DOWNLOAD PDF HERBICIDES IN THE ENVIRONMENT

Chapter 1 : Environmental Impact | Just Label It

Herbicides are much more than just weed killers. They may exhibit beneficial or adverse effects on other organisms. Given their toxicological, environmental but also agricultural relevance, herbicides are an interesting field of activity not only for scientists working in the field of agriculture.

Because they are used in agriculture and food production, pesticides are present at low levels in many of our diets. Less obvious is the fact that many people use pesticides around their homes, and even on their skin i. According to the NIH, the health effects of pesticides are still not well understood [1]. Potential effects include cancer and damage to the nervous, endocrine, and reproductive systems. Genetically modified organisms GMOs are often engineered to be more resistant to pesticides or produce pesticides themselves. How are GMOs changing the landscape of pesticide usage in our crop fields, and ultimately, the pesticide dosage in our dinners? Pesticides are substances used to repel, kill, or control animals insecticides or plants herbicides that are considered to be pests. There are different types of pesticides, which include synthetic pesticides and biopesticides Figure 1. Pesticides are used extensively in agriculture and they are also used at a lower scale in our homes and on ourselves. According to the National Institutes of Health NIH , the health effects of pesticides are not well understood, but their use has been associated with conditions such as cancer, diabetes, and neurological effects. GMOs have been changing the way that pesticides are used in agriculture. Herbicide-tolerant genetically modified GM crops have led to an increase in herbicide usage while insecticide-producing GM crops have led to a decrease in insecticides. Pesticides are grouped under several classes. As a result, their use has become deeply entrenched in our lives. We as consumers often reap the benefits of pesticide use with lower costs and a wider selection of food and clothing. As a way of conserving food supply and lower food costs, they also help to combat hunger and related problems in various parts of the world see this article. Pesticides can protect our homes and buildings from structural damage by creatures such as termites. They can protect our health, too â€” disease outbreaks are prevented by controlling insect and rodent populations. Pesticides can even disinfect our drinking water and medical instruments [2]. The Downside of Synthetic Pesticides Despite their agricultural, economic, and safety , pesticides can also have negative impacts on our health. Many conventional pesticides are synthetic materials that kill or inactivate the pest directly. These chemical pesticides include compounds such as organophosphates, carbamates, pyrethroids, and sulfonylureas. Short-term exposure to a large amount of certain pesticides can result in poisoning. The effects of long-term exposure to small amounts of these pesticides are unclear, but studies have linked them to a variety of chronic health conditions such as diabetes, cancer, and neurological defects for more detailed information, the EPA has an extensive table of health effects of different pesticides. Specifically, carbamates and organophosphates are known to affect the nervous system by disrupting a neurotransmitter called acetylcholine [3]. A study of 50 pesticides and more than 30, licensed pesticide applicators linked exposure of seven pesticides that contain chlorinated compounds including two herbicides, two organophosphate insecticides, and two organochlorines to increased risk of diabetes [5]. Exposure to pesticides has also been associated with increased infertility in women and developmental problems in children [6]. Natural Pesticides and GMOs Biopesticides are derived from natural materials such as plants, animals, bacteria, and minerals. There are three main categories of biopesticides: Bacillus thuringiensis Bt is a naturally occurring bacterium in the soil that produces proteins specifically active against certain insects. Bt corn is designed to control corn pests such as the European corn borer, corn earworm, and southwestern corn borer, and Bt cotton effectively controls cotton pests such as the tobacco budworm, cotton bollworm, and pink bollworm [7]. The use of Bt crops has led to a reduction in conventional synthetic insecticide use [8] Figure 2. The EPA has analyzed Bt crops and found that they do not pose any significant risks to human health [7]. Specifically, the EPA has done studies showing that the Bt protein in GM plants behaves as would be expected for a dietary protein, is not structurally related to a known food allergen or protein toxin, and does not show toxicity when administered orally at high doses [7]. Timeline of the introduction of Bt corn into cornfields and the concurrent reduction of insecticide usage in these fields. The two quantities are strongly

anti-correlated, suggesting that this Bt crop has made synthetic insecticides unnecessary. Roundup tolerance and the development of herbicide resistance GM herbicide-tolerant crops enable farmers to use certain herbicides that will kill weeds without harming their crop. Glyphosate is the most widely used herbicide in the world by volume [9]. It is employed extensively in agriculture and can be found in garden products in many countries. The use of these herbicide-tolerant crops has allowed farmers to switch from traditional herbicides to glyphosate Figure 3. The good news is that glyphosphate is thought to be less toxic and less persistent than traditional herbicides, which means that it carries fewer health risks for humans [10]. However, the World Health Organization recently announced that glyphosate is a probable carcinogen, so we still need to be cautious [11] for more information, the EPA also has a list of other pesticides and their carcinogen status. Although studies have shown conflicting conclusions about the link between glyphosate and cancer in humans, glyphosate has been linked to cancer in rats and mice and experiments in human cells have shown that exposure to glyphosate can cause DNA damage [9]. Plants may develop resistance to herbicides over time [12]. Weeds that have developed resistance to herbicides such as glyphosate may require higher amounts of glyphosate and perhaps other herbicides to keep them in check, and this means that herbicide-tolerant crops will be exposed to higher levels of herbicides as well. Timeline of glyphosate-based herbicide use on corn, cotton, and soybean in response to the growing popularity of their GMO versions. Since the introduction of Roundup-tolerant crops, herbicides have experienced a significant increase in application. Adapted from [15] Ways to reduce pesticide exposure The lack of conclusive evidence ruling out negative effects of chronic exposure to low doses of pesticides may mean that we should still work to minimize exposure to pesticides when possible. It is especially important to limit the pesticide exposure of more susceptible groups of people such as pregnant women and growing children. Pesticide use should be regulated in a way that will limit development of herbicide and insecticide resistance in their target organisms. This can help prevent an increase in the amount and toxicity of pesticides used. Making sure that farmers are aware of the best ways to limit unwanted pesticide resistance will also be essential. Fortunately, pesticide use is studied, monitored, and regulated by organizations such as the EPA and the World Health Organization. The EPA regulates pesticides in food by evaluating every new pesticide for safety and every new use before it is registered [13]. The EPA evaluates hundreds of scientific studies on pesticides to ensure their safety to humans. After a pesticide is registered, the EPA reevaluates its safety every 15 years [13]. Furthermore, it is essential to strike a balance in pesticide usage: GMOs have played a mixed role in this development, helping reduce pesticide use in some cases e. Thus, their use has not resolved our pesticide conundrum. Encouragingly, research is ongoing to find synthetic pesticides that have high specificity for their target pests. Alternative, non-chemical forms of pest control that are less toxic to humans and other organisms are also being studied [14]. Chances are good that these efforts will become part of the permanent solution. Hsiao is a Ph. Long-term pesticide exposure may increase risk of diabetes. National Institute of Environmental Health Sciences. Non-cancer health effects of pesticides. Are Bt crops safe? Widely used herbicide linked to cancer. Adoption of genetically engineered crops by U. IARC monographs volume Barfoot P and Brookes G. Key global environmental impacts of genetically modified GM crop use Executive summary and report: Herbicide tolerance and GM crops.

Chapter 2 : Weed-Whacking Herbicide Proves Deadly to Human Cells - Scientific American

The term organic herbicide has come to mean herbicides intended for organic farming. Some plants also produce their own natural herbicides, such as the genus Juglans (walnuts), or the tree of heaven ; such action of natural herbicides, and other related chemical interactions, is called allelopathy.

Many common weeds can be either food, medicine, or unwanted visitors to the garden, depending on the varieties and how you view them. The most environmentally friendly way to get rid of weeds is to pull them up, dig out the roots, let them dry in the sun, and then add them to a compost or mulch pile. An herbicide is a "substance that is toxic to plants," which means that your garden plants are just as susceptible to these treatments, they could have a negative effect in the soil if applied in large quantities, and they may cause human injuries if misused. This homemade herbicide is by far the simplest to prepare, and unless you happen to spill boiling water on yourself, is also the least harmful to both people and the environment. The application of direct heat to the foliage of weeds will cause the plants to immediately wilt, and repeated applications will kill any leaves that may resprout from the roots. A flame-weeder tool is available from home and garden stores, which allows you to apply flame and heat directly to the weeds without catching the whole neighborhood on fire. In fire-prone areas, weeding with flame needs to be done with some extra precautions, as dried weeds and grasses can easily catch fire and get away from you. Douse with sodium chloride: Sodium chloride, or common table salt, is an effective herbicide, and has some historical notoriety for possibly being used to lay waste to the soils of conquered peoples salting the fields prevents plants from growing there. Dissolve 1 part salt in 8 parts hot water it can be made stronger, up to 1 part salt to 3 parts water , add a small amount of liquid dish soap to help it adhere to the leaf surfaces , and pour into a spray bottle. Be careful to not soak the soil, and keep this mixture away from cement sidewalks or driveways it may discolor them. Multiple applications may be necessary. The vinegar can be applied by spraying full strength onto the leaves of the weeds, being careful to minimize any overspray on garden plants and nearby soil. Repeated applications may be necessary, and the addition of a little liquid dish detergent may improve the effectiveness of this homemade herbicide. Season them like chips: Another common homemade herbicide recipe calls for combining table salt or rock salt with white vinegar 1 cup salt to 1 gallon vinegar , and then spraying this mixture on the foliage of weed plants. Adding liquid soap is said to help the efficacy of this weedkiller, as is the addition of certain oils, such as citrus or clove oil. Harness up the 20 mule team: Borax, which is sold as a laundry and cleaning product in many grocery stores, might not actually get transported by a 20 mule team anymore, but it could help lend a hand in the yard as an herbicide. Add 10 ounces of powdered borax to 2. Keep overspray off of any plants you want to keep, avoid saturating the soil with the solution, and avoid contact with bare skin. Gardening 6 homemade herbicides: Related Content on Treehugger.

Chapter 3 : Side Effects of Herbicides | www.nxgvision.com

Herbicide Toxicity and Natural Herbicide Alternatives A surprisingly few number of studies have been done on herbicide toxicity to both our human health and the environment. Herbicides tend to get less publicity and less criticism than pesticides.

Weeds have been deemed undesirable during much of human history for their negative influence on crop production, their unsightly appearance in the landscape, and in some cases their toxic properties and negative effects on human and animal health. Consequently, weed control is as old as the discovery of agriculture, eight to ten thousand years ago. Techniques for weed control have progressed from the employment of intensive human labor to complex systems involving mechanical, chemical, and biological methods. The earliest methods to eliminate weeds involved physical removal by grubbing or hoeing, followed by cultivation practices using first draft animals and then tractors. Since , the use of chemical herbicides has become the predominant weed control technique in many parts of the world. Chemicals have been suggested for weed control since antiquity. Other chemicals include sodium chloride , sulfuric acid , sodium arsenite, copper sulfate, iron sulfate, carbon bisulfate, arsenic trichloride, and petroleum oils. The first synthetic herbicide, 2-methyl-4,6-dinitrophenol dinitro was developed in France in for selective weed control in beans. In ammonium sulfamate was introduced for control of woody plants. The chemical herbicide age began in when R. Pokorny first synthesized 2,4-dichlorophenoxy acetic acid 2,4-D and reported that it had growth-regulating effects on plants. Krause of the University of Chicago later suggested that 2,4-D might be used to kill weeds, which stimulated research to test this and other newly synthesized chemicals for weed control in the field. These herbicides proved effective, and in the American Chemical Paint Company was awarded a patent for 2,4-D as a weed killer. The great potential of synthetic herbicides to control weeds and reduce human labor stimulated the birth of the herbicide chemical industry, resulting in the development of over herbicides for weed control by the end of the twentieth century. Herbicides are now primarily developed in the private sector. Chemists typically synthesize a variety of compounds, which are screened for their ability to control weeds and then modified and formulated for efficient use. Present herbicides tend to have very low mammalian toxicity because they inhibit biochemical pathways that are unique to plants. There are a number of chemical classes of herbicides and various mechanisms by which herbicides kill plants. Herbicides generally act by inhibiting specific cellular functions, including photosynthesis, plant-specific amino acid biosynthesis, pigment formation, shoot and root growth, cell membranes, cellulose biosynthesis, lipid biosynthesis, and growth hormone activity. Herbicides may be applied in many ways. Others are primarily applied to emerged foliage and either have an immediate contact effect on the foliage by burning or desiccation, or are translocated throughout the plant, leading to total plant death systemics. Most soil-applied herbicides kill weed seedlings as they emerge from the soil, while foliage-applied herbicides control emerged weeds and can kill quite large plants. Herbicide selectivity, the ability to kill weeds but not crops, can be accomplished either by directed application or through biochemical mechanisms. Placement of the herbicide to avoid contact with the crop is widely used. For example, tree crops with deep roots often do not absorb soil-applied herbicides. While it is an effective herbicide for killing most broadleaf plants dicots , 2,4-D is ineffective on most grassy weeds monocots. This makes it useful in monocot crops, such as grains and turf. Others selectively kill monocot grasses but not dicots, making them effective in crops such as soybean. Some crops metabolize an applied herbicide to an inactive form while the weeds cannot, so the weed is killed, but the crop is not harmed. For example, atrazine is metabolized to an inactive form by maize while weeds are killed. In many weed and crop situations there are no good selectivity mechanisms for herbicides. With the advent of recombinant DNA technology genetic engineering certain crop plants, such as soybean, corn, and cotton, have been made resistant to nonselective herbicides such as glyphosate by adding genes that make the crop immune to the herbicide. This technology is expected to increase, though its rate of acceptance has been slowed by the reluctance of the food industry to utilize transgenic crops because of concerns expressed by certain consumer advocacy groups. Modern agriculture in the United States is almost inconceivable without the use of

herbicides. Herbicides reduce labor inputs for weed control and make it possible to control weeds where cultivation is infeasible. They reduce the need for mechanical cultivation that can injure crop plants and lead to soil degradation via structure loss and compaction. Herbicides allow the use of no-till crop production, which reduces the need for plowing, now considered a destructive practice. Efficient weed control improves crop growth by reducing weed competition for nutrients and water, and results in improved harvesting and crop quality. A Source of Controversy Despite the obvious advantages of herbicides, their use has raised concerns relating to human health and the environment. Since herbicides are toxic to plants, critics have questioned their toxicity to other organisms exposed directly or indirectly. The persistence of some herbicides in the environment has led to concerns relating to their carryover in the soil and effects on subsequent crops as well as their influences, due to drift or volatilization, on non-target plants. Furthermore, through repeated exposure to herbicides, many weeds have become resistant, which reduces the efficacy of previously effective herbicides. Other concerns involve herbicide costs, the requirement for additional equipment for precision application, and questions relating to proper disposal of unused herbicides. The advantages and disadvantages of herbicide use are thoroughly evaluated by the U. All new pesticides must be granted a registration, permitting their distribution, sale, and use. The EPA assesses a wide variety of potential human health and environmental effects associated with use of the product, including the particular site or crop on which it is to be used; the amount, frequency and timing of its use; and recommended storage and container disposal practices. In evaluating a pesticide registration application, the registrant must provide data from tests done according to specific EPA guidelines conducted under recognized "Good Laboratory Practice. The potential human risks evaluated include short-term toxicity and long-term effects, such as cancer and reproductive system disorders. A pesticide will only be registered if it is determined that it can be used to perform its intended function without unreasonably adverse effects on applicators, consumers, or the environment. The EPA also must approve the specific language that appears on each pesticide label; the product can only be legally used according to label directions. The EPA continually evaluates herbicides as to their safety, and any compound that is found to cause any adverse effect is immediately removed from the market. At the present time herbicides provide consistent, broad-spectrum, and effective weed management in an economical manner. In the future, herbicides will be required to pass even more stringent tests related to their safety. While new-generation herbicides will likely be applied at even lower doses with less environmental persistence and exceedingly low toxicity to non-target organisms, herbicides are now recognized as only one factor in efficient weed control. Weed management is an everevolving system that will continue to use an integrated approach, combining cultural, mechanical, chemical, and biological techniques. In this process, however, herbicides will remain an essential component for weed control to help insure a sustainable food production system that reduces unacceptable risks to the environment while producing an abundant and safe food supply. Weller, and Floyd M. Fundamentals of Weed Science. San Diego , Calif.: Weller Pick a style below, and copy the text for your bibliography.

Chapter 4 : Herbicide - Wikipedia

The herbicides 2,4-D, diuron, and prometon, and the insecticides chlorpyrifos and diazinon, all commonly used by urban homeowners and school districts, were among the 21 pesticides detected most often in surface and ground water across the nation (U.S. Geological Survey,).

Home Environmental Impacts When chemicals that are designed to kill are introduced into delicately balanced ecosystems, they can set damage in motion that reverberates through the food web for years. Honeybee populations are plummeting nationwide. Male frogs exposed to atrazine become females. Pesticides are implicated in dramatic bat die-offs. Pesticides wreak havoc on the environment, threatening biodiversity and weakening the natural systems upon which human survival depends. PAN works hard to promote agricultural systems that protect and strengthen, rather than contaminate, our natural ecosystems. The most recent was the killing off of dinosaurs. Seven in ten biologists believe that mass extinction poses an even greater threat to humanity than the global warming which contributes to it. Amphibians were the first to start dying off â€" in scientists identified the cause as a type of fungus, with population declines showing a strong correlation to pesticide exposure. Bats are the most recent victims. In the first cave floors were found covered with dead bats in the Northeast. Some scientists believe that like amphibians, bats have become more susceptible to deadly disease in this case, White Nose Syndrome because their immune systems are weakened by pesticides. Mystery of Disappearing Honeybees Without bees, say goodbye to almonds, peaches - even chocolate. So when the insects suddenly started dying off and abandoning their hives in , scientists, beekeepers and farmers sounded the alarm. As scientists unravel the mystery, they are discovering that exposure to pesticidesâ€"perhaps acting in synergy with other stressorsâ€"is a prime suspect. Most insecticides are inherently toxic to bees, and a recent study found a cocktail of toxic pesticides in the wax and honey of commercial hives. A new class of insecticides called neonicotinoids has been specifically implicated. Many European countries, including France, Germany, Italy and Slovenia, have already banned neonicotinoids in response to the threat, and beekeepers in these countries report that hives are beginning to recover. Meanwhile, researchers in the U. More than 75 million pounds of the herbicide are used on U. And it contaminates water supplies throughout the Midwest at levels above those found to turn male tadpoles into female frogs in the lab. In the s, the Syngenta corporation funded Dr. Tyrone Hayes of UC Berkeley to study the environmental impacts of atrazine. Hayes discovered ovaries growing in the testes of male frogs raised in atrazine-contaminated water, Syngenta refused to let him publish his findings. Genetically, the frogs are still males, but morphologically they are completely femaleâ€"they can even mate successfully with other males and lay viable eggs. Switzerland, where Syngenta is based, banned atrazine in PAN and our Midwest partners are pressing hard for transparent, science-based decisionmaking without undue influence from Syngentaâ€"the largest chemical company in the world. Depending on the type of chemical, contamination can last for days, weeks, months â€" even decades. Pesticides used by homeowners on lawns poison invertebrates at the bottom of aquatic food chains, upsetting fragile ecosystems statewide. Endosulfan runoff from tomato fields threatens the small fish that feed ibises, storks, and egrets. Pesticide runoff remains largely unregulated, and government agencies have shown little initiative in protecting complex aquatic ecosystems. Fortunately, when tainted runoff threatens a species already listed as endangered, the government can be forced to act. In the pacific northwest, creeks that are home to endangered salmon now require substantial buffer zones from toxic pesticides. The Center for Biological Diversity recently took legal action to force EPA to protect threatened and endangered species from of the most dangerous pesticides.

Chapter 5 : Environmental Impacts | Pesticide Action Network

From orchids and moths to hedgehogs and toads, our wildflowers and wildlife are dying out. Making the meadows safe again is a huge challenge - but there are glimmers of hope.

Learn More Weed Control and Herbicides If you decide to use an herbicide to control weeds, be sure to select the appropriate product for your situation. There are hundreds of different herbicides on the market. Be sure to read, understand and follow all of the label directions when mixing and applying herbicides. Make sure the label clearly states that the product can be used in the manner you intend to use it. Remember, more is not better. Use the application rate on the label. Some herbicides are selective, and only kill certain types of plants , while others are non-selective and kill almost any type of plant. Some herbicides kill weeds quickly, others can take up to a week or more. Some herbicides persist in plants and soils for long periods of time, while others only remain in plants or soil for a short time. Some herbicides have active ingredients that are more likely to move through soils towards groundwater. Others are much less likely to move through soils. The following list of resources is intended to provide an overview of weed control and herbicides. If you have specific questions about herbicides, or about any of the information provided below, feel free to call NPIC. If you just want some advice about how to control weeds, you may want to talk with staff at your local cooperative extension service. NPIC Specialists cannot give treatment recommendations, but extension agents often can. Our mission is to provide objective, science-based information about herbicides in order to empower people to make their own informed decisions. If you have questions about this, or any pesticide-related topic, please call NPIC at 8: Last updated May 04, Weeds Identify the type of weed s before choosing a treatment strategy. Identify weeds you can tolerate. Remove other weeds first. Hand pulling weeds before they flower will prevent the spread of weed seeds. You can place them directly into a bag for disposal. Deeply water an area and cover with a thick layer of cardboard or plastic to kill all plants present. A healthy lawn will naturally fight weeds. Consider mowing on a higher setting, and aerating and fertilizing when needed. Water more deeply, and less often, to discourage weeds. Mulches organic, synthetic, or living can be used to prevent weeds from growing. If you choose to use a pesticide, read the label before you buy. Try a lower toxicity product first. A few days before spraying, consider cutting the weeds back. Spraying on new growth may lower the amount needed. If you have a pesticide product in mind, have your label handy and click here for information about that product. County Extension Offices Through its county agents, the Cooperative Extension Service gives individuals access to the resources at land-grant universities across the nation. These universities are centers for research in many subjects, including entomology the study of insects and agriculture. Each county within the United States has an Extension office, which is staffed with agents who work closely with university-based Extension specialists to deliver answers to your questions about gardening, agriculture, and pest control. You can find the phone number for your local county extension office in the local government section often marked with blue pages of your telephone directory or by clicking on the map below.

Chapter 6 : Impact of pesticides use in agriculture: their benefits and hazards

Herbicides vary in their potential to dissipate in the environment. As soon as an herbicide is applied to its target, several processes immediately begin to remove the compound from the site of application.

Nearly 4, inert ingredients are approved for use by the U. About million pounds are applied to U. Until now, most health studies have focused on the safety of glyphosate, rather than the mixture of ingredients found in Roundup. The research team suspects that Roundup might cause pregnancy problems by interfering with hormone production, possibly leading to abnormal fetal development, low birth weights or miscarriages. Hundreds of studies over the past 35 years have addressed the safety of glyphosate. The EPA classifies glyphosate as a Group E chemical, which means there is strong evidence that it does not cause cancer in humans. In addition, the EPA and the U. The EPA has concluded that it is not dangerous to public health or the environment. The French team, led by Gilles-Eric Seralini , a University of Caen molecular biologist, said its results highlight the need for health agencies to reconsider the safety of Roundup. Scientists there also linked genetic malformations in amphibians to glysophate. In addition, last year in Sweden, a scientific team found that exposure is a risk factor for people developing non-Hodgkin lymphoma. Inert ingredients are often less scrutinized than active pest-killing ingredients. Although Monsanto is the largest manufacturer of glyphosate-based herbicides, several other manufacturers sell similar herbicides with different inert ingredients. Kemery said the EPA takes into account the inert ingredients and how the product is used, whenever a pesticide is approved for use. But some inert ingredients have been found to potentially affect human health. Many amplify the effects of active ingredients by helping them penetrate clothing, protective equipment and cell membranes, or by increasing their toxicity. For example, a Croatian team recently found that an herbicide formulation containing atrazine caused DNA damage, which can lead to cancer, while atrazine alone did not. POEA was recognized as a common inert ingredient in herbicides in the s, when researchers linked it to a group of poisonings in Japan. Doctors there examined patients who drank Roundup, either intentionally or accidentally, and determined that their sicknesses and deaths were due to POEA, not glyphosate. POEA is a surfactant, or detergent, derived from animal fat. In the French study, researchers tested four different Roundup formulations, all containing POEA and glyphosate at concentrations below the recommended lawn and agricultural dose. They also tested POEA and glyphosate separately to determine which caused more damage to embryonic, placental and umbilical cord cells. Umbilical cord cells were especially sensitive to POEA. The research appears in the January issue of the journal Chemical Research in Toxicology. These ranged from the typical agricultural or lawn dose down to concentrations , times more dilute than the products sold on shelves. The researchers saw cell damage at all concentrations. Goldstein said humans have protective mechanisms that resist substances in the environment, such as skin and the lining of the gastrointestinal tract, which constantly renew themselves. When they returned two weeks later, they found that 50 to percent of the populations of several species of tadpoles had been killed. This article originally ran at Environmental Health News , a news source published by Environmental Health Sciences, a nonprofit media company.

Chapter 7 : Pesticides and the Environment

Overview. Herbicides are used to kill weeds and other undesirable plants. There are many different types of herbicides, all of which can be dangerous to humans or the environment if used irresponsibly.

The Effects of Cigarette Smoking in Cells Pesticides and herbicides are pervasive chemicals in the environment. Pesticide, according to HistoryofWaterFilters. Herbicides are believed to present a bigger threat because they are highly concentrated in the water supply, due to runoff from agricultural use. These consequences are especially alarming as their effects are believed to induce devastating and life-long diseases, and deformities in children and unborn fetuses. Endocrine Disruptors The endocrine system is a messaging system that uses hormones and the bloodstream to convey responses throughout the body. A Pesticides News article classifies pesticides as endocrine disruptors. The action of these chemicals has been described as able to mimic the effects of human estrogen or testosterone; additionally, they are disruptive to the synthesis and breakdown of both estrogen and testosterone. The major endocrine glands include the pituitary gland, thyroid, adrenals, ovaries and testes. Adults can be affected by these chemicals. The article suggests however, that the effects that accumulate over the years in a developing person or during the intricate in-utero developmental process are far more dangerous. It has been found that animals and humans exposed to these chemicals in the womb are at a high risk of developing deformed reproductive anatomies, defects or alterations in sexual behavior, sperm counts, metabolism and brain development. Petroleum, as a fat-soluble substance, has long-term effects in the body because it remains in fat-laden tissues, like the brain and adipose cells, for a long period of time. Children are noted by the Pesticide Action Network to be at a higher risk for brain development and functional issues associated with pesticides, due to a higher consumption by children of such chemicals. The article notes that, when comparing food and air consumption on a pound to pound basis in children versus adults, children are more greatly exposed to environmental pesticides and herbicides. Moreover, a Pediatrics journal article theorized that organophosphates, a class of pesticide, may contribute to the prevalence of ADHD; exposure to this pesticide is most common in American children in the 8- to year-old age group. However, additional research is needed to confirm a causal relationship. Cancer Many studies of pesticides and herbicides have been performed on the workers and handlers of these chemicals, such as farmers and their families. However, a Organic Consumers Association article by Dan Sharpley notes that a specialized type of cancer known as acute lymphoblastic leukemia is assumed to be directly linked to pesticide exposure in a normal, non-agriculture setting. They add that pesticides are not directly causative and that genetic susceptibility also plays a role. Other Effects The diversity of pesticides and the way that each person metabolizes them may shed light on their diverse actions and detrimental effects in the body. Outside of their major effects on the endocrine system and their role in inducing neurological issues and childhood cancers, the site lists other non-specific effects of ingestion as eye, liver, kidney or spleen problems. They additionally describe anemia, cardiovascular, stomach and intestinal problems as related to pesticide exposure.

Chapter 8 : The Effects of Herbicides & Pesticides on Humans | Healthfully

Persistent herbicides can remain active in the environment for long periods of time, potentially causing soil and water contamination and adverse effects to nontarget organisms. In some cases, compounds that result from herbicide degradation may continue to be significantly toxic in the environment.

History[edit] Prior to the widespread use of chemical herbicides, cultural controls , such as altering soil pH, salinity, or fertility levels, were used to control weeds. Although research into chemical herbicides began in the early 20th century, the first major breakthrough was the result of research conducted in both the UK and the US during the Second World War into the potential use of herbicides in war. Templeman at Imperial Chemical Industries. In , he showed that "Growth substances applied appropriately would kill certain broad-leaved weeds in cereals without harming the crops. In the same year, Pokorny in the US achieved this as well. By analyzing soil as a dynamic system, rather than an inert substance, he was able to apply techniques such as perfusion. Quastel was able to quantify the influence of various plant hormones, inhibitors and other chemicals on the activity of microorganisms in the soil and assess their direct impact on plant growth. While the full work of the unit remained secret, certain discoveries were developed for commercial use after the war, including the 2,4-D compound. It allowed for greatly enhanced weed control in wheat , maize corn , rice , and similar cereal grass crops, because it kills dicots broadleaf plants , but not most monocots grasses. The low cost of 2,4-D has led to continued usage today, and it remains one of the most commonly used herbicides in the world. Like other acid herbicides, current formulations use either an amine salt often trimethylamine or one of many esters of the parent compound. These are easier to handle than the acid. Further discoveries[edit] The triazine family of herbicides, which includes atrazine , were introduced in the s; they have the current distinction of being the herbicide family of greatest concern regarding groundwater contamination. Atrazine does not break down readily within a few weeks after being applied to soils of above neutral pH. Under alkaline soil conditions, atrazine may be carried into the soil profile as far as the water table by soil water following rainfall causing the aforementioned contamination. Atrazine is thus said to have "carryover", a generally undesirable property for herbicides. Glyphosate Roundup was introduced in for nonselective weed control. Following the development of glyphosate-resistant crop plants, it is now used very extensively for selective weed control in growing crops. The pairing of the herbicide with the resistant seed contributed to the consolidation of the seed and chemistry industry in the late s. Many modern chemical herbicides used in agriculture and gardening are specifically formulated to decompose within a short period after application. This is desirable, as it allows crops and plants to be planted afterwards, which could otherwise be affected by the herbicide. However, herbicides with low residual activity i. This gives rise to a considerable level of terminology related to herbicides and their use. Intended outcome[edit] Control is the destruction of unwanted weeds, or the damage of them to the point where they are no longer competitive with the crop. Suppression is incomplete control still providing some economic benefit, such as reduced competition with the crop. Crop safety, for selective herbicides, is the relative absence of damage or stress to the crop. Most selective herbicides cause some visible stress to crop plants. Defoliant , similar to herbicides, but designed to remove foliage leaves rather than kill the plant. Selectivity all plants or specific plants [edit] Selective herbicides control or suppress certain plants without affecting the growth of other plants species. Selectivity may be due to translocation, differential absorption, physical morphological or physiological differences between plant species. They are used to clear industrial sites, waste ground, railways and railway embankments. Paraquat, glufosinate, glyphosate are non-selective herbicides. Preplant herbicides are nonselective herbicides applied to soil before planting. Some preplant herbicides may be mechanically incorporated into the soil. The herbicides kill weeds as they grow through the herbicide treated zone. Volatile herbicides have to be incorporated into the soil before planting the pasture. Agricultural crops grown in soil treated with a preplant herbicide include tomatoes, corn, soybeans and strawberries. Soil fumigants like metam-sodium and dazomet are in use as preplant herbicides. Preemergence herbicides are applied before the weed seedlings emerge through the soil surface. Herbicides do not prevent weeds from germinating but they

kill weeds as they grow through the herbicide treated zone by affecting the cell division in the emerging seedling. Dithopyr and pendimethalin are preemergence herbicides. Weeds that have already emerged before application or activation are not affected by pre-herbicides as their primary growing point escapes the treatment. These herbicides are applied after weed seedlings have emerged through the soil surface. They can be foliar or root absorbed, selective or nonselective, contact or systemic. Application of these herbicides is avoided during rain because the problem of being washed off to the soil makes it ineffective. Herbicides applied to the soil are usually taken up by the root or shoot of the emerging seedlings and are used as preplant or preemergence treatment. Several factors influence the effectiveness of soil-applied herbicides. Weeds absorb herbicides by both passive and active mechanism. Herbicide adsorption to soil colloids or organic matter often reduces its amount available for weed absorption. Positioning of herbicide in correct layer of soil is very important, which can be achieved mechanically and by rainfall. Herbicides on the soil surface are subjected to several processes that reduce their availability. Volatility and photolysis are two common processes that reduce the availability of herbicides. Many soil applied herbicides are absorbed through plant shoots while they are still underground leading to their death or injury. EPTC and trifluralin are soil applied herbicides. These are applied to portion of the plant above the ground and are absorbed by exposed tissues. These are generally postemergence herbicides and can either be translocated systemic throughout the plant or remain at specific site contact. External barriers of plants like cuticle, waxes, cell wall etc. Glyphosate, 2,4-D and dicamba are foliar applied herbicide. An herbicide is described as having low residual activity if it is neutralized within a short time of application within a few weeks or months - typically this is due to rainfall, or by reactions in the soil. An herbicide described as having high residual activity will remain potent for a long term in the soil. For some compounds, the residual activity can leave the ground almost permanently barren. Mechanism of action[edit] Herbicides are often classified according to their site of action, because as a general rule, herbicides within the same site of action class will produce similar symptoms on susceptible plants. Classification based on site of action of herbicide is comparatively better as herbicide resistance management can be handled more properly and effectively. List of mechanisms found in modern herbicides[edit] ACCase inhibitors: Acetyl coenzyme A carboxylase ACCase is part of the first step of lipid synthesis. Thus, ACCase inhibitors affect cell membrane production in the meristems of the grass plant. These herbicides slowly starve affected plants of these amino acids , which eventually leads to inhibition of DNA synthesis. They affect grasses and dicots alike. The ALS biological pathway exists only in plants and not animals, thus making the ALS-inhibitors among the safest herbicides. Enolpyruvylshikimate 3-phosphate synthase enzyme EPSPS is used in the synthesis of the amino acids tryptophan , phenylalanine and tyrosine. Synthetic auxins inaugurated the era of organic herbicides. They were discovered in the s after a long study of the plant growth regulator auxin. Synthetic auxins mimic this plant hormone. They have several points of action on the cell membrane, and are effective in the control of dicot plants. They bind to the Qb site on the D1 protein, and prevent quinone from binding to this site. Therefore, this group of compounds causes electrons to accumulate on chlorophyll molecules. As a consequence, oxidation reactions in excess of those normally tolerated by the cell occur, and the plant dies. The triazine herbicides including atrazine and urea derivatives diuron are photosystem II inhibitors. As a result, reactive oxygen species are produced and oxidation reactions in excess of those normally tolerated by the cell occur, leading to plant death. If this happens, the plants turn white due to complete loss of chlorophyll, and the plants die. To do this, farmers must know the mode of action for the herbicides they intend to use, but the relatively complex nature of plant biochemistry makes this difficult to determine. Attempts were made to simplify the understanding of herbicide mode of action by developing a classification system that grouped herbicides by mode of action. This information will make it easier to develop educational material that is consistent and effective. Knowing about herbicide chemical family grouping could serve as a short-term strategy for managing resistance to site of action. Most herbicides are applied as water-based sprays using ground equipment. Towed, handheld, and even horse-drawn sprayers are also used. On large areas, herbicides may also at times be applied aerially using helicopters or airplanes, or through irrigation systems known as chemigation. A further method of herbicide application developed around , involves ridding the soil of its active weed seed bank rather than just killing the

weed. This can successfully treat annual plants but not perennials. Because most weeds are annuals, their seeds will only survive in soil for a year or two, so this method will be able to destroy such weeds after a few years of herbicide application. This allows treatment of taller grassland weeds by direct contact without affecting related but desirable shorter plants in the grassland sward beneath. The method has the benefit of avoiding spray drift. In Wales , a scheme offering free weed-wiper hire was launched in in an effort to reduce the levels of MCPA in water courses. Sometimes, the wrong field or plants may be sprayed due to error. Use politically, militarily, and in conflict[edit].

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The impact of pesticides consists of the effects of pesticides on non-target www.nxgvision.comides are chemical preparations used to kill fungal or animal pests. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields.

Pesticides in our Environment Sam Claydon T Although each pesticide is meant to kill a certain pest, a very large percentage of pesticides reach a destination other than their target. Pesticides easily contaminate the air, ground and water when they run off from fields, escape storage tanks, are not discarded properly, and especially when they are sprayed aerially. Water Pesticides can be found in rain, ground water, streams, rivers, lakes and oceans. There are four major ways that pesticides can reach the water: Studies by the UK government show that pesticide concentrations exceed those allowable for drinking water in some samples of river water and groundwater. Soil The use of pesticides decreases the general biodiversity in the soil. Soil quality is higher without chemicals and this allows for higher water retention, necessary for plants to grow. Plants Nitrogen fixation, which is necessary for the growth of many large plants, is hindered by pesticides that can be found in soil. This can lead to a large decline in crop yields. Application of pesticides to crops that are in bloom can kill honeybees, which act as pollinators. This also decreases crop pollination and reproduction. Animals Animals may be poisoned by pesticide residues that remain on food after spraying. An application of pesticides in an area can eliminate food sources that certain types of animals need, causing the animals to relocate, change their diet, or starve. Poisoning from pesticides can even make its way up the food chain; for example, birds can be harmed when they eat insects and worms that have consumed pesticides. Birds There is evidence that birds are being harmed by pesticide use. Types of fungicides used in farming are only slightly toxic to birds and mammals, but may kill off earthworms, which can in turn reduce populations of the birds and mammals that feed on them. A few granules of a pesticide are enough to kill a small bird. Herbicides may also endanger bird populations by reducing their habitat. Aquatic Life Fish and other aquatic biota may be harmed by pesticide-contaminated water. Repeated exposure of some pesticides can cause physiological and behavioural changes in fish that reduce populations, such as abandonment of nests, decreased immunity to disease, and increased failure to avoid predators.