20 minutes later), panic had set in. The city's residents, some of whom had been outside and had the "rain" fall directly on their skin, experienced nausea, vomiting, headaches, muscle pain, respiratory problems, difficulty talking, excessive sweating and other problems.[2] As evacuations began and the first ambulances arrived, there was a second explosion, producing another cloud. Overstuffed taxis, public buses, trucks and cars attempted to move 60,000 residents away from the scene.[3]

TEKCHEM, the company responsible for the explosion, did not sound an alarm or offer the public information on the chemicals released; nor, initially, would they allow state investigators and firefighters to enter their facility.[4] When residents blocked the entrance to TEKCHEM's facility the next morning, demanding that it be closed and that they receive medical treatment, municipal authorities dispersed them, promising assistance. No formal agreement was signed, however, and the authorities have not fulfilled their promises. TEKCHEM was allowed to continue its dangerous, under-supervised chemical production operations with few changes; they only paid a fine. No follow up health surveys of the population living near the TEKCHEM plant were conducted.

DAME


Salamancans demonstrate in front of the TEKCHEM facility one year after the deadly explosion.

## Malathion

The chemical released by the explosions, malathion, is an organophosphate and therefore (like all organophosphates) a cholinesterase inhibitor—that is, it can overstimulate the human nervous system, leading to symptoms like nausea, confusion and, with high exposures, respiratory paralysis.[5] The type of malathion most likely involved in the TEKCHEM explosion often contains up to 11 impurities formed during production and storage. These impurities have been found to multiply malathion's toxicity many times over.[6] Isomalathion, one of the impurities, killed five sprayers and poisoned 2,800 others during a malaria-eradication program in Pakistan in 1976.[7] Malathion also appears to have "genotoxic" effects—that is, it damages the genes on DNA molecules.[8] A survey of 933 pregnancies in the San Francisco Bay Area after malathion spraying (intended to control the Mediterranean fruit fly) showed two and one-half times more gastrointestinal disorders than normal in children whose mothers had been exposed to malathion during the second trimester of pregnancy.[9]

Shortly after the TEKCHEM disaster, Mexican officials reassured the public that malathion breaks down very quickly in the environment. Although this is technically true, one of the breakdown products—malaoxon—may be more toxic than malathion itself.[10] Finally, it is possible that chemicals other than malathion were also released by the explosion in Salamanca; TEKCHEM has announced that it was just malathion, but no state or independent body has confirmed this assertion, and TEKCHEM has provided no proof.

## Official response

Local and state authorities deferred management of the TEKCHEM disaster to federal officials. Federal public health officials neither conducted health surveys nor assisted those affected in finding adequate medical attention. Psychological support was not provided. A week after the explosion, the chief of health for the region announced that no epidemiological follow up was necessary because the time of acute exposure had passed.[11] Information provided on the causes of the explosion was contradictory and inconclusive.[12] Proposals calling for TEKCHEM to overhaul its operations were dropped. Citizens' demands continued to be ignored.

DAME


The local group DAME and the citizens' coalition demand legal, scientific and financial assistance for the affected communities.

In the immediate aftermath of the explosion, TEKCHEM announced that 60 tons of malathion had been released. They later revised the figure to 7.5 tons, yet no independent investigation was undertaken.[13]

## TEKCHEM

In 1990, the state chemical producer FERTIMEX was dissolved by the Mexican government, and TEKCHEM purchased the FERTIMEX plant in Salamanca. TEKCHEM's primary activity in Salamanca is the production of organophosphorous pesticides like malathion—a fact which their public relations materials obfuscate.[14] They also produce DDT and lindane.[15]

Salamancans who live near the TEKCHEM facility no longer perceive the foul odor that outsiders immediately notice when arriving in Salamanca. An environmental study conducted in 1993 showed that FERTIMEX had left approximately 84,000 tons of hazardous materials on the site; one of TEKCHEM's stipulations upon purchasing the facility in 1990 was that they would assume no legal responsibility for disposing of these materials.[16] For years TEKCHEM's discharges have polluted a riverbed that has become known locally as "Ugly Brook."

The events of September 2000 were not the first time TEKCHEM had met with public resistance. On May 22, 1998, a gas with "a fetid odor" coming from the TEKCHEM facility caused throat and eye irritation to 557 children in a nearby school. Another cloud of gas was released on April 21, 2000.[17] Citizens' groups protested the health and environmental effects of both incidents, calling for the facility to be closed. But there is no evidence that sanctions or penalties were imposed on TEKCHEM for these incidents.

## Recent developments

On June 17, 2001, another foul-smelling cloud—blue this time—rose from the TEKCHEM plant. It was later announced that this cloud did not present significant health threats, but little evidence for this claim was offered.[18]

The one-year anniversary of the September 12 explosion was marked by a march, planning meetings and cultural events in Salamanca, coordinated by a local group called Dedication to the Environment and Ecological Betterment (DAME, by its Spanish initials). In a report on the aftermath of the TEKCHEM explosion, C. Francisco Javier Romero Sierra, the President of DAME, offered this terse summary: "From the day of the environmental disaster until today, we have not once encountered competent authorities who speak the truth, who fulfill their duties, who serve the population that elected them."[19]

DAME and the citizens' coalition that formed in response to the September 2000 disaster have issued a series of demands. First and foremost, they demand that legal, scientific and financial assistance be provided to the communities affected by the explosion so that they can organize into a civil association, accurately assess the damages caused by the explosion and effectively demand compensation. A crucial part of achieving this goal would be conducting a thorough epidemiological survey of everyone who lives close to the TEKCHEM plant.

The government has also promised US$5 million to clean up the 84,000 tons of hazardous materials left behind by FERTIMEX. DAME demands that the government establish a committee for public oversight of the allocation of these funds, to make sure that they fulfill their stated purpose.

Ultimately, DAME and the affected citizens demand that TEKCHEM's Salamanca plant be closed down.[20]

*Phillip Cryan is participating in the PAN North America fellowship program.*

*Notes*

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*3 "Accidente de la Planta de TEKCHEM (12 de Septiembre): Evaluación de la Situación Previa y Posterior: Resumen Ejecutivo." Doctora Lilia América Albert, page 2.*
*4 Op cit. "Reporte" page 1.*
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*20 Ibid., page 5.*

# GE Pollution in Mexico: Native Corn Contaminated

*by Phillip Cryan*

On September 19, 2001, Mexico's Secretary for the Environment and Natural Resources confirmed reports that genetically engineered material has contaminated native corn varieties in Mexico. Out of 22 communities tested by government agencies in the state of Oaxaca, contamination of corn by transgenics was found in 15.[1] It is the first proven case of transgenic contamination affecting a crop at its center of origin—in the region where it evolved, where numerous landrace varieties and wild ancestors still exist.

Mexico placed a moratorium on the planting of genetically engineered corn in 1998 in an attempt to protect the grain's biodiversity base. The government did not, however, eliminate or regulate the import of U.S. corn to be used for human food or animal-feed corn. At least 25% of corn produced in the U.S. is transgenic.[2] Some of the imported U.S. corn may have been planted by Mexican farmers, who had no way of knowing that the corn they purchased might be genetically engineered. (In fact, 80% of Mexican citizens have never heard of transgenic crops, according to a recent poll.[3]) Olga Toro Maldonado, a Oaxacan farmer, commented: "We wanted to try out the seed. No one told us that we should not plant the corn."[4]

The original discovery of transgenic contamination in Oaxaca was made by a research team led by Ignacio Chapela, a microbial ecologist at the University of California, Berkeley and a PAN North America board member. Chapela informed the Mexican authorities of his findings earlier this year and the government set about its own studies. On September 4, 2001, the director of Mexico's biosafety commission, Fernando Ortiz Monasterio, announced Chapela's findings. Response from the press and public led to the official acknowledgement on September 19 that government tests had also found transgenic material in native corn varieties in Oaxaca. The high rate of contamination (two out of every three communities tested in the government study) led Chapela to conclude that "this contamination may be much more extensive, and—what would be even worse—it may be affecting corn's wild relatives."[5] In recent weeks, scientists have announced the discovery of transgenic material in native corn varieties in the states of Puebla and Guanajuato.[6]

## No action by Mexican government

The Mexican government agencies responsible for overseeing agriculture, biodiversity, imports and the environment have yet to propose emergency measures to deal with the contamination. Víctor Manuel Villalobos, Undersecretary for Agriculture, has described the transgenic contamination as "of low frequency"—even though in 13 of the 22 communities tested, 3–10% of the corn contained transgenic material, and in two other communities the percentage was even higher.[7] In August, Villalobos had argued that the promotion of biotechnology was necessary "for the food security of the country," and denounced anti-genetic engineering organizations like Greenpeace as "environmental terrorists."[8] On September 26, Villalobos announced that the Mexican government would not institute a system for separating transgenic imports from non-transgenics, claiming that it would be too expensive.[9]

Dozens of civil society groups have called for an immediate moratorium on corn imports from the U.S. until such a system can be established. Chapela calls "eliminating the source of contamination" the necessary first step in addressing the problem.[10] A statement of demands signed by 30 Mexican nongovernmental organizations in late September outlines a plan for assessing the magnitude of the contamination, determining its sources, informing farmers, establishing mechanisms of oversight and detection for imports, disposing of the corn that has already been contaminated and undertaking legal actions against the corporations responsible for the transgenic corn.[11] No response to these demands has been issued by Mexican officials, nor have they offered any counterproposals. As Héctor Magallón of Greenpeace México observes, "perhaps [the authorities] intend to make this public only once the contamination has become irreversible, so that we have no choice left but to accept the unrestricted import, planting and commercialization of transgenics."[12]

## Part of a strategy?

Groups like Greenpeace, The ETC Group (formerly RAFI) and Guerreros Verdes (Green Warriors) argue that support for agri-biotech companies is part of the Mexican government's broader objective of market integration into NAFTA, whereby small farmers in Mexico are being squeezed off the land and forced into underpaid maquila (industrial) jobs in the cities.[13] Along with imperiling biodiversity, the introduction of transgenic crops allows a handful of corporations to deepen their control of the seed supply and expand pesticide sales. Farmers who want to grow local varieties or who own only a few acres of land are unable to compete with larger farms that buy seeds and pesticides from the agri-biotech giants—especially now that the genetic material of the small farmers' local corn varieties cannot be protected from contamination by the agri-biotech companies' products.

*Phillip Cryan is participating in the PAN North America fellowship program.*

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*7 "Greenpeace tenía razón: hay maíz transgénico en Oaxaca,"* Crónica, *September 20, 2001, page 30.*
*8 "Decide Gobierno apoyar alimentos transgénicos,"* Reforma, *August 28, 2001.*
*9 "Imposible, separar los cultivos transgénicos,"* El Financiero, *September 26, 2001.*
*10 Op cit. "Irresponsable."*
*11 Open letter to CIBIOGEM (Interdepartmental Commission for Biosafety and Genetically Modified Organisms), September 24, 2001.*
*12 Op cit. "Irresponsable."*
*13 "Corn and NAFTA: An Unhappy Alliance,"* Seedling, *June 2000, http://www.grain.org/publications/jun002-en-p.htm; "Campesinos demand end to GM imports," Associated Press, October 17, 2001; Open letter to President Fox, Guerreros Verdes, August 30, 2001; World Food Sovereignty Day seminar press release, October 16, 2001; "Continúa México comprando maíz transgénico de Estados Unidos, pese a tener almacenadas 630 mil toneladas de maíz mexicano," Greenpeace México, Boletín 183, October 15, 2001.*

# U.S. EPA Approves Bt Corn Despite Lack of Testing

*by Ellen Hickey*

On October 15, 2001, the U.S. Environmental Protection Agency (EPA) announced approval of genetically engineered Bt corn for seven more years, despite serious questions about the dangers the crops pose to human health or the environment. PAN North America criticized the EPA for rushing to approve Bt corn without conducting necessary tests on human health effects and failing to investigate new concerns about environmental impacts.

Bt plants produce a type of insecticidal or Bt toxin, one of a family of related molecules produced by a soil bacterium, *Bacillus thuringiensis* (Bt). To develop these Bt crops, a company clones the insecticidal gene from the bacterium and inserts it into a crop plant. The plant then produces the toxin in most, if not all, parts of the plant through all or most of a growing season.

The five varieties of Bt corn still on the market are made by Monsanto, Pioneer/DuPont, Dow and Syngenta. At least three types of Bt corn were previously taken off the market. Most Bt corn varieties received initial approval from EPA in 1995, and were granted a federal registration that expired on September 30, 2001.

## Allergenicity concerns

As we learned with the StarLink debacle, human allergenicity is a key issue related to Bt crops; however, during the re-registration process, EPA failed to take into account several recent studies showing that Bt toxins could act as possible human allergens. In July, EPA's own scientific advisory panel, which included leading U.S. allergists, called for more tests to determine the potential allergenicity of Bt crops, yet the Agency approved the corn for planting before such tests were carried out.

The allergenicity studies that serve as the basis for EPA's approval of Bt corn have several serious flaws. For example, the Agency has not required that biotechnology companies conduct toxicity and allergenicity tests on the pesticidal proteins actually produced in Bt crops and eaten by consumers. Instead, EPA accepts substandard tests conducted on surrogate proteins from bacteria, which can differ substantially from their plant-produced counterparts. (For more information, visit the Friends of the Earth Web site at http://www.foe.org/safefood.)

## Environmental impacts

In addition to human health research, studies on potential environmental impacts of Bt corn were inadequate. EPA ignored the concerns of researchers at Cornell University, Iowa State University and the University of Minnesota about impacts of Bt corn on monarch butterflies. Recently released studies leave open the possibility that exposure to Bt corn may have long-term, harmful effects on the butterflies. Biologists from the three schools, all of whom have been involved in related research, urged EPA to delay a decision, or grant a one-year provisional renewal, until more data were available on the risk for monarch caterpillars exposed to Bt corn. (For more information, see Ag Biotech Infonet at http://www.biotech-info.net/butterflies_btcorn.html.)

## Organic farmers disappointed

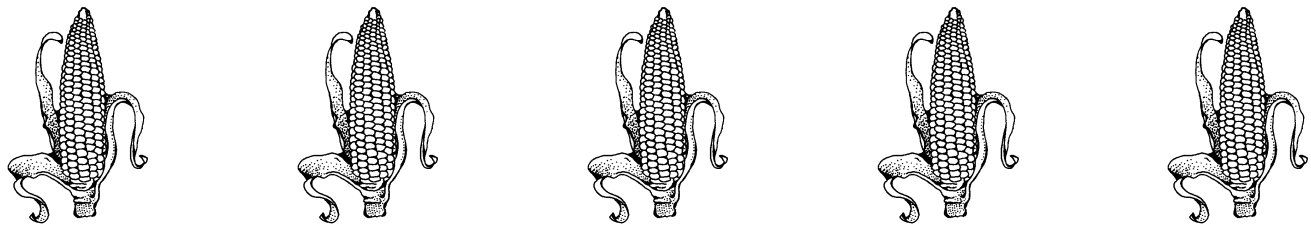
Organic farmers were also disappointed with EPA's decision. Bt sprays are an important pest management tool for many organic and some conventional farmers, but continued use of Bt crops may reduce their effectiveness. Toxins in Bt sprays break down rapidly in the environment as opposed to the Bt in genetically engineered crops, which breaks down very slowly. With widespread use of Bt crops, there is increased insect exposure to the toxin, and insect resistance is much more likely to develop, resulting in the loss of Bt sprays as a valuable tool.

EPA announced that to ensure that Bt continues to be a safe and effective form of pest management for farmers, the Agency has mandated several provisions "to strengthen insect resistance management, to increase research data on potential environmental effects and to improve grower education and stewardship." Whether these mandates will be successfully implemented is doubtful when one examines implementation of such requirements in the past. A biotechnology industry survey published in January 2001 showed that nearly 30% of farmers who grew Bt corn in 2000 did not follow the resistance management guidelines.

Lack of implementation and enforcement of Bt corn guidelines was also clearly evident during the StarLink corn disaster. In 2000, Genetic Engineering Food Alert found that StarLink corn, a type of Bt corn approved only for animal feed, had contaminated the human food supply. In the resulting investigation, it was found that many farmers had not followed the guidelines for growing StarLink, and had not segregated the corn after harvest. Regulations and guidelines agreed to by Aventis, the corporation that produced the StarLink seed, were not passed on to farmers, and little if any follow up by the corporation or EPA was done to see if the plans were being implemented.

*Ellen Hickey is Director of Research and Communications at PAN North America.*

*Sources: GE Food Alert press releases, July 24 and October 12, 2001. EPA Pesticide Program Update, October 18, 2001. "Farmers violating biotech corn rules," Associated Press, January 31, 2001.*



# Atrazine

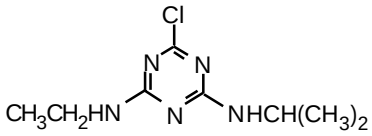
A factsheet by the Northwest Coalition for Alternatives to Pesticides (NCAP)

- Atrazine, a triazine herbicide, is one of the two most commonly used agricultural pesticides in the U.S.
- According to the National Toxicology Program, atrazine is "immunotoxic," disrupting the function of the immune system.
- Exposure to atrazine also disrupts hormone systems. Detailed research, much of it done by the U.S. Environmental Protection Agency (EPA), showed that testosterone, prolactin, progesterone, luteinizing hormone, estrogen and a thyroid hormone are all affected by atrazine.
- In laboratory tests, atrazine delays puberty. In addition, inflamed prostates occur more often in the offspring of mother animals that were fed atrazine while they were nursing than in the offspring of unexposed mothers.
- Atrazine is a pervasive water contaminant. It is the most common pesticide found in rivers, streams and groundwater. The U.S. Geological Survey's (USGS's) recent national monitoring study found atrazine in rivers and streams, as well as groundwater, in all 36 of the river basins that the agency studied. It is also often found in air and rain.
- In lakes and groundwater, atrazine and its breakdown products are persistent, and can persist for decades. It is also persistent in soils. Half lives (the amount of time required for 50% of the atrazine applied to disappear) can be over 100 days in surface layers of soils. Below the surface, atrazine can persist for years.

*by Caroline Cox*

Atrazine (see Figure 1) is a widely used herbicide in the triazine family. Certain crops (primarily corn and related crops) are tolerant of atrazine, and it is used to kill weeds without crop death in those situations.[1] Atrazine was first registered in the U.S. in 1959.[2] Currently, the major manufacturer is Syngenta (formerly Novartis Crop Protection, Inc.),[3] but it is marketed by many companies.[4] Use of atrazine has been the subject of significant concerns because it is one of the most commonly detected pesticide contaminants of rivers, streams and wells.[5]

**Figure 1**
**Atrazine**




*2-chloro-4-ethylamino-6-isopropylamino-s-triazine*

## Use

Atrazine is "one of the two most widely used agricultural pesticides in the U.S."[6] according to the U.S. Environmental Protection Agency (EPA). Estimated annual use is between 64 and 75 million pounds. The primary crops on which atrazine is used are corn, sorghum and sugar cane.[7]

## Mode of action

Atrazine kills plants by blocking photosynthesis, the process by which green plants use sunlight, carbon dioxide (from the atmosphere) and water to make sugars and related molecules. Without this "food," the plant is unable to grow and dies.[8]

## Inert ingredients

Like most pesticide products, commercial atrazine products contain ingredients other than atrazine. Misleadingly called "inerts," the identity of most of these compounds is not publicly available.

Most of the toxicological tests used in the registration of a pesticide are done with the active ingredient only; when possible, the following summary of atrazine's toxicology will identify whether a particular study used atrazine alone or was done with commercial products (atrazine plus inerts).

## Effects on the immune system

Four studies have shown that atrazine can disrupt normal immune system function, enhancing the risk of infectious disease or cancer.

In rats fed atrazine for three weeks, lymphopenia (a reduction in the number of white blood cells, cells that fight infection and disease[9]) was "pronounced"[10] at a dose of 100 mg/kg per day, the lowest dose tested.[11] This study compared immune system effects of 17 pesticides, and atrazine was one of five pesticides to which the immune system was most sensitive.[12]

In human blood cells, treatment with atrazine decreased the production of interleukin,[13] a regulatory protein in the immune system[14]; interferon,[15] an immune system protein that fights viral infections[16]; and tumor necrosis factor,[17] a protein that kills tumor cells.[18]

Cultures of spleen cells treated with atrazine produced fewer b-lymphocytes,[19] immune system cells that produce antibodies,[20] than untreated cells.[21]

A National Toxicology Program study of immune system function in mice concluded that "atrazine was found to adversely affect the immune system and, thus, is considered to be an immunotoxic compound."[22]

## Effects on hormones

The impact that environmental pollutants can have on the normal function of human and animal hormone systems has been a significant concern in the past decade.[23] Hormones are biologically active molecules that control growth, development, behavior and reproduction and thus are crucial to many important life functions.[24] Atrazine disrupts a stunning variety of hormone systems including the following:

- Testosterone. Often called the "male" sex hormone, testosterone promotes the development of male sex characteristics.[25] It is converted into biologically active forms in various organs. A series of studies showed that atrazine inhibits this conversion in male laboratory animals, reducing the amount of the active forms in the pituitary[26, 27] and the hypothalamus.[28] A single dose of 1 mg/kg was sufficient to cause this inhibition,[29] and the atrazine breakdown product deethylatrazine had similar effects.[30] In addition, the number of testosterone receptors in the prostate gland was reduced by atrazine exposure[31] in both young adult rats and older rats.[32] Atrazine also reduces the ability of an active form of testosterone to bind to receptor molecules in the prostate.[33] Atrazine exposure of mothers during pregnancy and nursing affects testosterone levels in their offspring: exposure during pregnancy increases the amount of the active form of testosterone in the pituitary of the female offspring, but exposure during both pregnancy and nursing reduces these levels in male offspring. In addition, exposure to either atrazine or deethylatrazine during nursing decreased the number of testosterone receptors in the prostate of male offspring.[34]
- Prolactin. Prolactin stimulates the production of breast milk in nursing females.[35] Atrazine inhibits "surges" of prolactin that occur during nursing and in response to release of estrogen ("female" sex hormones).[36, 37]
- Progesterone. Involved in the regulation of menstruation, progesterone also is important during pregnancy.[38] In female rats, exposure to atrazine induced "pseudopregnancies" in which, although the rats were not pregnant, their progesterone levels were high and the animals did not cycle through sexually active phases as they usually do.[39]
- Luteinizing hormone. Luteinizing hormone is produced in the pituitary gland and regulates the secretion of other sex hormones.[40] Atrazine blocks the "surge" of luteinizing hormone that occurs before ovulation.[41, 42]
- Estrogens. Often called "female" sex hormones, estrogens regulate the development of sex characteristics and the menstrual cycle, help maintain pregnancy and prepare the breasts for nursing.[43] Atrazine is not estrogenic; that is, it does not cause certain physiological activities that estrogens cause. Atrazine does not cause increases in uterus weight, as estrogens do, nor does it cause cell division that normally occurs in response to estrogens.[44] However, atrazine does have estrogen-related activities. It increases the activity of an enzyme called aromatase that converts testosterone and related hormones to estrogens, and thus could increase estrogen levels.[45] In a yeast that was genetically modified to produce the human estrogen receptor, atrazine displaced estrogens from the estrogen receptor at low estrogen concentrations, but not at high ones.[46] In addition, the atrazine breakdown product, deethylatrazine, has some estrogenic activity.[47]
- Thyroid hormones. In rats, atrazine caused a decrease in the blood levels of the thyroid hormone triiodothyronine,[48] a hormone that regulates metabolism and growth.

**Studies of exposed people and laboratory tests show that atrazine and atrazine-containing herbicides reduce the ability to reproduce successfully.**

## Effects on reproduction

Studies of exposed people and laboratory tests show that atrazine and atrazine-containing herbicides reduce the ability to reproduce successfully.

Studies of exposed people have looked both at farmers and residents of agricultural areas. In the Ontario [Canada] Farm Family Health Study, the incidence of premature birth in families in which the father applied atrazine on the farm was nearly double that of families in which the father was not exposed to pesticides.[49] The incidence of premature birth was even higher in families where atrazine was used in the yard.[50]

Another study, conducted by the University of Iowa, studied communities whose drinking water came from an Iowa reservoir that was more contaminated with herbicides than other Iowa water supplies. The average atrazine contamination level in this reservoir was 2.2 parts per billion (ppb), just below the federal drinking water standard of 3 ppb. Elsewhere in the state levels averaged 0.6 ppb. Researchers found that the incidence of what is called intrauterine growth retardation (IUGR), babies with low birth weight for their gestational age, was about double the incidence of IUGR in towns with less contaminated water.[51] In a companion study, researchers found that the incidence of birth defects was more than double that in towns with less contaminated water. The incidence of limb reduction defects increased the most.[52]

A study that documented atrazine contamination of various tissues related to reproduction increases the concerns raised by the research summarized in the previous paragraphs. Researchers at the University of Bonn in Germany found atrazine in breast milk and cervical mucus in 20% (2/10) of the subjects tested.[53]

Effects on reproduction have also been demonstrated in female laboratory animals. Female rabbits which were fed atrazine had smaller litters and more miscarriages than unexposed rabbits. The lowest dose causing these effects was 75 mg/kg per day. In multigenerational studies with rats, animals fed atrazine had offspring which weighed less than the offspring of unexposed animals. The lowest dose causing these effects was 40 mg/kg per day.[54] At slightly higher doses (50 mg/kg per day), atrazine caused complete pregnancy loss (loss of the full litter) in rats of one laboratory strain (F344); similar results in other strains occurred at higher doses.[55]

Atrazine also disrupts the normal function of the male reproductive system in laboratory animals. In rats, atrazine caused a reduction in the ability of sperm to move and a reduction in the number of sperm in the epididymis, the part of the testes in which sperm mature. These effects were caused by a dose of 60 mg/kg given twice a week.[56]

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The atrazine breakdown product diaminochlorotriazine also reduces successful reproduction. Rats fed diaminochlorotriazine during pregnancy had offspring that weighed less than offspring of unexposed mothers and their bone development was also altered.[57]

## Effects on development

Recent studies have shown that atrazine can affect juveniles as they develop into adults. In studies conducted by EPA scientists, sexual maturity is delayed in rats fed atrazine from the time they are weaned until puberty. In males a dose of 12.5 mg/kg delayed puberty while a higher dose (50 mg/kg per day) was required to cause a delay in females.[58, 59] In males, the primary breakdown products of atrazine have caused the same delay in puberty that atrazine does[60] as has exposure to atrazine before birth.[61]

**A 1998 study of chromosome damage in blood cells of workers in an atrazine production facility found that "occupational exposure to atrazine causes a significant increase in the percentage of chromosomal damage."**

Because feeding atrazine at relatively high doses reduces the weight of laboratory animals, it is possible that these effects on development could be related to reduced body weight rather than a direct effect of atrazine. To test this possibility, the EPA researchers in the studies of delayed puberty included in their experiments rats whose food was reduced so that their weight would match the weight of the atrazine-fed animals. In males, puberty was not delayed in the food-deprived animals as much as it was in the atrazine-fed animals.[62] Puberty of food-deprived females was not delayed.[63] Thus, atrazine directly affects the timing of puberty.

In addition, atrazine can affect the development of the prostate. When mother rats were treated with atrazine for the first four days after they gave birth (this is during the time that they are nursing their offspring), their male offspring were more likely to develop prostate inflammation. The dose required to cause inflammation was 25 mg/kg per day.[64] When pregnant rats were exposed to atrazine between the fifteenth and nineteenth day of their pregnancies, their male offspring also developed inflamed prostates.[65]

## Mutagenicity

EPA recently evaluated tests of atrazine's mutagenicity, its ability to cause genetic damage. This review included tests submitted to the agency as part of the registration process and tests published in the scientific literature.[66] EPA concluded that "the available evidence did not indicate a mutagenic effect of atrazine exposure."[67]

However, the EPA review omitted studies that raise serious concerns about atrazine's mutagenicity. A 1998 study of chromosome damage in blood cells of workers in an atrazine production facility found that "occupational exposure to atrazine causes a significant increase in the percentage of chromosomal damage."[68]

Also omitted from the EPA analysis were studies that looked at the ability of atrazine to cause genetic damage at the concentrations at which atrazine has been measured in drinking water. The studies used cultures of cells from hamster ovaries, a standard cell culture for mutagenicity tests. The first study found that the incidence of chromosome breakage increased at concentrations less than 3 ppb,[69] the legally enforceable public drinking water standard.[70] A second study, using a similar protocol, found increased breakage of the largest chromosome at an atrazine concentration of 3 ppb (with borderline statistical significance) and a statistically significant increase at a concentration of 18 ppb. The highest atrazine concentration detected in Illinois water samples is 18 ppb.[71] The third study in this series found similar results: atrazine increased the frequency of chromosome damage at concentrations of both 3 and 18 ppb.[72] These studies measured a kind of genetic damage not studied in any research included in the EPA analysis.

The EPA analysis omitted consideration of the role that "inert" ingredients play in the mutagenicity of atrazine-containing herbicides. The tests submitted to EPA as part of the atrazine registration process are all tests using atrazine alone,[73] as are most of the published studies. NCAP has identified one study that compares a commercial atrazine product with atrazine alone. In this study, the commercial product caused about twice as many mutations as did atrazine.[74]

In addition, EPA failed to consider the implications of the atrazine derivative called N-nitrosoatrazine. N-nitrosoatrazine is formed in the human digestive system when both atrazine and nitrate are present.[75] Because both compounds are common water contaminants,[76] "there is much concern that this will increase the exposure to nitrosamines [N-nitrosoatrazine]."[77] Both atrazine and N-nitrosoatrazine can damage chromosomes in human blood cells. However, while concentrations of 1 part per million (ppm) of atrazine caused damage, much lower levels (0.1 ppb) of N-nitroso atrazine caused damage.[78] N-nitrosoatrazine was also "strongly mutagenic" in hamster cells.[79]

EPA also omitted consideration of synergistic effects with other herbicides. In a study in which human blood cells were exposed to low concentrations of linuron and atrazine (individually and together), both atrazine (at 1 ppb) and linuron (at 1 ppm) increased the frequency of broken chromosomes, but not significantly. The combination, at lower concentrations (0.5 ppm of linuron and 0.5 ppb of atrazine), caused a significant increase in broken chromosomes.[80] A study of chromosome breaks in the bone marrow cells of mice drinking water containing atrazine and/or the herbicide alachlor had similar results. Neither atrazine nor alachlor alone (at concentrations of 20 ppm) caused chromosome damage, but the combination (10 ppm of each) did.[81] Like atrazine, alachlor is a common water contaminant.[82]

Although tests on cells from humans or other mammals should be most relevant to human hazards, EPA has given little consideration to the type of organism used in the mutagenicity studies they evaluated. In the tests using bacteria and yeast, only a few (5/23) were positive (showed genetic damage). However, in the tests using cells from humans or rodents a much larger proportion (10/23) were

positive.[83] An older (1980) review for the European Community of a smaller number of studies also noted that the type of organism was important: most positive results in this review were in mammals and in whole-animal rather than cell culture tests.[84]

Finally, the differences between data provided to EPA by atrazine manufacturers and data available in the published scientific literature are striking. A review published by EPA in 1993 found that all of the eight studies submitted for registration purposes were negative, but 14 out of 39 published studies were positive.[85]

Supporting evidence for the mutagenicity of atrazine comes from a study of a protein called p53 in rats fed relatively low doses of atrazine (2.7 mg/kg per day). This protein plays a central role in "DNA repair and survival after DNA damage." (DNA is the molecule from which genetic material is made.) The percentage of blood cells containing the p53 protein increased dramatically (about 20-fold) in the animals that were fed atrazine.[86]

**Atrazine was the most commonly detected pesticide in river basins from all three land uses studied (agricultural, urban, and mixed).**

## Carcinogenicity

Whether or not atrazine is carcinogenic (causes cancer) is a controversial subject that has been studied in both people and laboratory animals. Studies of exposed farmers and farmworkers that have demonstrated an association between atrazine exposure and cancer include the following:

- Researchers from the Italian National Cancer Institute studied the association between triazine use and ovarian cancer in women corn farmers. They found that women who applied triazines, or cultivated fields where triazines had been used, were more than twice as likely to have ovarian cancer as unexposed women.[87]
- Researchers from the University of Kentucky studied the association between the incidence of breast cancer in Kentucky and a composite measure of triazine exposure. (The index was based on well and drinking water contamination data, acreage of corn production, and estimates of triazine use.) The study found that breast cancer risk was higher (1.1 to 1.2-fold) in counties with medium and high levels of triazine exposure than it was in counties with low exposure.[88]
- The Cancer Registry of Central California looked at correlations between atrazine use in California (by county) and the incidence of six types of cancer. The study found that for Hispanic males, the incidence of leukemia was associated with the use of atrazine. For black men, the incidence of brain and testicular cancer was associated with the use of atrazine.[89]
- Researchers from the University of Prince Edward Island and the University of Guelph studied associations between atrazine contamination of wells and drinking water and the incidence of six types of cancer in Ontario, Canada. They found the incidence of stomach cancer in both males and females increased with increasing atrazine water contamination.[90]

Atrazine has caused cancer in the following laboratory studies:

- In the Sprague-Dawley strain of laboratory rats, atrazine caused breast tumors in females.[91]
- In the F344 strain of rats, atrazine caused breast tumors in males. In females, atrazine caused cancers of the uterus, leukemia, and lymphoma.[92] (Another study of F344 rats, submitted as part of atrazine's registration, found no increases in tumors or cancer.[93])

One final laboratory study is not a standard carcinogenicity study but rather a study of cancer-causing mechanisms. In this study, using cell cultures from rat intestines and human colons, atrazine caused cells to proliferate, to increase in number. Human cells were more sensitive to atrazine than rat cells. Proliferation of colon or intestinal cells is part of the development of colon or intestinal cancer.[94]

EPA's evaluation of these studies concluded that atrazine is "not likely to be carcinogenic in humans." With respect to the studies of exposed people, the agency stated that "there is no supporting evidence or a sound argument of biological plausibility that these cancers may result from exposure to atrazine. Also, the lack of confirming studies indicates that the human investigations by themselves do not make a strong case for an association between atrazine exposure and human cancer."[95]

With respect to the laboratory studies, EPA concluded, based on detailed studies, that "it is unlikely that atrazine's mode of cancer action in SD [Sprague-Dawley] rats is operative in humans." The agency believes that atrazine causes cancer in Sprague-Dawley rats by weakening surges of luteinizing hormone. This initiates the equivalent of menopause earlier than it occurs in unexposed rats. During "menopause" in the Sprague-Dawley rat, levels of the hormone estrogen are high, which causes breast tumors. In humans, menopause causes low levels of estrogen, so the Sprague-Dawley rat results are not relevant.[96]

EPA's analysis leaves a critical question unanswered: if the hormonal effects of atrazine that cause breast cancer in Sprague-Dawley rats do not occur in humans, what is the effect on humans of this compound which appears to cause such significant disruption of hormone systems? What experiments can answer this question? Before giving atrazine a "not likely" cancer classification, shouldn't EPA find out what the effects in humans are likely to be? The International Agency for Research on Cancer (IARC) evaluated essentially the same set of studies and concluded that "atrazine is not classifiable as to its carcinogenicity to humans,"[97] leaving the door open for further studies. NCAP believes that IARC's conclusion is more appropriate and more protective of human health than EPA's conclusion.

## Synergy

Synergy occurs when the combination of two chemicals is more toxic than either chemical alone. In terms of acute toxicity, atrazine is synergistic with a common class of insecticides, the organophosphates. A study using fruit flies as a test animal found that atrazine was synergistic with the organophosphate insecticides parathion, diazinon, dyfonate and phorate.[98] A second study, using aquatic midges as a test animal, found that atrazine was synergistic with the organophosphates trichlorfon, malathion, chlorpyrifos and methyl-parathion.[99]

An insecticide in another chemical family, carbofuran, was also synergistically toxic with atrazine to fruit flies.[100]

Atrazine can also act synergistically with respect to effects other than acute toxicity. Atrazine causes more genetic damage in combination with other herbicides than it does alone. Another example

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concerns dinitrotoluene, a chemical that is transformed in the intestine of laboratory animals into carcinogenic and mutagenic compounds. Exposure to atrazine increased the formation of these mutagenic molecules.[101]

## Contamination of rivers and streams

Atrazine frequently contaminates rivers and streams, according to the U.S. Geological Survey's (USGS's) National Water-Quality Assessment Program (NAWQA) begun in 1991. USGS has compiled data from the first 20 river basins studied by NAWQA and the summary paints a startling picture of atrazine contamination.[102] Atrazine was the most commonly detected pesticide in river basins from all three land uses studied (agricultural, urban and mixed), and the atrazine breakdown product deethylatrazine was also commonly found. In agricultural basins, USGS found atrazine in about two-thirds of the samples tested. In urban basins, USGS found atrazine in 70% of the samples. In major rivers with mixed land uses, USGS found atrazine in 80% of the samples. Concentrations were as high as 120 parts per billion (ppb) in agricultural basins, 14 ppb in urban basins and 22 ppb in river basins with mixed land uses.[103] At both agricultural and mixed land use sites, concentrations were close to or exceeded the U.S. drinking water standard of 3 ppb in about 5% of the samples.[104]

For information about contamination of a particular river basin, the NAWQA Web site is an excellent resource: http://water.usgs.gov/pubs/nawqasum.

NAWQA and other studies document important patterns in atrazine's contamination of rivers and streams:

- Atrazine contamination is not geographically restricted. It is common in the midwestern "Corn Belt" where use is widespread, but rivers and streams from all 36 basins that have been studied by NAWQA are contaminated.[105] Contamination is common in locations as diverse as Oregon's Willamette Valley,[106] south-central Texas,[107] Denver, Colorado,[108] and New York's Hudson River.[109]
- Highest atrazine concentrations are found in rivers and streams when there is rain following spring atrazine applications to agricultural land. These pulses of atrazine can exceed the drinking water standard set by EPA and are not removed by conventional water treatment.[110] For example, the cities of Lincoln and Omaha, Nebraska, draw their water from wells that are "hydraulically connected" (located near and using the same water) to the Platte River at Louisville, Nebraska. USGS found atrazine above EPA's drinking water standard in one third of the samples of river water from Louisville.[111]
- However, atrazine is often found year round, although concentrations are lower than they are during the spring.[112, 113] Atrazine found during other seasons probably enters the river from contaminated groundwater. This contamination can originate at "some distance from the river."[114]
- Heavy rainfall and full streams lead to the highest pulse concentrations of atrazine, indicating that it is "a readily available constituent in the watershed that is being washed off in proportion to the amount of excess rainfall (runoff)."[115] Smaller rivers have larger and more abrupt pulses, while in large rivers, elevated concentrations can be spread out over several months.[116]
- There is not a simple relationship between atrazine use and levels found in rivers and streams. USGS scientists recently summarized atrazine loads in the Mississippi River between 1975 and 1997. While atrazine use in this basin declined during this period (from 38,000 to 25,000 tons), atrazine loads in the river did not decrease.[117] In smaller rivers and streams, however, and over a shorter time period (1989-1994), USGS found significant decreases in concentration even though use had declined only slightly. One possible explanation is that restrictions in atrazine use were implemented at this time.[118]
- Atrazine contamination of water is not restricted to areas downstream from where it is used. For example, British researchers who intensively studied a small watershed concluded that "atrazine was found at relatively high concentrations when it had not been applied to any of the fields draining to the sampling point."[119]

## Contamination of groundwater

Atrazine commonly contaminates groundwater. It has been found in the groundwater of all 36 river basins studied by USGS.[120] Atrazine was often the most common pesticide detected. Deethylatrazine, formed when atrazine breaks down, was also common. About one-third of the agricultural well samples were contaminated with atrazine in the first 20 basins studied, as were about 15% of the urban samples and 10% of the samples from mixed use basins.[121]

Important reasons for atrazine's presence in ground water are its widespread use and long persistence.[122]

Reducing atrazine use can reduce groundwater contamination. For example, atrazine use in Iowa declined by 12% between the mid-1980s and the early 1990s. Over the same interval, the frequency of atrazine-contaminated wells declined 14%.[123]

As with rivers and streams, atrazine has contaminated groundwater in areas where it has not been used nearby. Researchers from Environment Canada studying prairie springs found atrazine when "it was not used anywhere in the vicinity of the aquifers."[124] They suggest that transport in the atmosphere is the most likely source.[125]

## Contamination of rain

Atrazine is commonly found in rain. A USGS compilation of national, multistate, state and local monitoring studies showed that atrazine was found at nearly every site where rainfall was collected.[126] In some cases, concentrations in rain are above drinking water standards.[127] The amount of atrazine deposited in rain can be large. For example, USGS calculates that the rain deposits 110,000 kilograms of atrazine in the Mississippi River basin every year, over one-third as much as is carried annually by the river.[128] Rain also can be a significant source of atrazine in the ocean: University of South Carolina researchers calculated that a two or three day rainstorm deposited atrazine along the South Carolina coast equal to 10% of the amount deposited annually by rivers.[129] Rain can carry atrazine long distances; for example, atrazine is deposited in rain in the remote Isle Royale National Park in Lake Superior.[130] Atrazine has also been found in fog in California.[131]

## Persistence in lakes and ponds

According to EPA, atrazine "should be somewhat persistent"[132] in lakes or other water bodies with still water. In fact "somewhat persistent" may be an understatement. For example, USGS scientists estimate that persistence in deep lakes "may exceed 10 years"[133] and calculated that breakdown of atrazine in Lake Superior is "very slow (about 1% per year)."[134] Swiss scientists came to similar conclusions after studying a group of lakes: a small amount of atrazine degraded during the summer, otherwise the only losses of atrazine were by flushing. In 1989, Switzerland instituted "drastic application restrictions" for atrazine, but the amount of atrazine in the lakes did not decrease through 1994.[135]

Persistence in ponds is less, but still significant. German researchers found, for example, that the atrazine concentration in experimental ponds in April was over half what it had been the previous September, immediately after addition of atrazine.[136]

## Persistence in groundwater

Atrazine is persistent in groundwater. For example, in a laboratory study, the half life for atrazine in groundwater sediments was almost six years[137] and a two month study "did not show a significant decrease"[138] in atrazine concentrations. In Delaware, USGS researchers estimated that the atrazine breakdown product deethylatrazine persisted for 25 years.[139]

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***continued from page 11, Plan Colombia Update***

strategy for the Andean region will involve law enforcement cooperation, intelligence exchanges, blocks on terrorist financing and "where appropriate—as we are doing in Afghanistan—the use of military power."[11] Taylor and Secretary of State Colin Powell have labeled the Revolutionary Armed Forces of Colombia (FARC)—a rebel army that routinely blows up the pipelines used by U.S. and European oil companies—a "terrorist organization of global reach," the only organization identified as such in the Western Hemisphere.[12]

Senator Patrick Leahy, who introduced the provision calling for a study of the fumigations' health effects, provided a terse summary of Plan Colombia's flaws during the Senate debate: "We have spent billions down there, and drugs [in the U.S.] are just as accessible."[13] Coca cultivation dropped by 203,000 acres in Peru between 1990–2000 as a result of U.S.-funded eradication efforts; over the same period, it rose in Colombia by 204,000 acres.[14] When fumigations have become widespread and destructive enough to make coca production in southern Colombia untenable, it will only increase elsewhere. In the meantime, Amazonian forest is ravaged by deforestation, the health of people and animals is imperiled, and farmers and their families are deprived of food because of the spraying—all in the name of "ending" the supply of drugs.

*Phillip Cryan is participating in the PAN North America fellowship program.*

*Notes*

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# News Notes

## SOUTH AFRICA PROMOTES BIOTECH, LIMITED LABELING

This fall, the South African government released an agricultural and medical biotechnology promotion strategy that includes an emphasis on development of insect- and disease-resistant plants. The strategy recommends that the South African government articulate an overall policy position on biotechnology and outlines responsibilities of various government departments.

Specifically, the Department of Agriculture would stimulate research and development related to biotechnology and improve administration of applications for genetically engineered (GE) crop field trials in order to quicken turnaround times; the Department of Trade and Industry would change the national Patents Act to facilitate the biotechnology industry; the Department of Education would promote biotechnology to the public; and the Department of Environmental Affairs and Tourism would monitor legislation to ensure safe use of biotechnology and promote technology transfer both into and out of South Africa.

The Department of Health, responsible for developing GE food labeling legislation under the strategy, has released draft labeling legislation that supported by South Africa's biotechnology industry association.

Environmentalists called for stricter labeling legislation, including "GMO free" food labels, but the Department of Health will not allow labels that declare a food genetically modified organism (GMO) free, free of GMO materials or free of residues derived from GMOs. However, voluntary labeling of food as "not genetically modified," "not produced by certain techniques of genetic modification" or "prepared without certain techniques of genetic modification" is permitted provided that this exact wording is used, that the accidental presence of GE material is less than 1% of total content and that the name of the certifying body appears close to the label.

The implementation of the government's biotechnology promotion strategy is expected to cost US$22 million annually, with a portion of the budget specifically earmarked for strengthening the link between universities and industry.

Currently, the three GE crops approved for planting in South Africa—Bt white corn, Bt yellow corn and cotton—are all produced by multinational seed companies. The South African government is urging more South African companies to enter the sector.

*Source:* Agrow: World Crop Protection News, *October 12, 2001.*

*Contact: PANNA.*

## CHINA'S BIGGEST COTTON REGION SUFFERS

Over one million hectares of cotton fields in China's Xinjiang Uygur Autonomous Region were attacked by pests this summer. Economic losses resulting from the damage are expected to climb to US$85 million (700 million yuan) by the end of the year, a local official said. Parts of the region in western China were severely affected by aphids and red spiders.

Although the drought this past summer provided favorable conditions for pests to thrive, the Vice-Director of Xinjiang General Station of Plants Protection said that the major cause of the disaster was that pesticides had killed the pests' natural enemies.

Farmers in the cotton producing areas of the region earn over 60% of their income from cotton. Although pest problems are common in the area, "I have never seen such a long-lasting and severe problem as this before," said one local farmer who lost 6.7 hectares of cotton to the pests.

Cotton is a primary industry in Xinjiang and the region's largest export. Xinjiang is the biggest cotton producing area in China. Last year, total cotton output in Xinjiang reached 1.5 million tons.

*Source: WorldSources Online, September 13, 2001.*

*Contact: PANNA*

## FRENCH CHEMICAL PLANT EXPLOSION KILLS AT LEAST 29

On September 21, 2001, an agricultural chemical plant exploded in Toulouse, France's fourth largest city. The explosion damaged buildings as far as three miles away and spewed acid clouds into the air. Days after the blast, 29 people were reported dead, 10 missing, approximately 800 hospitalized and more than 2,500 injured.

The AZF plant produced ammonium nitrate and other agricultural chemicals. Days after the explosion, environmental inspectors announced that most of the ammonia and other gases released into the air had dispersed. However, officials warned nearby towns and villages not to drink tap water because the plant had contaminated the nearby Garonne River.

The AZF chemical works, situated on a 40-acre site near Toulouse's one million inhabitants, is Europe's third-largest and France's largest manufacturer of fertilizers and other agricultural chemicals. Built in 1924, it was later modernized and bought by the oil and chemical conglomerate Total-Fina-Elf—the world's fourth-largest oil group.

The AZF plant, where 470 people work, is among 372 sites in France classified under a European Union directive as high-risk, meaning that extra security precautions must be taken. The high-risk designation, officially named "Seveso," was put in place after a 1976 chemical disaster in the Italian village of Seveso, where a pharmaceutical factory malfunctioned, producing a toxic cloud containing dioxin.

Toulouse's mayor as well as other residents question how the petrochemical plant, classified as "high risk," came to be so close to the edge of a large city.

Experts said that even a very large stock of ammonium nitrate is not a problem as long as it is kept dry and cool. If it gets humid it can heat up and ferment, leading to spontaneous combustion. But chemists also explained that fertilizer, while commonly available as plant food, can also serve as an explosive.

The exact cause the explosion is unknown. Some parties speculate that it was an accident, some the result of negligence, and still others think that it was a deliberate act. Toulouse's city prosecutor has ordered a judicial inquiry into the disaster.

*Sources: CCN.com, September 21, 2001;* The New York Times, *September 25, 2001.*

*Contact: PANNA.*

## FRANCE WITHDRAWS TRIAZINES FROM MARKET

In September 2001, France's Farm Minister announced a nationwide ban on atrazine and related triazine herbicides due to the threat they pose to human health and their "generalised presence" in water supplies.

The ban calls for the withdrawal of atrazine, simazine and cyanazine from the French market by September 30, 2002, and prohibits their use in other products after June 30, 2003. Switzerland's Syngenta AG, Israel's Makteshim and Italy's Sipcam-Oxon are the world's biggest producers of the chemicals, according to France's pesticide industry group. Use restrictions were also announced for terbuthylazine, ametryne and terbutryne.

First introduced to the French market in 1962, triazines are used mostly on maize and sorghum crops but are sometimes applied to trees and vines. In 1999, French growers applied atrazine to all sorghum crops and 80% of maize, according to the national farm ministry.

Recent studies in France found degraded atrazine products in 50% of samples taken from

# News Notes

surface water and 52% of groundwater supplies. In recent years, French authorities have ordered people not to drink tap water in areas where triazine content exceeded recommended levels.

In October, France's Health Minister commented that the drinking water of more than 500,000 people in France was "absolutely not drinkable."

At the same time, the Farm Minister announced a "decision in principle" to ban sodium arsenite, a fungicide used on vines, in order to protect human health and the environment. It is not known when a formal ban will be announced. Sodium arsenite is a known carcinogen—possibly linked to an increased risk in testicular cancer—and a developmental toxin. The Minister also said that the government would formally evaluate the risks of pesticides on human health and the environment.

Following France, Belgium will ban the sale of atrazine from May 2002 and its use as of June 2002.

*Sources: PAN Europe Monthly, October 2001; Reuters, October 2, 2001, October 16, 2001.*

*Contact: Pesticide Action Network Europe, Nernstweg 32, D-22765, Hamburg, Germany; phone (49-40) 39 91 91022; fax (49-40) 390-75-20; email coordinator@pan-europe.de; Web site http://www.pan-europe.net.*

## BASF SUBSIDIARY FINED FOR ILLEGAL U.S. PESTICIDE SALES

In September, the U.S. Environmental Protection Agency (EPA) charged Micro Flo Company—a wholly owned subsidiary of BASF Corporation—with importing and selling millions of pounds of illegal, counterfeit pesticides in the U.S. over a several year period.

EPA's charges against Micro Flo, a U.S.-based pesticide formulator and distributor, constitute the largest enforcement case ever brought by the U.S. government for pesticide-related violations. EPA assessed a fine of US$3.7 million and has listed 673 separate violations by Micro Flo of the U.S. Federal Insecticide, Fungicide, Rodenticide Act.

In May 2000, EPA officials conducted inspections at a Micro Flo pesticide formulation plant and warehouse. Based upon these inspections and EPA's review of records submitted by Micro Flo, the Agency determined that the company violated U.S. law.

EPA's alleges that Micro Flo offered pesticides for sale whose composition differed from the description in their registration. EPA also charges that Micro Flo falsified notices accompanying shipments of active ingredients claiming that they were produced by an EPA-approved producer. In reality, the imported chemicals were from foreign companies whose products were not approved by EPA.

Permethrin and acephate were two chemicals imported illegally. While they are both registered for use in the U.S., they must be imported from EPA-approved companies. During 1999, Micro Flo imported large quantities of both of them from unapproved sources. For example, EPA documents show that over 400,000 pounds of acephate, a nerve toxin and possible human carcinogen, were imported using falsified documents.

In 2000, BASF ranked as the seventh largest agrochemical company in the world, with global sales of US$2.2 billion comprising 11% of the world market. The company predicts an almost 50% increase in agrochemical sales this year, expecting 2001 sales to hit US$3.1 billion.

*Sources: U.S. EPA Enforcement and Compliance Update, September 18, 2001; U.S. EPA Civil Complaint, FIFRA-04-2001-3000, September 11, 2001; Wright & Sielaty Press Release, September 14, 2001;* Agrow World Crop Protection News, *April 13, 2001, August 31, 2001.*

*Contact: PANNA.*

## DUPONT CONVICTED OF RACKETEERING

A jury in the U.S. state of Florida has found DuPont Co., makers of the fungicide Benlate (benomyl), liable for racketeering, negligence, fraud and defective product claims in a lawsuit filed by two Costa Rican-based plant nurseries. Ordered to pay US$78.3 million to the nurseries, DuPont announced that it would appeal the decision.

Numerous Benlate cases against DuPont over the past ten years have resulted in litigation and settlement charges costing the company a total of approximately US$1.3 billion. In April 2001, DuPont announced that it would phase out sales of Benlate around the world by the end of 2002.

The racketeering charges were based on information gathered from internal DuPont documents showing the company conducted tests in Costa Rica in 1992, but destroyed the records as claims against Benlate grew. The growers' attorney maintained that DuPont assigned an attorney to supervise the testing, skewing some results and discarding those that were unfavorable.

Testifying for the growers, a plant pathologist stated that DuPont documents dating back to 1980 describe Benlate as an unstable product prone to deterioration in hot, moist conditions. According to his testimony, some plants treated with Benlate grew to only 10% of their expected height, miniature roses in Florida dropped all of their leaves within two days of treatment and Hawaiian orchids treated with Benlate were too malformed to sell. The plant pathologist attributed the problems to a natural byproduct of the breakdown of Benlate that, he maintained, turned the fungicide into an herbicide.

DuPont's attorney stated that after U.S. testing in 1992, DuPont came to the conclusion that Benlate did not cause the damage. According to DuPont, the problem was due to a one-time incident of herbicide contamination at a Benlate mixing plant. However, growers' complaints about crop damage continued long after the single contamination incident occurred.

*Sources: Reuters, August 13, 2001; Associated Press, August 8, 2001, July 9, 2001;* Miami Herald, *February 22, 2001.*

*Contact: PANNA*

## UGANDA TO EXPORT ORGANIC COFFEE TO U.S. AND E.U.

This year, Uganda became the first African country to export certified organic Arabica coffee to the U.S., and the first exporter of certified organic Robusta coffee to Europe. Low world prices for coffee have prompted growers and traders to target organic markets where consumers are willing to pay higher prices, according to the Ugandan coffee trade association.

Overall production of organic coffee and numbers of organic coffee farmers have been rising rapidly in Uganda over the past three years. Less than 500 tons in 1998–99, organic coffee production is predicted to double by the end of this year to 1000 tons and reach 1500 tons next year.

Although Uganda has been exporting coffee for the past 50 years, the agreement between a U.S. company and a Ugandan exporter to market organic coffee will be the first time that Ugandan coffees will be branded on the world market. Previously, no packages have indicated that the coffee was from Uganda.

In Uganda, organic production for export started with cotton in 1994, and coffee soon followed, but it was not until the 1997–98 growing season that organic coffee was produced on a large scale. Over the past five years, Uganda has been exporting organic coffee, cocoa, sesame and cotton.

*Source:* The Monitor *(Kampala), June 19, 2001;* New Vision *(Kampala), July 10, 2001.*

*Contact: PANNA.*

# News Notes

## U.S. AGROCHEMICAL SALES UP 4.3% IN 2000

Increased sales for all major crops categories led to a 4.3% rise in U.S. revenues for 24 major agrochemical companies. The companies' total U.S. sales in 2000 were US$7.9 billion.

Export revenues fell by 1.3% to US$2.6 billion but, in volume terms, exports rose by 7.7% to 739 million pounds of active ingredient. Despite declining export revenues, total overall sales of the 24 companies registered an increase of 2.9% for a value of US$10.5 billion.

Herbicide sales made up 64% of the U.S. agrochemical market in 2000. The 2.7% rise in U.S. herbicide sales to US$5.1 billion was mainly due to increased use on soybeans, cotton and small-grain cereals. Agricultural herbicide use rose by 2.6% to US$4.3 billion, while non-crop herbicide sales increased by 3.2% to US$744 million.

Corn and soybeans remained the largest U.S. pesticide markets but accounted for less than 50% of the market for the second consecutive year.

Corn herbicide sales fell by 2.5% to US$1.5 billion in 2000, but soybean herbicide sales increased by 8% to US$1.3 billion. Cotton remained the third-largest crop in the U.S. pesticide market with a 9.9% increase in sales valuing a total of US$870 million .

Canola saw the largest rise in pesticide use of all crops in 2000, with a 25% increase in sales. Other market increases include seed treatment sales (+19.9%), grapevines (+18%), tobacco (+16%), citrus fruit (+12%) and small grain cereals (+10%).

*Source:* Agrow: World Crop Protection News, *August 31, 2001.*

*Contact: PANNA*

## HANDFUL OF CORPORATIONS DOMINATES AGRICULTURE

In the past decade, the value of corporate mergers and acquisitions worldwide increased from US$462 billion in 1990 to over US$3.5 trillion in 2000, roughly 12% of total world economic output. Such corporate concentration is evident in the agriculture industry: the top 10 seed firms now control 30% of the US$24.4 billion commercial seed market and the top 10 agrochemical corporations control 84% of the US$30 billion agrochemical market.

Rural Advancement Foundation International (RAFI) has monitored corporate concentration in the food and agriculture industries for several decades. Under its new name, the Action Group on Erosion, Technology and Concentration (or the ETC Group) the group has released a report analyzing corporate concentration in the food, agriculture and health sectors. Entitled "Globalization, Inc.—Concentration in Corporate Power: The Unmentioned Agenda," the report provides a brief sector-by-sector analysis of the leading companies involved in the closely related fields of pharmaceuticals, biotechnology, genomics, seeds, agrochemicals, food and beverage processing and mega-grocery retailers.

Following two decades of mergers and acquisitions, only five major agricultural biotechnology (ag biotech) firms, or "Gene Giants," dominate the market: Pharmacia, DuPont, Syngenta, Aventis and Dow. Some companies such as Novartis, AstraZeneca and Pharmacia have sold off their ag biotech interests, but the German-based agrochemical companies Bayer and BASF each announced plans in the past year to invest heavily in ag biotech, casting doubt on speculation that the sector is dying.

Despite industry claims that ag biotech is implemented and accepted by diverse groups of farmers growing diverse crops worldwide, the introduction of genetically engineered (GE) crops over the past five years is better characterized by uniformity, industrial agriculture and corporate concentration. In 2000, only four commercial GE crops—soybean, maize, cotton and canola—accounted for virtually all crops planted. In the same year, 98% of all GE crops were grown in three countries: the U.S., Argentina and Canada. Three-quarters of the area devoted to GE crops last year was engineered for a single trait: herbicide tolerance. The rest was engineered for Bt crops, insect resistance or a combination of the two traits. Finally, only one company's GE seed technology—Pharmacia (Monsanto)—accounted for 94% of the total area sown to GE crops last year.

The closely interlinked nature of the ag biotech, seed and agrochemical industries is clear: seven top ag biotech companies (the top five plus Bayer and BASF) rank as the world's top seven agrochemical corporations. These seven Gene Giants also rank among the world's top 10 seed corporations.

The top two seed companies—Syngenta and Pharmacia—control 34% of the global agrochemical market, valued at US$29.9 billion in 2000. Last year, the second year of decline, global agrochemical sales fell by 0.6%. According to industry analysts, sagging pesticide sales are a reflection of the global farm crisis—the combination of overproduction and rock bottom commodity prices. Sales in North America, which account for nearly 30% of the world's total agrochemical sales, were up by 2.8% partly due to soybean plantings. One analyst predicts that the agrochemical market will grow by 1% per year over the next five years.

*"Globalization Inc. — Concentration in Corporate Power: The Unmentioned Agenda" July/August, 2001 is available on the ETC Group's Web site at http://www.rafi.org.*

*Source/Contact: ETC Group (formerly known as Rural Advancement Foundation International, or RAFI), P.O. Box 68016 RPO Osborne, Winnipeg MB, R3L 2V9, Canada; phone 204-453-5259; fax 204-925-8034; email rafi@rafi.org; Web site http://www.rafi.org.*

## BAYER BUYS AVENTIS CROPSCIENCE

In October 2001, Germany's Bayer Corporation purchased Aventis CropScience for US$6.63 billion. With this acquisition, Bayer will become one of the largest agrochemical companies in the world, second only to Syngenta. The purchase of Aventis CropScience will double Bayer's existing agriculture-related business. Bayer expects its sales in this area to reach approximately US$6.62 billion in 2001, and to exceed US$7.1 billion by 2005.

Activities of the new company, Bayer CropScience, will include biotechnology, seeds and all agrochemical products. However, the StarLink technology and related potential liabilities are excluded from the agreement and will remain with Aventis. Bayer will split its agrochemical and pharmaceutical activities into two separate companies once the acquisition of Aventis CropScience is finalized. A separate legal entity will be formed to integrate the two divisions.

The European Union anti-trust authorities must still approve the merger. Aventis, formed in 1999 by a merger of Hoechst and Rhone-Poulenc, and Bayer expect approval by early 2002. Although Bayer would like to acquire all of Aventis CropScience, it expects the authorities to scrutinize one or two products closely. BASF, another major agrochemical giant, would be a potential buyer of any products that Bayer was forced to divest.

Bayer anticipates that the merger will result in the loss of 4,000 jobs, or approximately 15% of the combined work force at Aventis CropScience and Bayer's agrochemical facilities. CropScience's union has announced that it will work to protect jobs despite the ownership change.

Internationally, Bayer is involved in the health care, agriculture and specialty chemical sectors. In 2000, the company recorded total sales of US$27.7 billion.

*Sources: Bayer AG press release, October 2, 2001; AFX,*

# News Notes

*October 2, 2001; Reuters, October 2, 2001;* Agrow: World Crop Protection News, *October 12, 2001.*

*Contact: PANNA.*

## TOXIC PESTICIDE TO "DECONTAMINATE" GE FIELDS

In October, the New Zealand government announced plans to ban commercial release of genetically engineered (GE) organisms for two years. However, the government also announced that it will lift a 16 month ban on field trials of GE crops and would review research proposals on a case-by-case basis. New Zealand's Prime Minister added that approvals for GE field trials would be accompanied by strict rules to prevent contamination.

The lifting of the ban on field trials means that ten field trials of GE crops—including potatoes, sugarbeets, peas, pine trees, petunias and corn—might start during the next year.

Some indigenous Maori members of Parliament object to GE technology on religious and cultural grounds. The two year ban on commercial release of GE products is an attempt to give the government time to research socio-economic, ethical and environmental concerns associated with the technology. Unless renewed by the government, the ban will lapse after two years.

Following the government announcements, 3,000 New Zealanders launched a non-violent civil disobedience campaign—dubbed "Green Gloves"—pledging to remove GE field trials from the islands. Activists say the campaign will not target GE labs, only places where GE organisms have been released into the environment.

On October 31, Maori protesters with anti-GE banners arrived at the Environmental Risk Management Authority, the government body that evaluates applications for GE research projects, and demanded information about research that has already been done.

Despite government promises to introduce legislation ensuring that materials used in field trial research would be destroyed or locked away, critics charge that the government's proposed conditions on field trials do not alter current practices and will do nothing to prevent the escape of GE material into the environment.

The process of cleaning up after GE field trials was called into question earlier that month when it was revealed that the acutely toxic pesticide chloropicrin will be used to "decontaminate" land in Kerikeri, New Zealand following HortResearch's field trial of GE tamarillos.

Chloropicrin, a chlorinated chemical commonly used in tear gas and as a soil fumigant, is highly toxic to the aquatic environment. In addition to acute health effects, exposure to chloropicrin has been linked to recurrent asthma, pulmonary edema, anaemia and irregular heartbeat. Other chronic, long-term effects may include respiratory, eye, skin, heart, gastro-intestinal and musculo-skeletal problems. Occupational exposure to the chemical is also thought to cause rhabdomyolosis, a potentially fatal condition marked by the degeneration of skeletal muscles.

HortResearch's head of science said that the company is undertaking the sterilization in response to community concern. It is believed to be the first attempt to "clean up" land used to grow GE crops.

While one local anti-GE group expressed approval for the attempt to mitigate the risks of the tamarillo trials, The Soil and Health Association of New Zealand expressed great concern over the choice of method and called the use of chloropicrin "unacceptable."

In addition to the danger that the chemical poses to human health and the aquatic environment, critics note that using chloropicrin will kill beneficial organisms such as insects, earthworms, plants, bacteria, fungi and nematodes.

Meriel Watts, Director of the Soil and Health Association of New Zealand, challenged claims about the safety and precision of the genetic engineering process, noting that the reliance on the indiscriminant instrument of a highly toxic chemical "says a lot about science's inability to control their new technology."

*Sources: Ananova, October 16, 2001; The Soil & Health Association of New Zealand, press release, October 16, 2001, October 30, 2001; Reuters, October 30, 2001;* New Zealand Herald, *October 31, 2001; Green Gloves press release*, October 31, 2001.

*Contact: The Soil and Health Association of New Zealand, P O Box 36-170, Northcote, Auckland 9, New Zealand; phone +64 9 480 4440; fax +64 9 480 4440; email info@organicnz.pl.net; Web site http://www.soil-health.org.nz/.*

## ORGANIC PRODUCTION UP IN ARGENTINA

Organic farming is expanding rapidly in Argentina as a growing number of producers are willing to spend more to grow products that can get premium prices. The number of organic farmers in the country has grown from approximately 220 in 1995 to 1,500 this year. The amount of land dedicated to organic farming has also jumped from 5,000 hectares in 1993 about 3 million hectares in 2001.

The nation's economic downturn over the past three years has reduced domestic consumer demand so organic producers are turning to export markets. Argentina exports about 90% of its organic production mostly to the European Union and the United States. Major organic crops include fruit, rice, sugar, tobacco and yerba mate.

Organic grains and oilseeds, especially corn and soybeans, make up the bulk of the exports. An official with Senasa, the national food and animal health inspection service, said that the export of these crops jumped 30% in three years to 40,000 tons in 2000.

The increase in organic farming—predicted as a result of premium prices providing incentives for farmers—is expected to continue to be fueled by exports. In addition, farmers benefit since prices for organic production are often established by contract before the harvest. This helps to insulate them from drastically fluctuating prices that can plague conventional commodity production.

Argentina is the largest producer of organic foods in South America according to an official in Buenos Aires province, where half of the nation's organic crops are produced.

*Source: Reuters, September 17, 2001.*
*Contact: PANNA.*

## OBSOLETE PESTICIDES IN NEPAL

Greenpeace has called on pesticide manufacturers to remove and ensure safe disposal of obsolete pesticides that the companies have exported to and abandoned in Nepal over the past 20 years.

An acute problem across the developing world, there are seven known locations of obsolete pesticides stocks in Nepal containing over 70 tons of pesticides including banned substances such as dieldrin, chlorinated organomercury compounds and DDT.

Companies such as Bayer, Sumitomo, Sandoz, Shell, Rhone Poulenc, DuPont, Union Carbide (Dow) and Monsanto abandoned the pesticides in Nepal after they reached their expiry date or were banned. The companies originally exported most of the pesticides to Nepal as donations or through international "aid" packages.

Attempts to contain a stockpile of obsolete pesticides near Kathmandu, Nepal, have been successful, according to statements by Greenpeace. In October, a dozen activists from India, Germany and the U.K. spent two weeks alongside Nepalese agricultural technicians trying to make an old warehouse safe where pesticides had been stored in

# News Notes

their original—now rusting and rotting—containers. The pesticides—including a thick layer of chemicals that had leaked all over the warehouse floor—threatened local water supplies, irrigation systems and soil as well as the health of local residents, workers and livestock, Greenpeace said.

Working in full protective gear, the clean-up crew aimed to contain all the poisons in high density barrels and hundreds of small containers in order to prepare them for transport back to the original countries of production.

The most dangerous pesticides at the Kathmandu site according to Greenpeace are chlorinated organomercury compounds produced by the German company Bayer and banned in the European Union since 1988. Greenpeace added that Bayer has refused repeated requests from the Nepalese government to help clean up the stocks.

*Source: Environmental News Network, October 18, 2001.*

*Contact: Greenpeace International, Keizersgracht 176, 1016 DW Amsterdam, The Netherlands; phone (31-20) 523-6222; fax (31-20) 523-6200; email supporter.services@ams.greenpeace.org; Web site http://www.greenpeace.org.*

## ESTROGEN-LIKE COMPOUNDS AFFECT PLANTS

A recent study in the journal *Nature* has shown that estrogen-like compounds in pesticides and other chemical pollutants can disrupt the chemical signaling process in plants. Although it is well documented that estrogen-like molecules interfere with animals' hormones, the study is the first to show that such molecules affect the signaling process in plants. The findings suggest that there could be a new range of potential affects on the environment and crops, as well as human and animal fertility.

Normally, leguminous plants such as soy bean, alfalfa, pea and clover send chemical signals to symbiotic bacteria in their roots. The plants use these bacteria to convert nitrogen in the air into a form used for manufacturing protein.

However, after assessing the effects of different chemicals on the bacteria's nitrogen fixing activity, the study found that certain chemicals—such as the pesticide DDT—disrupt the signals between the legumes and the bacteria in their roots. Researchers found that estrogen-like compounds caused up to a 90% decrease in the bacteria's nitrogen fixing activity.

By impairing nitrogen fixation, the application of certain pesticides may have the unintended effect of inhibiting plant growth. Widespread use of nitrogen-supplying fertilizers may have masked this effect, one researcher said.

The study raises concerns about the possible effects on humans and animals. When the signaling process between the bacteria and the plant breaks down and impedes nitrogen fixation, the nitrogen deficient plant increases its signal production. This could lead to elevated levels of natural phyto-estrogens in plants that could possibly be transferred in turn to the human or animal when consumed. Phyto-estrogens are known to mimic hormones—especially those related to fertility—in humans and other mammals.

*Source:* New Scientist, *September 14, 2001.*

*Contact: PANNA.*

## STUDY SHOWS LINK BETWEEN DDT AND EARLY PUBERTY

Pesticide residues may be causing children in developing countries to start puberty unusually early, Belgian researchers say. A recent study found that children who emigrated from India and Colombia were 80 times more likely start puberty at a younger age than Belgian children. The girls in the study started developing breasts before they were eight years old, and started menstruating before they were ten.

The pesticide DDT may be the cause, researchers suspect, since over three-quarters of the children who experienced early puberty had high levels of DDE—a chemical derivative of DDT—in their blood. DDE mimics estrogen, a key hormone that helps to regulate the reproductive system and controls sexual development.

Banned in the U.S. and the European Union for decades, DDT is still widely available and used in some developing countries, often to control malaria.

Testing the children's blood for a range of pesticides revealed that 21 out of 26 immigrant children who experienced early puberty had high levels of DDE. Traces of the chemical were found in only two out of 15 Belgian children.

Children emigrating to other European countries also have a tendency to start puberty early. The study cast doubt on the prevailing explanation that puberty started earlier when undernourished children reached the West and gained weight rapidly. The study's lead researcher discounted the suggestion, noting that some children were well nourished when they arrived. Genetics were an unlikely cause, he added, since the effect was evident in children from a variety of different countries.

However, since many children in developing countries are undernourished, he said, their development is slowed down and they may not experience early puberty. But he added that their reproductive systems may still be harmed, noting that their susceptibility to hormone-sensitive cancers such as breast cancer could be increased.

The research team plans to study the effects of DDE in the lab and also investigate whether immigrant children who experience early puberty have higher levels of pesticide residues in their blood than those who do not. Preliminary results from tests on rats suggest that DDE makes the brain send out signals that start puberty.

*Source:* New Scientist, *May 19, 2001.*

*Contact: PANNA.*

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| Bt | *Bacillus thuringiensis* |
| CA | California |
| CIA | U.S. Central Intelligence Agency |
| DPR | California Department of Pesticide Regulation |
| EPA | U.S. Environmental Protection Agency |
| EU | European Union |
| FAO | UN Food and Agriculture Organization |
| FDA | U.S. Food and Drug Administration |
| GE | Genetic engineering |
| GMO | Genetically modified organism |
| GPC | *Global Pesticide Campaigner* |
| IPM | Integrated pest management |
| NGO | Nongovernmental organization |
| PAN | Pesticide Action Network |
| PANA/P | PAN Asia and the Pacific |
| PANNA | PAN North America |
| PUR | Pesticide Use Reporting |
| POPs | Persistent organic pollutants |
| RUP | Restricted use pesticides |
| UN | United Nations |
| UNDCP | UN Drug Control Programme |
| UNEP | UN Environment Programme |
| USDA | U.S. Department of Agriculture |
| WHO | World Health Organization |
| WTO | World Trade Organization |

# ☛ The Resource Pointer #41

**Propaganda and the Public Mind: Conversations with Noam Chomsky**, 2001. Noam Chomsky and David Barsamian. Provides insight into issues such as U.S. military escalation in Colombia and growing inequality worldwide. Argues that ordinary citizens working together, have the power to make meaningful change. 256 pages. US$16. South End Press, 7 Brookline Street #1, Cambridge MA 02139-4146; phone (800) 533-8478; fax (617) 547-1333; email southend@southendpress.org; Web site http://www.southendpress.org.

**Independent Media Center Web site**, http://www.indymedia.org. Offers grassroots, non-corporate media coverage. Features articles in nine languages plus links to Web sites for more than 40 independent media centers located across North America, South America, Europe, Africa and Australia. Independent Media Center; email general@indymedia.org; Web site http://www.indymedia.org.

**Fairness & Accuracy in Reporting (FAIR) Web site**, http://www.fair.org. Provides articles and analysis of current events neglected in the mainstream media. Analyzes and critiques mainstream media through articles, studies and reports. FAIR, 112 W. 27th Street, New York, NY 10001; phone 212-633-6700; fax 212-727-7668; email fair@fair.org; Web site http://www.fair.org.

**Pesticides Research Report: Do Pesticides Cause Lymphoma?** 2001. Susan Osburn. Reviews and abstracts of 117 scientific studies and articles. Discusses validity of cancer research, individual options to reduce risk and global studies on pesticides and lymphoma. Free; available at http://www.lymphomahelp.org/docs/research/research_report.asp. Lymphoma Foundation of America, P.O. Box 15335, Chevy Chase, MD 20825; phone (703) 525-2076; fax (703) 527-4056; Web site http://www.lymphomahelp.org.

**Pesticides and Human Health**, 2000. Gina Solomon, Oladele Ogunseitan and Jan Kirsch. Highlights impacts of pesticide exposure including acute, dermatological, cancer, respiratory, neurological, reproductive and immune system illness. 60 pp. Free; available at http://www.psrla.org/pesthealth.htm. Contact Californians for Pesticide Reform, 49 Powell Street, Suite 530, San Francisco, CA 94102; phone (415) 981-3939; fax (415) 981-2727; email pests@igc.org; Web site http://www.igc.org/cpr.

**National Resources Defense Council (NRDC) Web site on Contaminants in Breastmilk**, http://www.nrdc.org/breastmilk. Helps parents and others make informed decisions about breastfeeding and babies' health. Contains detailed information on POPs and useful links. NRDC, 40 West 20th Street, New York, NY 10011; phone (212) 727-2700; fax (212) 727-1773; email nrdcinfo@nrdc.org; Web site http://www.nrdc.org.

**Ag Bio Tech InfoNet Web site, http://www.biotech-info.net.** Presents information on agricultural biotechnology with a focus on scientific reports and technical analysis. Special sections on Bt crops and monarch butterflies and more. New materials added weekly. Karen Lutz Benbrook, EcoLogic, Inc., 5085 Upper Pack River Rd., Sandpoint, ID 83864; phone (208) 263-5236; fax (208) 263-7342; email karen@hillnet.com; Web site http://www.biotech-info.net.

**Behind Closed Doors**, 2001. Center for Health, Environment and Justice (CHEJ), Stop Dioxin Exposure Campaign. Provides evidence of the chemical industry's efforts to keep the dangers of dioxin hidden from the public. Free; available at http://www.chej.org/behinddoors.html. Contact CHEJ, P.O. Box 6806, Falls Church, VA 22040; phone (703) 237-2249; email mrohde@chej.org; Web site http://www.chej.org.

**Pesticides in India—Environment and Health Sourcebook**, 2000. Toxics Link. Discusses pesticide industry in India, from manufacture to use. Provides a directory of pesticide research laboratories in India and abstracts of pesticide research publications. 173 pages. US$10. Toxics Link-Delhi, H-2 Ground floor, Jungpura Extension, New Delhi 110014; phone (91-11) 432-8006; fax (91-11) 432-1747; email tldelhi@vsnl.com; Web site http://www.toxicslink.org.

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## PAN Pesticide Database Web site

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## Pesticide Action Network Updates Service (PANUPS)

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## Pesticide Action Network

PAN is an international coalition of citizens' groups who oppose the misuse of pesticides and support reliance on safe, ecologically sound alternatives. Established in 1982, PAN currently links over 400 organizations in some 60 countries, coordinated by five Regional Centers. For more information, contact the Regional Center nearest you.


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