Water Contamination from Pesticides In Crop Runoff

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Since the early 1930s farmers have been using pesticides on their crops. Pesticides are used on crops to control a variety of pests, disease carriers, and weeds. After the Locust infestation during the Dust Bowl, pesticides have become very useful for farmers. However, even though pesticides may be good for crop growth, they can be very harmful for the environment. They can contaminate the soil, local streams, rivers, ponds, lakes, turf, other vegetation, and they can even be toxic to local animals such as fish, birds, beneficial insects, and non-target plants. I have noticed in the last few years that, as there has been an increase of rain, especially in Kansas, there has been a lot more crop runoff and, since most crop fields are located near streams and rivers, most of the runoff drains into the local streams and rivers. When flooding occurs, the streams and rivers take most of the pesticide treated crops with them when they recede, which is where most of the cities get their water. In this paper I will discuss how water contamination from pesticides in crop runoff has increased since the early 19th century and if there is a solution to this problem.

Background

Runoff is the movement of water across the soil surface. Runoff usually occurs when irrigation, rain or snow melt adds water to the surface faster than it can enter the soil. The water that ends up running off the cropland towards canals, streams, rivers, and lakes can also move chemicals like pesticides and fertilizers. According to the Pesticide Environmental Stewardship, how much a pesticide will move from an area depends on a complex interaction of pesticide and soil properties with weather conditions and site characteristics. (Gardner et. al.)

Pesticide runoff will be the greatest when heavy rain follows soon after pesticide application. Runoff is also susceptible to happen if a pesticide is applied to saturated soil and then is followed by light rain or additional irrigation. According to a study conducted in the lower Midwest, “Frozen soils enhance the opportunity for pesticide runoff and can approach 100 percent; therefore, pesticides should never be applied to frozen soils.” (Gardner et. al.) The slope or grade of the cropland can also contribute to runoff. The more slope there is to the ground, the more likely water is going to runoff the site. According to the

Pesticide Environmental Stewardship, the amount and type of vegetation on a site will affect runoff. “Conservation tillage or reduced-tillage cropping systems leave ample vegetation or crop residue that slows the movement of runoff water and will keep the pesticide on site.” (Gardner et. al.)

According to the Pesticide Environmental Stewardship, the physical and chemical properties of a pesticide are good indicators of potential runoff losses. The only way for farmers to know if the product that is being used is vulnerable to runoff is to read the Environmental Hazards section on the pesticide label. Manufacturers must assess the properties of their products related to solubility, absorption, and persistence, and state the appropriate precautions on the label. Highly soluble pesticides are more likely to be taken away by running water, and washed off the cropland. Most pesticides have low water solubility and do not dissolve enough to significantly contaminate runoff water in the dissolved state. Pesticides that are absorbent to soil particles will stay on the treated site as long as the soil remains. However, pesticides can be moved on soil particles if the soil is eroded by heavy winds or heavy rain. (Gardner et. al.), “the persistence of a pesticide plays a role in pesticide runoff; the faster it degrades, the less it is available to move with runoff water.”

Recent Scientific Research

The United States Department of Agriculture conducted a study in 1996 that focused on nonpoint and point water contamination. The USDA discusses that “Nonpoint source loading begins with the availability of pollutants: Tilled soil is exposed, pesticides are applied, or animal waste is spread on the land, for example. These available pollutants are then detached (as when the impact of raindrops dislodges soil particles), adsorbed (pesticides adhere to clay particles, for example), or dissolved by rainfall or snowmelt, which then carries the detached, adsorbed, and dissolved pollutants over the land to nearby surface water bodies, or through the soil into groundwater.” The most comprehensive evaluations of point and nonpoint source water contamination in surface water are State assessments that were prepared under authority of Section 305(b) of the Clean Water Act. States and Tribal governments designate uses for each body of water such as swimming, fishing, irrigating, or drinking, and adopt

criteria to protect the designated uses. (USDA et. al.) According to the USDA, The States and Tribes report their assessments of water quality to the U.S. Environmental Protection Agency in a form known as a 305(b) report, as follows: “States and Tribes are required to designate uses consistent with the 'fishable/swimmable' goal of the Clean Water Act. They then set water quality standards that include designated uses, criteria to support those uses, and an antidegradation policy and method for implementing it;” “water designated for use as drinking water typically has a higher standard, or different criteria, than water designated for agricultural use. Substances that occur naturally in water, such as phosphate or nitrate, are considered pollutants only when their concentrations in the water are high enough to cause health or environmental problems;” “States and Tribes set standards for water and define the condition of some portion of the assessed waters in quantifiable physical, chemical, or biological terms;” and “waters not supporting uses, partially supporting uses, or for which uses are considered threatened are assessed to determine the sources of pollution, such as urban runoff, agriculture, or point sources, and the causes of impairments or threats, such as nutrients, sediment, or habitat modification.” The most recent State assessments found that nearly two-thirds of assessed bodies of water in the United States support their designated uses. However, because not all waters are assessed for each 305(b) report, the full extent of agriculture's contribution to water quality impairment is not known. In 1994, where States reported sources of impairment, agriculture was a contributing source for 60% of the impaired river miles and 50% of the impaired lake area. It was found that agriculture was a contributing source for 34% of impaired estuary area. States identified agriculture as a major source of impairment for 25% of impaired river miles, 10% of impaired lake areas, and 6% of impaired estuary areas. The USDA came to the conclusion that, where agriculture is a source of impairment, the two most prevalent types of pollutants are sediment and nutrients.

Methods Information

For the past decade farmers have been trying to find ways to reduce crop runoff and protect the water quality. Because of the potential for agricultural input to be in the wrong place and causing water quality degradation or other environmental problems, management practices and systems have been developed that can sustain yields and protect the natural resources that produce them. According to the USDA, nearly 75% of farmers have already changed some farming practices to help reduce the delivery of nonpoint source pollutants. (USDA et. al.), "In order to reduce potential pollutants farmers and ranchers are decreasing the availability of: soil to become sediment, primarily through the use of agronomic practices such as cover crops, residue management, and rotations that include close-grown crops, nutrients for transport, by accounting for all nutrients available, regardless of source, method of incorporation, and application rate and timing, pesticides through integrated pest management, including crop rotations, cultivation, biological pest control, scouting, and selecting pesticides that are more environmentally friendly, as well as through reducing the use of pesticides in their operations, salt through irrigation water management, including application, timing, and amount, heavy metals by controlling soil acidity, monitoring, and limiting quantities and locations for sludge application, and pathogens by minimizing surface runoff, detachment, and transport; excluding livestock from surface waters; using buffer strips in riparian areas; and properly disposing of dead animals." (USDA et. al.)

According to Bruce Kraig, there are two solutions that have begun to be used more widely on local and state levels in both wetter and drier parts of the Midwest. These two solutions are sustainable farming and regenerative agriculture. (Kraig et. al.), "This means diversified rotational cropping, cover cropping during the off season, and shallow plowing among others. In the Midwest about 10% of farmers are using these practices that preserve all the state's topsoil and deter water runoff with their loads of chemicals." Related to these techniques is restoring wetlands and natural prairie grasses in farming areas. Wetlands absorb and disperse waters while prairie grasses hold a great deal of moisture. Where these techniques have been implemented on the High Plains, the aquifer has actually increased in volume. In the rain-soaked areas of the Midwest interspersing wetlands and prairie with farmland has been effective in controlling flooding.

Water contamination from pesticides in crop runoff has increased since the 19th century, but there is a solution. Researchers have proven that pesticides from crop runoff is polluting local waters and it has gotten worse throughout the years. Scientists have found many solutions to this problem which include sustainable farming, regenerative agriculture, restoring wetlands, and regulations on water usage. By using these methods on crop land farmers can slowly prevent the problems of run off and can have a more efficient growth of crops. It now appears likely that within the next decade there will be widespread implementation of measures to prevent the pollution of local waters.

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