FARMER INFORMATION KIT

Pesticides & The Chesapeake Bay Watershed Project

ACKNOWLEDGMENTS

This Kit was produced by staff and participants of the *Pesticides & the Chesapeake Bay Watershed Project's* Agriculture Working Group. This group is comprised of diverse experts from the agricultural community, government agencies and technical researchers, including representatives of: Johns Hopkins Center for a Livable Future, U.S. Department of Agriculture-Natural Resources Conservation Service, University of Maryland Extension Services, Maryland Organic Food and Farming Association, IPM Institute of North America, as well as private experts in IPM and organic land care.

The recommendations included in the Kit were developed by members of the Agriculture Working Group in their individual capacities; this acknowledgment of their contributions to the Kit does not indicate full endorsement of any or all of the Farmer Information Kit contents by them or their agencies and organizations.

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The purpose of this kit is to address the concerns of farmers in the Chesapeake Bay region with at-a-glance, constructive information on a number of important issues related to the use of pesticides, especially Best Management Practices (BMPs) and conservation planning to reduce pesticide impact on health and the environment. Pesticides play a critical role in modern agriculture, helping farmers protect crops from damage by insects, weeds, rodents and molds – thus increasing the yield, or storage life of crops. However, a growing body of research links them to a range of acute and chronic illnesses, as well as the environmental decline of the Bay watershed.

The fact sheets in this kit were developed by the Project's Agriculture Working Group, which consists of experts with a range of opinions on BMPs. Group members include experts from USDA, UMD Extension Services, MD Organic Farmers Association, IPM Institute of North America, Johns Hopkins Center for a Livable Future, as well as riverkeepers and officials from watershed associations. Their participation does not imply endorsement or agreement with all aspects of this document. With their input, every effort was made to take into account the varying perspectives of farmers regarding BMPs – both in terms of the benefits they see from pesticides, as well as their increasing concern about the health impacts from ongoing exposure to these chemicals. All journals cited are peer reviewed scientific publications. In addition, a significant portion of the sourcing for this kit comes from a variety of content provided by the agricultural extension services of several states. This kit is intended to provide user-friendly information, along with guidance on freely available sources of credible, in-depth content accessible online from government agencies, extension services and scientifically respected non-profit organizations.

The Kit is intended to provide helpful information on key concerns: pesticides and family health, the impact of pesticides on the Bay, conservation planning, best management practices and alternative practices – all of which are economically and environmentally sound.

Feedback is always welcome.

The Pesticides and the Chesapeake Bay Watershed Project was established in 2007 by the Maryland Pesticide Network and the Johns Hopkins Center for a Livable Future. The Project is the first working group in Maryland dedicated to reducing the occurrence and risks of pesticides in the Bay watershed, in order to protect water quality, aquatic life, wildlife and public health. Project participants include scientists, public health experts, waterkeepers, watermen, federal, state, and county government agency representatives, representatives of the agricultural and pest management industries and environmental organizations.

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Contents

FACT SHEET NO. 1

History of Pesticides – The Dilemma

The agricultural revolution of the past 60 years has enabled farmers to feed a growing world population. Pesticides have been a key to this dramatic expansion of national and international food production. While pest management has been a part of agriculture for more than 2,000 years, it has largely been in recent decades that we have seen growing concern about the negative consequences of chemical pesticides on the health of farmers and the public, as well as on the environment.

While pesticides play a critical role in modern agriculture, a growing body of research links them to a range of acute and chronic illnesses, as well as environmental decline...

- More than 2,000 years ago, the Chinese used ants as a form of biocontrol against caterpillars. The Romans used Hellebore, a poisonous herb, to control rats. Centuries later, several pesticides and herbicides found in nature came into wide use, such as: Pyrethrum, an insecticide derived from chrysanthemums, discovered in the 1300's.
- Arsenic, discovered in 1600's and used as an insecticide and weed killer.
- Nicotine, originally discovered to kill aphids, which suck the juice from plants.

The use of these substances preceded methyl bromide and DDT in the 1930's, phenoxyacetic acids in the early 1940's and organophosphates, which originally were created as pesticides in Germany, and were adapted for use as weapons of war and used in gas chambers by the Nazis in World War II. After the war, chemical pesticide use increased crop yields and became an integral aspect of agricultural practices by the mid-1950s. Since then, pesticides have allowed for a dramatic increase in world food production.

Congress approved the first pesticide regulations in 1947 with the enactment of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), which was primarily intended to protect farmers and others from mislabeled, ineffective or adulterated pesticides. In 1970, authority for pesticide regulation was moved from USDA to the newly-created Environmental Protection Agency (EPA). Under FIFRA:

- EPA can prohibit the use of a pesticide in the United States, restrict uses and set the level of pesticide residues.
- Pesticide manufacturers must obtain a registration for their products from EPA.
- Registration requires the manufacturer to supply data demonstrating that the pesticide "will perform its intended function without unreasonable adverse affects on public health or the environment." This is defined as "any unreasonable risk to man or the environment, taking into account the economic, social and environmental costs and benefits of the use of any pesticide."

MID-20TH CENTURY FARMING

Up to the early 1970's, many farmers had to make seven trips across a field for weed control. They had to walk their soybean fields and vegetable fields during hot weather to cut or chop out weeds. However labor was much less expensive then and farm children supplied most of the agricultural labor force. The typical acreage of a grain farmer on Delmarva was 500 acres, with 250 acres of corn and 250 acres of soybeans.

Disease and insects robbed farmers both of quantity and quality of their products. Many cooperative buyers of vegetables that would be canned or frozen required high-quality, disease and insect-free produce. The development and growth in insecticides and fungicides allowed growers to save on increasing labor costs, while applying preventive suppression treatments of fungicides and insec-

ticides in order to meet buyers' standards. This also enabled individual farmers to manage larger acreage. In 2008, the average size of a grain farmer on Delmarva was approximately 3000 acres – six times larger than it was 30 years earlier.

CONCERNS REGARDING RELIANCE ON PESTICIDES IN AGRICULTURE

While pesticides have played a critical role in modern agriculture, a growing body of research links them to a range of both acute and chronic illnesses, as well as environmental decline. Pesticides also have posed challenges for farmers – including the development of pesticide-resistant pests, killing of beneficial insects, and secondary pest outbreaks. Recent research indicates the effectiveness of certain pesticides is decreasing. More than 500 insect species have developed resistance to at least one pesticide, along with 270 species of weeds and 150 plant diseases[1]. Consequently, farmers have needed to use larger doses and more frequent pesticide applications.

Although pesticides do offer benefits for farmers and other users, research indicates that pesticides are linked to health-related and environmental problems (see Fact Sheets No. 2 and 3 in this kit). For example, certain pesticides are considered endocrine disruptors – substances that may cause cancer and reproductive disorders in humans and wildlife, at low doses. These chemicals include the herbicides atrazine (banned by the European Union in 2004) and alachlor (banned by the European Union in 2006). Intersex fish – male fish bearing immature eggs – found in the Potomac and other waterways in our area have been linked to low levels of endocrine disruptors and other industrial chemicals.

FOOD QUALITY PROTECTION ACT

Due to concern about the adverse impacts of pesticides, Congress passed the Food Quality Protection Act in 1996. This law changed the way EPA regulates pesticides[2], by changing how it sets residue limits for pesticides on foods. The law requires EPA to:

- Publish specific safety findings before a residue limit can be established;
- Tighten these limits by a factor of ten to protect the health of infants and children;
- Make re-registration of existing pesticides easier, but reassess existing residue limits whenever it reevaluates a pesticide's registration;
- Consider the special vulnerability of infants and children to pesticide risks;
- First address those pesticides that pose the greatest health hazards.
- Complete reviews of the registration of all existing pesticides within 15 years[3].

Despite its mandate to use an extra ten-fold margin of safety to ensure that thresholds are safe for infants and children, EPA has not regularly applied this safety factor in its review of pesticides and has been known to reduce the safety factor down to 1x for certain pesticides, despite the law's requirement for a 10 x safety factor.

TRANSITION TO REDUCED PESTICIDE USE

In recent decades, new technology, the transition to Integrated Pest Management (IPM) and the growth in organic farming all have provided models and strategies for reducing pesticide runoff to the Bay, as well as for reducing and even eliminating reliance on pesticides in agriculture.

Increasing number of farmers are learning about and implementing IPM. According to the IPM Institute of North America, IPM includes:

1 Benbrook, Pest Management at the Crossroads, 1996)
2 US Environmental Protection Agency, 2003b
3 Percival et al, 1998

- A thorough understanding of pests and pest biology;
- Careful inspection and monitoring for pest presence and pest conducive conditions;
- Pest prevention utilizing a variety of strategies.

Pesticides are used only when non-chemical measures are inadequate. University of Maryland Extension Services website states that "Natural control factors regulate pest populations and are maximized in IPM as the primary means of management; if this strategy fails to maintain pests below economic levels, in IPM, then pesticides in combination with other tactics are used as a last resort."

Farmers who implement Integrated Pest Management (IPM), as well as organic farmers, understand that maintaining a soil environment rich in microbiology – that is able to sustain healthy crop, withstand insects, weeds, disease, drought and heat stress – reduces the need for chemical intervention. Adequate soil microbiology is critical for uptake of the nutrients in natural fertilizers by crops for sustained plant health. "Feed the soil" is the cornerstone for natural resistance to pests and disease.

Many farmers look upon the increasing use of pyrethroid pesticides as a less toxic alternative, when contrasted with traditional organophosphate pesticides, which are declining in use. However there is increasing concern among some farmers and consumers about these synthetic chemicals, which are found (along with pyrethrins) in over 3,500 registered products used in households, on pets, for mosquito control and in agriculture. Although pyrethroids are less acutely toxics to some animals, U.S. EPA notes that pyrethroids in urban runoff expose aquatic life to harmful contamination in water and sediment.[4] Pyrethroids are toxic to some aquatic species and are linked to breast cancer and reproductive disorders in humans.

CONCERNS FOR FARMERS REGARDING PESTICIDES

Health

A growing number of farmers are troubled about the impact of pesticides on the health of their families, employees and neighbors, as well as the impact on the environment. As a result, they are implementing IPM to reduce their pesticide use and exposure (see Fact Sheet No. 2 in this kit).

Cost-effectiveness of Best Management Practices

An important concern for farmers is how shifting from conventional farming to reduced pesticide use farming impacts their livelihood. Farmers are confronting challenging questions regarding the economic impact of such a shift. For example, a farmer must consider quantity (yield), quality, cost of production and market for product, in order to ensure a positive bottom line and stay competitive.

Herbicides used both to prevent weed growth and to kill weeds have allowed for reduced tillage. This in turn has reduced fuel, energy, and labor costs. It also has reduced equipment wear and tear.[5] No-tillage is becoming a more popular agricultural practice, due to continuing improvements in equipment technology since the mid-1980s. According to the Conservation Technology Information Center (CTIC), no-till adoption in the United States has increased more than 200 percent since 1990 from nearly 17 million acres to over 51 million acres. The impact of till vs. no-till practices on the Bay and its tributaries is controversial among experts in the field, including the contributors to this Kit. Some experts hold that no-till farming practices, while helping the Bay by reducing the amount of nutrients needed, increase use of some pesticides, including atrazine, which has been

4 http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html
5 http://www.ag.ohio-state.edu/~news/story.php?id=2007

detected in 100 percent of water samples. Other experts state that no-till actually reduces pesticide usage and runoff. The answer to whether till or no-till is the best environmental practice is usually a site-specific soil quality issue. Best management practices – including Integrated Pest Management – must introduce methods that address both concerns and eliminate pesticide and nutrient runoff into the Bay and its tributaries.

It is important to note that there is a growing consumer base for both local food and food grown without pesticides. An increasing number of farms with smaller acreage – including organic farms – have shown it is possible to reduce and even eliminate reliance on pesticides. In order to reduce pesticide use and stay competitive, farmers need to assess what pesticides they can reduce or eliminate through the practice of IPM and still maintain yield and quality, preserve their markets and ensure a positive bottom line.

Responsible Pesticide Use

Certified Crop Advisors can help farmers address their IPM plans and needs, while using the most effective and least toxic products when non-chemical interventions have failed. Hiring a properly certified and trained pest management applicator is critical to implementing an IPM program in which a farmer can transition to reduced use of pesticides. The Maryland Department of Agriculture's Best Management Practices[6] provides guidance on this and other important issues.

6 http://www.mda.state.md.us/pdf/bmp.pdf

FACT SHEET NO. 2

Pesticides & Your Family's Health

Recent research suggests that farmers, their families and other agricultural workers are at increased risk of a wide range of physical and mental health problems due to pesticide exposure. Illnesses and symptoms related to pesticide exposure and poisoning affect not only farmers, but may also occur in their spouses and children. Even people who do not work in agriculture but live in agricultural areas are at risk for a multitude of health problems. Many health effects linger long after exposure, and are not limited to high-dose incidents, but also may result from consistent, low or moderate exposure over time.

For farmers considering how to reduce exposure to pesticides, the Rodale Institute offers a comprehensive online course…

RESPIRATORY PROBLEMS

Research indicates that there may be a "role for specific pesticides in respiratory symptoms among farmers".[7] These symptoms range from minor irritation to indicators of serious disease, such as lung cancer, which is associated with several widely used insecticides.[8]

Untreated mold damage and insect damage, which causes respiratory and other health problems, can affect both the quality and yield of some crops. Non-chemical preventive measures can be taken to avoid mold damage. However, pesticides often are used to address mold when it exists. Many agricultural workers suffer from farmer's lung, which until recently had been solely attributed to breathing allergenic dust from moldy crops. Symptoms include shortness of breath and a general feeling of illness, and can even become fatal, as the underlying cause may not be found until after a substantial amount of damage has been done to the lungs[9]. But according to a 2006 study, pesticides were also found to be associated with farmer's lung. Pesticides, herbicides, and fungicides may also contribute to asthma symptoms in farm workers[10]. Farm women who mixed or applied pesticides showed a 50% increase in prevalence of allergic asthma[11]. Farmers are also at increased risk for allergic rhinitis[12] (also known as hay fever), a swelling of the nasal passages often accompanied by a runny nose and itchy eyes. Symptoms may be severe enough to interfere with everyday activities. Pesticide exposure is also associated with chronic bronchitis, particularly in individuals who have experienced high exposure.[13]

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DNA DAMAGE

Research also has linked pesticide exposure to DNA damage, which can cause multiple health problems such as cancer, neurological diseases and other genetic defects. A 2008 study found that "chronic exposure to pesticides produces DNA damage in pesticide sprayers,"[14] with other studies showing similar findings[15].

CANCER

Pesticides also have been linked to various forms of cancer. Atrazine, for example, may be associated with lung, bladder, non-Hodgkin's lymphoma, and multiple myeloma.[16] Research shows that chlorinated pesticide use by applicators older than 50 is a significant risk factor for prostate cancer,[17] and those with a family history of the disease are especially at risk.

The common herbicides pendimethalin and EPTC show significant association with pancreatic cancer.[18] One study finds an increased risk of gastric cancer among workers in fields treated with 2, 4-D, chlordane, propargite, and trifluin.[19] According to the U.S. Agricultural Health Study,[20] "exposure to amine pesticides may be an overlooked exposure in the [cause] of bladder and colon cancer. Even children of farm workers may be affected. One study finds that "parental exposure to certain pesticides may increase the risk of leukemia in offspring."[21] Low-level exposure has been indicated as a risk factor in childhood cancers, based on risk factors showing a significantly higher risk in children living in areas of high levels of agricultural activity.[22]

NEUROLOGICAL EFFECTS

Research has linked pesticide use to neurological symptoms, such as depression -- not only "cumulative lifetime exposure"[23] but also single event[24] or "acute high-intensity" exposure.[25] Pesticide exposure also can cause decreased concentration, decreased memory, mood swings and personal-

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25 Beseler CL, Stallones L, Hoppin JA, Alavanja MC, Blair A, Keefe T, Kamel F. Depression and pesticide exposures among private pesticide applicators enrolled in the Agricultural Health Study. Environmental Health Perspectives. 2008 Dec;116(12):1713-9. Epub 2008 Sep 9.

ity changes.[26] Research has already established links between household pesticide use and autism spectrum disorders, and research shows higher risk in areas with higher usage of organochlorine pesticides.[27]

Children's cognitive functioning may also be at risk. A 1998 study examined two farming communities, one that used chemical pesticides and fertilizers and one that did not.[28] At the urging of the mothers in the community that used chemicals, researchers tested the children, ages 4 and 5. The children in this community were found to be "less proficient at catching a ball, reflective of poor hand-eye coordination. They also had lower stamina levels.

EYE HEALTH

In a study of farmers' wives, results indicated that fungicides may be linked to retinal degeneration and other eye disorders.[29]

FERTILITY

Pesticide exposure can also have adverse effects on fertility. One study of women in an agricultural region indicates that those who used herbicides or fungicides up to two years before attempting conception were more likely to be infertile.[30] Another study finds longer time to pregnancy in women reporting pesticide exposure.[31] Given reports of pesticide-related endocrine disruption in animals, these findings are not surprising.

REDUCING EXPOSURE TO PESTICIDES

For farmers considering how to reduce exposure to pesticides, the Rodale Institute offers a comprehensive online course for farmers who either are integrating some sustainable methods into their current farming system, or who are planning a complete transition to certified organic. The Rodale course can be accessed at www.tritrainingcenter.org/course. It is possible to adopt some organic farming methods without becoming 100% organic certified. The Rodale material is designed to help farmers understand the National Organic Standards and use them as a framework for implementing certain aspects of organic production, or for fully transitioning to organic production.

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30 Greenlee AR, Arbuckle TE, Chyou PH. Risk Factors for Female Infertility in an Agricultural Region. Epidemiology. 2003 Jul;14(4):429-36.

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HEALTH EFFECTS OF PESTICIDES

Acute Health Effects	Pesticide Category	Chemical Examples	Chronic Health Effects
Vomiting, diarrhea, excess secretion of saliva and tears, confusion, constriction of airways, headache, dizziness, impaired vision, weakness, stomach cramps, muscular weakness and respiratory paralysis, constriction of pupils, fatigue	Organophosphates	Chlorpyrifos, diazinon, methyl parathion, malathion, azinphos-methyl, naled, glyphosate	Diazinon is associated with liver and pancrease damage[I], diabetes[II], non-Hodgkin's lymphoma[III], and, in children exposed before birth, low birth weight and delayed neurodevelopment[IV].
Malaise, muscle weakness, central nervous system depression, dizziness, nausea, vomiting, diarrhea, abdominal pain, blurred vision, excess secretion of saliva and tears, constriction of airways, headache	N-Methyl Carbamates	Carbaryl, aldicarb, fenoxycarb, methomyl, bendiocarb	For aldicarb: endocrine disruption, learning behavior problems, reproductive effects, and asthma[V]. For carbaryl, damage to kidney, liver, ovaries, and testes, and behavioral problems[VI]. Also associated with farmer's lung[VII]
Allergic reactions, life-threatening allergic reaction, tremor, loss of balance at very high doses	Pyrethrins	Pyrethrum	
Dizziness, irritability to sound or touch, headache, vomiting, diarrhea, blurred vision	Pyrethroids Type I	Allethrin, permethrin, sumethrin, cyfluthrin, tetramethrin	Breast cancer[VIII], endocrine disruption[IX]
Seizures, dizziness, irritability to sound or touch, headache, vomiting, diarrhea, tingling sensation	Pyrethroids Type II (cyanopyrethroids)	Deltamethrin, cypermethrin, fenvalerate	Breast cancer[X], endocrine disruption[XI]
Incoordination, tremors, tingling sensation, heightened sensitivity to stimulation, headache, dizziness, nausea, hyperexcitable state, seizures	Organochlorines	Lindane, endosulfan, dicofol, methoxychlor	Cancer and reproductive effects[XII], autism spectrum disorders[XII], retinal degeneration[XIV], farmer's lung[XV]
Nausea and vomiting, diarrhea, headache, confusion, bizarre behavior, peculiar breath odor, muscle weakness, low fever, decreased blood and body tissue pH, changes in heart activity, muscle damage	Chlorophenoxy compounds	2,4-Dichlorophenoxyacetic acid (2,4-D), 2,4-DB, 2,4-DP	Birth defects[XVI]

Acute Health Effects	Pesticide Category	Chemical Examples	Chronic Health Effects
Pain, diarrhea, headache, muscle pain, kidney failure, fluid in lungs, neurologic toxicity from diquat	Dipyridyl compounds	Paraquat, diquat	Parkinson's Disease[xvii], reproductive effects[xviii], kidney/liver damage[xix]
Nosebleeds, bleeding gums, blood in urine, dark feces due to intestinal bleeding, bruising, anemia, fatigue, labored breathing	Anticoagulant rodenticides	Warfarin, brodifacoum, difenacoum, coumachlor, bromadiolone	
Nose, throat & eye irritation, skin irritation, muscle spasm, abdominal pain, fever, tremor, thirst, sweating, rapid heart beat, greatly increased body temperature, chest constriction, labored breathing, mental confusion	Chlorophenols	Pentachlorophenol (PCP, Penta)	Cancer, reproductive effects, damage to liver and kidneys[xx]
Greatly increased body temperature, rapid heart beat, rapid breathing, anxiety, confusion, thirst, sweating, fever, headache, malaise	Nitrophenols and Nitrocreosols	Dinocap	
Headache, dizziness, nausea, loss of balance, tremor, agitation, muscle weakness, visual disturbances, slurred speech, vomiting, seizures, respiratory distress, fluid in lungs, convulsions	Fumigants	Methyl bromide	Neurotoxicity[xxi]
Eye, lung & mucus membrane irritation, skin irritation, fluid in lungs	Fumigants	Metam sodium	Cancer, birth/ developmental defects, reproductive toxicity[xxii]
Fatigue, dizziness, nausea, abdominal pain, diarrhea, irritation of the skin, eyes, and respiratory tract, allergic eczema, asthma[xxiii], rashes	Triazenes	Atrazine, simazine, cyanozine, amethryn, promethryn, zine	Cancer[xxiv], birth defects, reproductive effects[xxv], neurotoxicity

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FACT SHEET NO. 3

Pesticides & The Chesapeake Bay Watershed

Home to more than 3,600 species of plants, fish and animals, the Chesapeake Bay is the most biologically diverse estuary in the United States.[32] However, the plants and animals that live in the Bay are increasingly exposed to pollutants – including runoff of pesticides used by urban/suburban lawn owners, golf courses, state agencies and farms – that endanger the health of this ecosystem. In addition, pesticides in streambed sediment can make their way up the food chain and bioaccumulate in edible fish, increasing human exposure risk.

In many areas, including the Potomac River Basin, pesticides and their breakdown products have been found at levels that exceed federal water quality standards. A USGS summary of compound detections in the Potomac River Basin lists 28 herbicides and 14 insecticides that were detected in ground and surface waters.[33] By examining the existing federal standards and benchmarks used for these compounds to protect aquatic life, wildlife, and human health, it is apparent that some of these pesticides exceeded existing thresholds for aquatic life, fish-eating wildlife or humans, including alachlor, atrazine, metolachlor, cyanazine and diazinon.[34] In a 2004 study of Chesapeake waters, scientists detected atrazine in 100% of water samples taken at 60 different stations spread across five different Bay tributaries.[35] While many farmers rely on these chemicals, which are designed to target specific organisms, they may also be harmful to fish, shellfish, wildlife and water quality.

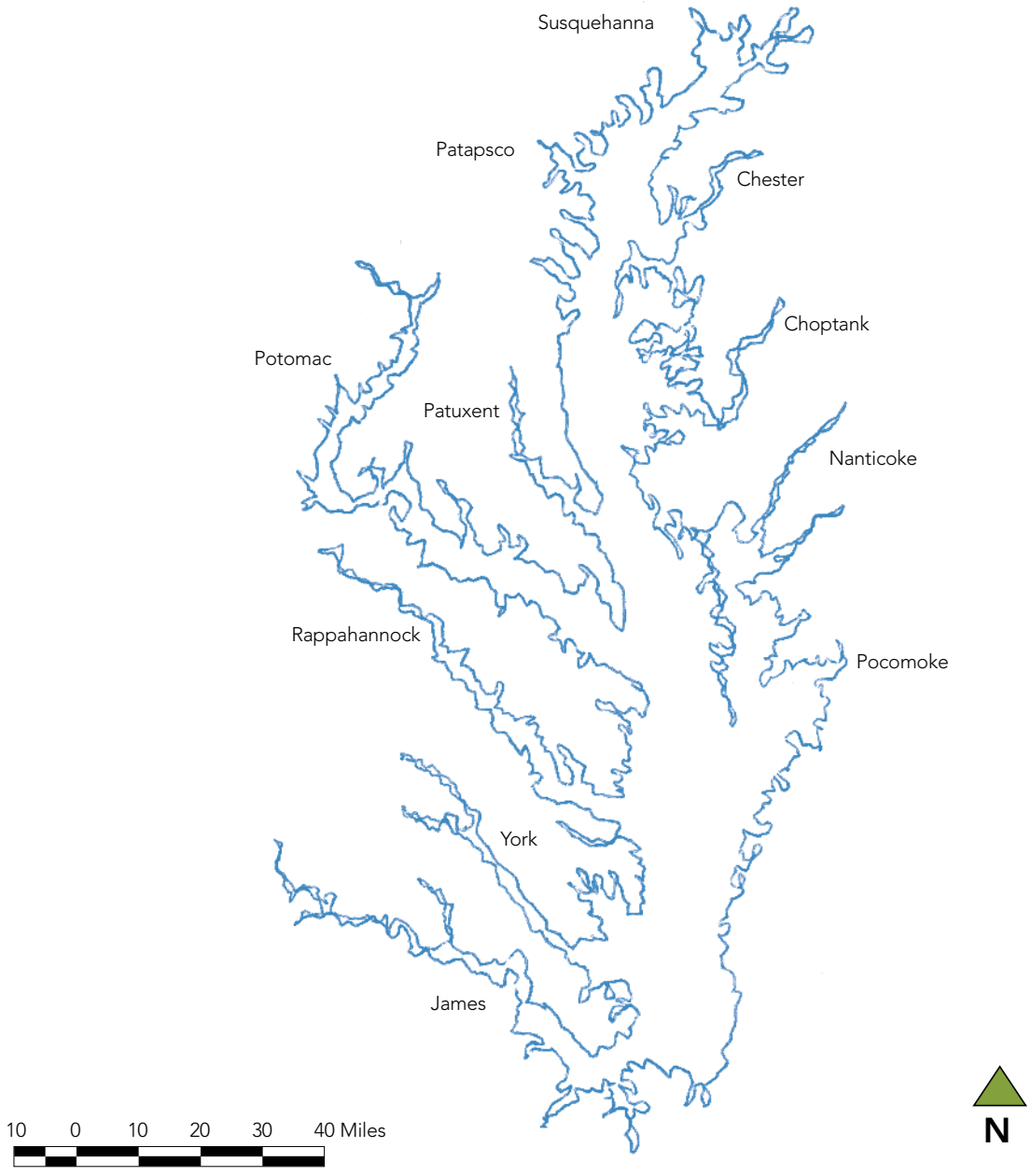
IMPACT ON THE BAY AND ITS TRIBUTARIES

A number of studies link certain pesticides to adverse effects on water quality and aquatic life. For example:

- Bay microbial communities that may serve as a precursor to change in the overall health and viability of the Bay can be altered by exposure to glyphosate (Roundup) and atrazine, widely used in the watershed.[36]
- Reduction in the growth of key living resources of Chesapeake Bay have been observed in the laboratory at low part-per-billion concentrations for some pesticides.
- Scientists have recorded incidents of intersex fish – male fish bearing immature eggs – in the Potomac, Shenandoah and Susquehanna Rivers. The specific agents causing intersex fish have not yet been determined with any certainty, but in March 2008 USGS scientists identified several pesticides in the Potomac River that could be responsible.
- Studies on atrazine have documented potential adverse effects to fish at exposure levels below those predicted by EPA and recorded through monitoring.[37] Documented effects include renal system damage[38]; also disruption to endocrine and olfactory systems affecting behavioral functions related to survival and reproduction.[39]

32 Chesapeake Bay Program, 2003
33 Ator, 2008
34 Ator, 2008; US Environmental Protection Agency, 2003b
35 McConnell et al., 2007
36 Thom et al, 2003
37 Saglio and Trijasse, 1998
38 Fischer-Scherl et al., 1991; Oulmi et al., 1995
39 Moore and Waring, 1998; Moore and Lower, 2001

THE CHESAPEAKE BAY AND ITS MAJOR TRIBUTARIES



Source: Chesapeake Bay Program

"...plants and animals that live in the Bay are increasingly exposed to pollutants... that endanger the health of this ecosystem..."

WHERE IT ALL COMES FROM

While conventional agriculture accounts for most of the pesticide use in the United States – about 80% -- households also contribute to pesticide pollution with weed and insect killers used in residential areas. According to the Chesapeake Stormwater Network, "lawn and turf grass is now the largest crop grown in the Chesapeake Bay watershed — more than 3.8 million acres covering a staggering 9.5% of the watershed's total land area…"[40] Every day, pesticides like triclosan – found in antibacterial soaps, cleaning products, and even toothpaste – are washed down household drains. Golf courses and other non-residential landscaped areas also contribute heavily to pesticide runoff. Pesticides also enter the water through spray drift and atmospheric deposition – airborne particles settling on bodies of water – and sewage sludge from water treatment plants. During storms or with improper use or disposal of these chemicals, agricultural fields can produce large amounts of chemical runoff – often during the spring, when many species are more vulnerable to the effects of chemical compounds.

FARMERS CAN HELP RESTORE THE BAY AND ITS TRIBUTARIES

By implementing best management practices (BMP's) the agricultural community can make a positive impact on Bay restoration, with actions that include:

- Technology and strategies that reduce pesticide runoff
- Integrated Pest Management
- Use of non-chemical alternatives

(Also see Best Management Practices Resource List in this kit for further information)

40 http://www.chesapeakestormwater.net/blog/2009/6/10/chesnet-storm-news-no-9.html

FACT SHEET NO. 4

Conservation Planning & Crop Management

Conservation planning includes conservation tillage, conservation buffers and management of weeds, pests and crop nutrients. Developing and implementing a conservation plan is a farmer's best option to ensure compliance with environmental regulations intended to protect natural resources. A conservation plan that emphasizes Integrated Pest Management (IPM) will enable a farmer to cost-effectively provide multiple benefits to the quality of air, water and soil, as well as improving impacts on human health, wildlife habitat and biodiversity.

As part of proper conservation planning, it is important that farmers identify natural resource concerns, such as local ponds, streams and drainage paths into them. Farmers should work with a crop adviser who will meet with them and identify proper mitigation techniques.

"Farmers should consider adopting conservation plans that are practical, site specific and easily integrated with an overall production system."

USDA-NRCS – NATIONAL CONSERVATION PRACTICE STANDARDS

The Natural Resources Conservation Service of USDA makes freely available online for farmers a comprehensive list of dozens of information sheets s as part of its National Conservation Practice Standards. For more information visit www.nrcs.usda.gov/technical/standards/nhcp.html.

NRCS conservation practice standards contain information on why and where a practice is applied, and sets forth minimum quality criteria that must be met during the application of that practice in order for it to achieve its intended purpose(s). The conservation practice information sheets contain a photograph of the installed practice, plus a definition or description of the practice, where it is commonly used and a brief description of the conservation effects of this practice when it is properly applied.

NRCS also provides Conservation Practice Physical Effects (CPPE) documents, with guidance on how a particular practice will affect natural resources (soil, water, air, plants, animals and human) and the resource concerns associated with each of those resources.

Farmers should consider adopting conservation plans that are practical, site specific and easily integrated with an overall production system. Conservation plans can include, but are not limited to, practices that can be implemented based on site-specific circumstances:

- tile inlet and outlet maintenance of a drainage system.
- nutrient use, in-season and late-season nitrogen testing.
- systematic soil testing on a regular schedule.
- terraces to handle erosion on slopes of 4 or 5 percent or steeper.
- conservation tillage, ridge-till, strip-till, or no-till. The impact of till vs. no-till practices on the Bay and its tributaries is controversial, with some experts holding that no-till farming practices, while helping the Bay by reducing the amount of nutrients needed, increases reliance on the herbicide atrazine.

- residue cover and relationship of residue cover to each successive tillage operation.
- pasture erosion control through proper vegetation establishment, "clean" livestock water sources, and rotational grazing plans.[41]
- record keeping of:
  * IPM implementation
  * Planning, installation, and maintenance of buffers, waterways and terraces.
  * Chemicals, nutrient and manure applications
  * Volunteer time, leadership or members in environmental groups.

41 http://www.ipm.iastate.edu/ipm/icm/2003/2-17-2003/cons.html

FACT SHEET NO. 5

Resources for Best Management Practices

Agricultural Best Management Practices include all strategies and technologies that provide for a healthy and bountiful crop, are economically sound and reduce or eliminate negative public health and environmental impacts, such as runoff into the Bay and its tributaries. BMP's range from pesticide application and drift management to reduce runoff, to buffers, Integrated Pest Management and organic farming.

"Anyone can use organic practices without being certified organic..."

PROGRAMS & GUIDELINES FOR FARMERS

University of Maryland Extension Services has published a guide to Integrated Pest Management, discussing how natural control factors regulate pest populations and are maximized in IPM as the primary means of management; if this strategy fails to maintain pests below economic levels, in IPM, then pesticides in combination with other tactics are used as a last resort. Visit www.mdipm.umd.edu/about/overview.cfm.

The Maryland Department of Agriculture (MDE) has published an extensive "Guide to best management practices for farms in the Chesapeake Bay watershed, coastal zone and western regions, " and it is available online at www.mda.state.md.us/pdf/ConsumerChoices.pdf

MDA also has published online a detailed "Pesticide Applicator Certification and Business Licensing Requirements," which includes information on certification and recertification requirements for applicators. This online document is useful to help farmers insure their applicators are in strict compliance with the law: Visit www.mda.state.md.us/plants-pests/pesticide_regulation/pesticide_applicator_certification_business_licensing_req.php

Another MDA document, written primarily for homeowners, also contains useful information on the types of information and identification the agricultural community can request from applicators to determine that they are properly trained and licensed. The document, "Beware of Fly-by-Night Companies Illegally Applying Pesticides in Homes," can be found at www.mda.state.md.us/pdf/URBAN.PDF

USDA-NRCS

Pesticide Management Planning

The Natural Resources Conservation Service of USDA encourages farmers to adopt a pesticide management plan if they are going to use pesticides, in order to reduce environmental risk related to these chemicals. The objective is to help farmers understand risk and resource concerns, stress mitigation and encourage farmers to use other non-chemical controls before applying pesticides – and not to employ pesticides as a first line of defense.

The Environmental Quality Incentives Program (EQIP)

The 2008 Farm Bill offers America's agricultural producers and nonindustrial private forest landowners more assistance than ever before to voluntarily conserve natural resources on our Nation's pri-

vately owned farm and ranch lands. Its provisions provide technical and financial assistance to help producers implement conservation practices that reduce erosion, protect our waters, improve fish and wildlife habitat, improve air quality, and conserve energy. EQIP offers financial and technical assistance to help eligible participants with developing a Pest Management Plan for their farm operation and install or implement structural and management practices on eligible agricultural land.[42]

NEW TECHNOLOGIES FOR CAPTURING, REDUCING OR ELIMINATING RUNOFF

Water-Related

Link to information on laser leveling: www.westlandswater.org/wtrcon/handbook/leveling.htm

Tail water returns

Some growers with large integrated operations collect their tail water for reuse on the next field in line. All the water is eventually re-circulated.

Conversion to high efficiency systems

Many growers have or are in the process of converting to drip or micro sprayer irrigation systems, which run according to the crop cover usage. These systems deliver water directly to each plant and have minimal risk of runoff.

Irrigation scheduling

Many growers take advantage of irrigation practice review services that give irrigation uniformity evaluations and tips for better management. The Research by the Center for Irrigation Technology provides information on new irrigation practices and how to apply them to a variety of agricultural situations. Visit www.cati.csufresno.edu/cit/rese.

Other means of capturing runoff

- Capture storm water using field borders to supplement field irrigation;
- Construct berms at low ends of the field to trap sediment and runoff;
- Use cover crops, vegetation filter strips and buffers to help capture flows; and
- Shorten irrigation runs with checks to manage and capture flows.

GPS guidance

Allows a tractor to drive over the same path within a field within inches of the previous pass. This controls the zones where water can collect and run off a field, allowing the grower to better control storm water by knowing which areas of the field will have the lowest infiltration rates.

Vegetated ditches

This type of ditch has been studied as a method to considerably slow water flow and reduce sediment and contaminants from running off into the waterway. Visit www.curesworks.org/bmp/bmpGeneral.asp

42 http://www.de.nrcs.usda.gov/programs/eqip/index.html

Vegetated Buffers and Filter Strips
These buffers and strips are used to reduce contaminant, nutrient and sediment runoff to maintain or improve water quality. Strips of grass or other permanent vegetation are planted between crop fields and water bodies to capture rainfall and sediments while allowing pesticides and nutrients in runoff to break down.

Vegetated buffers can be maintained in permanent vegetation to slow water runoff and protect against bank degradation during storm and flooding events. Buffers help to restore fish and wildlife habitat and foster beneficial native plant and insect communities. The dimensions of the buffer zone and the appropriate plant species for each site depend on the characteristics of the site, such as volume of water flow, slope and soil type.

Improving soil structure
Special tillage equipment can aerate the soil, reducing runoff through increased water penetration and retention. Gypsum or earthworms added to the soil may also have similar effects in compacted soils. For more information visit www.sarep.ucdavis.edu/worms/werner.htm. Also consult University of California IPM Online at www.ipm.ucdavis.edu.

WHEN USING PESTICIDES

Application changes
New technologies not yet widely available control the application of material within orchards to only when the sprayer passes a tree. Such technology is available for herbicide sprayers, spot spraying weeds as the boom passes over the weed. Electrostatic spray systems are used on field crops to have the applied material drawn to the plant and repelled by the soil surface.[43]

Transitioning to Integrated Pest Management or Organic Farming
The Rodale Institute offers a comprehensive online training program for farmers planning to transition to organic farming. Visit www.rodaleinstitute.org/transition_fact_sheet.

The Sustainable Agricultural Research and Education Program (SARE), which operates under a cooperative agreement with the University of Maryland, offers a fact sheet on "Transitioning to Organic Agriculture." Visit www.sare.org/publications/organic/organic01.htm.

The Northeastern IPM Center has published a number of guides focusing on integrated pest management for corn, soy, grain and other crops. A comprehensive list of the Center's available guides can be found at: www.northeastipm.org/ipm_resources_all.cfm

As stated under the EQIP program, Funding is available through the Environmental Quality Incentives Program (EQIP), administered by the USDA Natural Resources Conservation Service.[44]

Pesticides & the Chesapeake Bay Watershed Project: BMP Matrix
Project stakeholders with expertise in best management practices have collaborated on this comprehensive data base for BMP's for the Agricultural, Commercial and Residential sectors. Visit www.mdpestnet.com

43 http://www.krcd.org/water/water_quality/ag_mgt_practices.html
44 http://www.de.nrcs.usda.gov/news/news09/Organic_Ag_2009.htm

FACT SHEET NO. 6

Economically & Environmentally Sound Alternatives

Farmers considering adopting IPM, organic or other alternative practices should first know that it is possible to do so without going 100% organic and seeking certification. Many farmers considering these alternatives are concerned that they may encounter unmanageable problems. In particular, many fear that reducing farm inputs could lead to a dramatic drop in yields, weed control difficulties and increased labor requirements. Farmers also may face financial barriers, such as costs for modifying equipment, storage or livestock facilities. The U.S. Department of Agriculture, in its detailed guide about Making the Transition to Sustainable Agriculture notes that "many farmers perceive difficulties in securing operating loans from financial lenders accustomed to conventional crops, practices, and systems (ftp://ftp-fc.sc.egov.usda.gov/WSI/pdffiles/Sustainable_Agriculture-Making_the_Transition.pdf). To combat these and other potential problems, successful sustainable farmers recommend a gradual transition. USDA offers its strategy allowing for incremental adjustments, so that farmer learning can occur with minimal risks to profitability.

Anyone can use organic practices without being certified organic, and farmers can use organic practices in ways that are complementary to a conventional system. In addition, organic practices can enhance conventional farming, for example by using natural predators in a way that allows for reduced use of pesticides.

INTEGRATED PEST MANAGEMENT (IPM)

IPM is a critical component of multidisciplinary environmental stewardship – sustainable agriculture – when combined with other farming practices. In particular, IPM cost-effectively provides for:

- Improvements to air, soil and water quality through reduced pesticide and fertilizer inputs.
- Alternatives to soil fumigation such as green manures and alternatives to herbicides such as mulching both increase soil respiration and ecosystem functioning to improve soil quality.
- Improvements in wildlife habitat, biological pest control and alternative pollinators through cover crops, windbreaks, and wild flower strips that also help prevent soil erosion.
- Reductions in air pollution and offsite pesticide contamination attained by using improved "smart sprayer" agri-technology for more targeted pesticide applications.
- Substitution of non-pesticide control (e.g. mating disruption dispensers or increased biological control) for pesticide inputs.
- Substitution of environmentally safer, low rate, reduced risk pesticides in place of broad spectrum neurotoxin insecticides.
- Improved safety to pesticide applicators and workers should be considered.
- Reduction in pesticide residues on food as an important outcome.

TRANSITIONING TO ORGANIC PRODUCTION

As of 2007, there were some 13,000 certified organic producers in the USA, up from about 3,000 in 1994. Sales of organic produce have increased approximately 20% annually.[45] While sales of organic produce are coming from a relatively small consumer base, demand is growing, and many main-

45 http://ofrf.org/resources/organicfaqs.html

stream supermarkets and other outlets offer organic produce and products. Farms can be certified as organic as a whole farm or on a field-by-field basis. Most organic farms are small family-owned operations. However, organic farming is also being done on larger scale.

All farms and ranches that sell over $5,000/year of organic products must be certified in order to sell their products as "organic". Land that is set aside for organic production must not have prohibited substances such as certain fertilizers, pesticides, GMO's or other prohibited substances applied for at least 36 months prior to the first harvest of an organic crop. In considering transition to organic production, choose a USDA- accredited agency and ask for an Organic System Plan (OSP) application packet. Visit www.ams.usda.gov/nop for a list of USDA-accredited certification agencies and to download the National Organic Program regulations.

The following practices need to be implemented during the 36-month transition period:

- Discontinue all uses of prohibited substances
- Implement conservation practices
- Establish a soil-building crop rotation
- Develop effective fertility, pest disease and weed management strategies using preventive practices and natural fertility inputs including compost, mulch and cover crops.
  * Compost
  * Mulch
  * Cover crops
- Use non-synthetic (natural) biological, botanical or mineral inputs if needed
- As a last resort, use synthetic substances that are listed on the National List of Approved and Prohibited Substances, which is part of the NOB regulation
- Establish buffer zones wide enough to prevent drift of prohibited substances from adjoining land
- Set up a record-keeping system in order to track inputs used, seed, seedlings and crops harvested, stored and sold.

ONLINE COURSES & TOOLS

The Rodale Institute offers a comprehensive online course for farmers who either are integrating some sustainable methods into their current farming system, or who are planning a complete transition to certified organic (www.tritrainingcenter.org/course). It is designed to help farmers understand the National Organic Standards and use them as a framework for transitioning to organic production.

According to the IPM Institute of North America, IPM includes a thorough understanding of pests and pest biology, careful inspection and monitoring for pest presence and pest conducive conditions and pest prevention utilizing a variety of strategies. Pesticides are used only when non-chemical measures are inadequate. However the lack of a credible, comprehensive and easy-to-use pesticide evaluation tool has limited IPM promotion and performance benchmarking by grower groups, USDA, eco-certifiers and commercial food buyers.

The Institute is developing an efficient, user-friendly and economically sustainable tool for farmers, advisors, program managers, policy makers and others to fully evaluate pesticide options for impacts on health and environment, and to improve the quality and quantity of IPM by facilitating implementation of practices mitigate the harmful impacts of pesticide applications. The Institute's tool "PRIME" is not yet available, but information on the project can be found at www.ipminstitute.org/prime/index.htm.

In addition, the institute has established this page of potential information resources for farmers at www.ipminstitute.org/prime/resources2.htm.

FACT SHEET NO. 7

Best Management Practices for Corn, Soybeans & Grain

There is a wealth of resources freely available online for farmers, discussing various aspects of Best Management Practices (BMPs) for corn, soybean and grain production,

NATIONAL SUSTAINABLE AGRICULTURAL INFORMATION SERVICE

The National Sustainable Agricultural Information Service has published a guide to Biointensive Integrated Pest Management for crops. Visit www.attra.org/attra-pub/PDF/ipm.pdf. It explains biointensive Integrated Pest Management (IPM), outlines the concepts and tools involved and provides informational resources for implementation. It is targeted to individuals interested in agriculture at all levels. It puts forward these basic principles:

- Actions are taken to restore and enhance natural balances in the system, not to eliminate species.
- Regular monitoring makes it possible to evaluate the populations of pest and beneficial organisms.
- The presence of a pest does not necessarily constitute a problem.
- A consideration of all possible pest management options before action is taken.
- A philosophy that IPM strategies integrate a combination of all suitable techniques in as compatible a manner as possible; it is important that one technique not conflict with another.

NORTHEASTERN IPM CENTER

The Northeastern IPM Center has published a number of guides focusing on integrated pest management for corn, soy, grain and other crops. The Center's content relevant to corn and soybeans draws upon an exhaustive list of links to more than 3,000 guides and facts sheets on virtually all aspects of integrated pest management. This comprehensive resources can be found at www.northeastipm.org/ipm_resources_all.cfm

NATIONAL CENTER FOR APPROPRIATE TECHNOLOGY

The National Center for Appropriate Technology has published a guide to Sustainable Corn and Soybean Production www.attra.ncat.org/attra-pub/PDF/cornbean.pdf. This comprehensive guide focuses in part on the principle that one way to increase the profitability of corn and soybean production is to reduce input costs and build drought-hardiness through sustainable management practices.

The Virginia Cooperative Extension has published a fact sheet on use of IPM on the eastern shore. The IPM practices put forward by the VA Extension are based on the principle that IPM practices must always be economically feasible. Its advice on using IPM focuses on using all available tools and always considering the costs involved, including environmental costs. Visit www.ext.vt.edu/news/solutions/solutions2008/articles/IntegratedPestManagement.html.

RODALE INSTITUTE

The Rodale Institute offers a comprehensive online training program for farmers interested in simply integrating more sustainable methods into their current farming system planning, or considering a switch of crops to organic: (www.rodaleinstitute.org/transition_fact_sheet) The course covers:

- The fundamental principles of organic agriculture
- Practical details about organic crop and livestock production
- Marketing opportunities available to organic producers
- Recordkeeping and other specific requirements of organic certification

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