A Review of Studies on Occurrence Rules of Agricultural Non - point Source Pollution in Different Ecological Regions

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Abstract

In recent years, scholars both at home and abroad pay more and more attention to agricultural non-point source pollution, and research has been deepening. However, there is still no systematic comparative study of agricultural non-point source pollution in different ecological regions. Due to different ecological types, different soil physical states, different man-made fertilizer inputs, different rainfall characteristics and different topography, agricultural non-point source pollution has a huge difference in contribution to water environment pollution. In this study, by combining different ecological types, different rainfall characteristics and different topography and other factors to explore the characteristics of agricultural non-point source pollution and emission laws.

Keywords

Different ecological areas; Agricultural non-point source pollution; Laws occur.

1. The Concept of Agricultural Non-Point Source Pollution

From the source of pollution, water pollution point source pollution (Point Source Pollution) and non-point source pollution (Non-point Source Pollution) two types [1]. The term non-point source pollution is relative to point source pollution. Unlike point source pollution, non-point source pollution is defined by the US Clean Water Act Amendments of 1997 as contaminants that enter the surface and groundwater bodies in a wide-area, dispersive, and trace form . Compared with the point source pollution, the non-point source pollution has the characteristics of complex mechanism, strong randomness, wide spatial distribution, fuzzy pollution source, complex influence factors and difficult to be monitored because it has no fixed discharge points and the sources are scattered and difficult to identify. So it has not been well controlled [2,3]. With the continuous implementation of various control and management measures of non-point source pollution, people's understanding of non-point source pollution has been gradually deepened. The concept of non-point source pollution proposed by the people mainly refers to the pollution of rainfall runoff. With the deepening of research, at the same time, according to the mechanism of non-point source pollution formation and the occurring area, the non-point source pollution of soil and water loss, Non-point source pollution and urban non-point source pollution, the study further refinement.

Non-point source pollution in agriculture refers to all kinds of pollutants (salt, nutrients, pesticides, germs, etc.) caused by irrigation (precipitation) under agricultural production. Through surface runoff, farmland drainage and infiltration It is the most common, widely distributed and the most polluting non-point source pollution [4]. According to this concept, non-point sources of agricultural pollution

of water bodies mainly include two aspects: First, the external surface water bodies (rivers, rivers, lakes, etc.) pollution, mainly manifested as aggravated water eutrophication trend; second irrigation and Its wider range of groundwater pollution, such as the current performance of the more prominent groundwater nitrate pollution.

Agricultural non-point source pollution, especially from large-scale or large-scale, polluted farmland runoff pollution has become an important part of agricultural non-point source pollution. According to the survey, non-point source pollution in most countries comes from agriculture [5-7]. Therefore, research and control of agricultural non-point source pollution are particularly important. Agricultural non-point source pollution mainly comes from soil loss, irrational application of fertilizers and pesticides, and residual pollution of agricultural film [8]. Different from point source pollution, agricultural non-point source pollution is affected by rainfall characteristics and surface runoff circulation Therefore, the characteristics are very complicated. The main features are dispersal and concealment of pollution, randomness and uncertainty of pollution, extensive and unpredictable pollution [9]. The non-point source runoff in agriculture is seriously polluted, it is harmful to the receiving water body and difficult to control. Therefore, it has been widely concerned by scholars both at home and abroad. The research on agricultural non-point source runoff has become a relatively independent research field, becoming an area of environmental science, hydrology , Agricultural ecology, natural geography, management and other disciplines cross-cutting hot spots.

2. Occurrence Mechanism and Causes of Agricultural Non - point Source Pollution

a) Agricultural non-point source pollution mechanism

The transfer and transformation mechanism of agricultural non-point source pollution is the basis for quantitative research and control and management of the model. In recent years, many scholars have conducted in-depth research on agricultural non-point source pollution from the perspective of dynamic process. As a continuous dynamic process, the formation of agricultural non-point source pollution mainly consists of the following processes: rainfall runoff process, soil erosion process, surface solute dissolution process and soil solute leakage process, and these four processes are interrelated with each other effect.

The research of rainfall runoff process is mostly based on hydrology, focusing on runoff flow and runoff characteristics as a driving force of non-point source pollution. Soil erosion process is an important part of agricultural non-point source research. It has been recognized that soil and water loss not only damages the soil environment and quality, but also brings harm to the receiving water body, because the soil and water loss are important carriers of pollutants. The transport and distribution of solutes in soils have become more and more active research fields in the theory of soil solute transport. From the research object, the study of nitrogen leakage in farmland has always been a topic of concern to scholars and experts at home and abroad, becoming a hot issue in the study of agricultural non-point source pollution, mainly in the estimation of the total amount of nitrogen leaching . In addition, there is still much controversy over whether phosphorus leaching can be neglected. A view that leakage leaking smaller, can be ignored. The soil has a strong ability of fixing and adsorbing P, and due to strong adsorption and fixation of phosphorus on the soil, its effectiveness on crops is very low. Phosphorus is also not easily leached into the groundwater by rainwater or irrigation water and causes pollution. Another view is that leakage leaking can not be ignored. In recent years, many scholars at home and abroad related research results show that: although the soil has a strong adsorption and fixation of phosphorus, but when the soil reaches a certain level of phosphorus, the strong phosphorus adsorption sites will be occupied, As a result, the phosphorus uptake and retention in the soil is close to saturation. At this time, the amount of phosphorus loss drastically increases with the increase of soil phosphorus [10-11].

b) causes of agricultural non-point source pollution

The agricultural non-point source pollution is affected and dominated by the precipitation time and the surface runoff circulation process. The pollution generated by the method is strong in randomness, with many influencing factors, various types of pollutants, the number of pollutants, the route of emission, the time of occurrence and the conditions of occurrence Certainty.

Fertilizer pollution. Since the founding of our country, the rapid development of agricultural production can not be separated from the contributions of chemical fertilizers. However, with the expansion of production scale and demand, a series of environmental problems have been followed along with the pursuit of efficiency. For a long time, due to the unreasonable fertilization time, fertilization method and fertilization rate, the utilization rate of fertilizers in our country is relatively low, generally only 30% ~ 40% [12]. About 70% of the fertilizers remain in soil, water and atmosphere , A large number of fertilizers with rainfall, runoff, leaching, leakage and other means of loss.

Pesticide contamination. Since the 1990s, research on non-conservative or solid pollutants tends to increase, and research on toxic organic compounds (mainly pesticides and herbicides) from non-point sources tends to increase. The research objects shift from fertilizers to pesticides . According to statistics, more than 84% of peasants will exceed the prescribed standard dosage, and some highly toxic and high-residue pesticides will enter the environment and pollute the crops, soil and atmosphere , And pollute the water with precipitation.

Intensive farming pollution. Since the reform and opening up, the livestock and poultry farming industry in China has developed rapidly. However, some rural farms have poorly equipped and poorly managed equipment, which has also brought about the problems of livestock manure waste discharge and pollution.

Domestic waste and sewage irrigation pollution. With the development of urbanization in rural areas, the amount and types of rural domestic waste and wastewater have also increased substantially. However, the facilities for collecting and disposing of waste have not yet been developed or improved in many areas. A large amount of domestic garbage is randomly piled up. Its leachate pollutes the surface water and groundwater, and the emitted odors pollute the atmosphere. More serious is sewage irrigation. A large amount of untreated sewage is directly used for farmland irrigation.

Plastic film residual pollution. Since the 1980s, the widespread application of agricultural film covering technology has brought about serious environmental problems while bringing economic benefits. Large amounts of plastic film remain in the soil and even can not be degraded, not only reduce the permeability of soil, reduce soil moisture, weaken the drought resistance of cultivated land, but also seriously affect the growth and development of plant roots and water and fertilizer migration, resulting in crop yield [13].

Straw pollution. The remaining straw that has not been properly used in rural areas has become the root cause of problems such as straw burning and waste of resources. Straw burning caused by increased airborne particles, causing pollution of the atmosphere, and the normal production and life of human interference; straw burning on the physical properties of the soil will also have an adverse effect, increase soil compaction, reduce soil fertility, aggravate the drought, so that crops Growth affected.

3. Research Status and Development Trend in Relevant Fields at Home and Abroad

In the 1960s, developed countries started to pay attention to non-point source pollution. In the 1970s, the United States took the lead in systematic study of non-point source pollution [14]. After just a few decades, people are aware of the seriousness of non-point source pollution and the urgency of governance. At present, non-point source pollution has become a ubiquitous global environmental problem in the world. Studies have shown that non-point Source pollution is the main cause of surface water pollution, while agricultural non-point source pollution accounts for the largest proportion [15].

According to statistics, from 30% to 50% of the surface water bodies in the world are affected by non-point source pollution, and 12% of the 1.2 billion hectares of cultivated land that have been degraded to varying degrees in the world are caused by agricultural non-point source pollution. According to the 1990 report of the United States, the non-point source pollution in the United States accounts for about two thirds of the total pollution, of which agricultural non-point source pollution accounts for 68% -83% of total non-point source pollution and affects 50% -70% Contaminated or threatened surface water bodies. The 2006 US water quality monitoring report shows that agricultural non-point source pollution has become the most important source of water for monitoring and is the third largest source of water pollution in estuaries and plays a major role in groundwater pollution and swamp degeneration [16]. Since the first bill on agricultural pollution was introduced in 1989, the EU took the prevention and treatment of agricultural pollution as the focus of its water pollution control and a major issue in the sustainable development of modern agriculture and society. A great deal of work has also been carried out in Canada, the United Kingdom, Australia, Germany and other countries. Japan, Sweden, Hungary, the Netherlands, Estonia and Turkey have begun to attach importance to this issue.

China's agricultural non-point source pollution situation is not optimistic. Since the reform and opening up, under the guideline of "high yield, high quality and high efficiency", China's agricultural sector has made vigorous efforts to promote agricultural production with the goal of increasing output and continuously increased the strength of agricultural development. The input elements such as chemical fertilizers, pesticides and agricultural films have been widely applied, Agricultural non-point source pollution continues to intensify. According to the research results of Soil and Fertilizer Institute of Chinese Academy of Agricultural Sciences, since the 1960s, the input of farmland fertilizers in China has been increasing year by year [17], and now it has become the largest producer and consumer of fertilizer in the world, causing serious water pollution Dianchi Lake, the Great Lakes, the Three Gorges reservoir basin of nitrogen and phosphorus eutrophication degree gradually escalated. With the improvement of point source pollution control ability, the quality of water environment has not been fundamentally improved, and the severity of non-point source pollution has gradually emerged. According to statistics, of the nitrogen entering the Yangtze River and the Yellow River each year, 92% and 88% respectively come from agriculture, especially about 50% of nitrogen fertilizer. In agricultural production, the large-scale application of fertilizers and pesticides to agricultural pollution has become the main reason affecting the water environment, and the low utilization of chemical fertilizers, excessive use of pesticides exacerbated the extent of agricultural non-point source pollution. According to a rough estimate, China's water pollutants from agricultural non-point source pollution accounts for about 1/3 [18]. Non-point source pollution of eutrophication caused by agricultural non-point source pollution takes Taihu Lake, Dianchi Lake and Chaohu Lake as an example. Non-point source pollution has become the main source of total nitrogen and total phosphorus inflow into the lake, of which total nitrogen contribution rate is 59%, 33 % And 63% respectively. The contribution rate of total phosphorus was 30%, 41% and 73% respectively [19]. In recent years, due to the state's emphasis on the ecological environment, farmland runoff pollution has become a hot spot for research and has aroused great attention of domestic scholars. It has become a key issue of non-point source pollution. At present, there are many studies on agricultural non-point source runoff pollution, for example, some for farmland management methods, such as Yang Cuiling [20] on different intercropping plantation cropland surface runoff pollution research. Some for specific types of planting, such as Xianyuan Guan [21] studied the basic law of runoff loss of tea plantations in sloping fields under natural rainfall conditions; Zhang et al. [22] studied the nitrogen and phosphorus nutrients under natural rainfall in vegetable fields with the surface The basic law of runoff. Some for different modes of fertilization, such as Duan Yonghui et al [23] for different types of fertilizers, intensity, time and manner on the vegetable land runoff nitrogen and phosphorus loss were studied; In addition, Liang Xinqiang et al [24] The experiment plot of single row irrigation was used to study the characteristics of nitrogen and phosphorus loss from runoff in paddy fields in Jiaxing of Taihu Lake under several natural rainfalls. The results showed that soluble nitrogen was

the main form of nitrogen loss from natural rainfall runoff , Accounting for about 70% -92% of total nitrogen (TN). Particulate phosphorus accounts for a large proportion of runoff phosphorus loss. Rainfall and fertilization are the major factors that affect the runoff output of nitrogen and phosphorus.

Based on the above literature, a great deal of work has been done on the loss and migration of N, P and sediment from agricultural non-point source pollutants in China. However, there are few reports on the systematic studies of agricultural non-point source pollution in different ecological zones. Research on the transport, transformation mechanism and emission mechanism of pollutants is still weak and needs to be further developed. The factors affecting the migration and transformation of agricultural non-point source pollutants include the features of the basin landscape structure, the characteristics of the system interface, the characteristics of the underlying surface of the river basin (land use, river ditch system, soil characteristics, etc.), rainfall characteristics (rainfall distribution, rainfall intensity, Duration, etc.), soil type, farmland management measures, etc. In recent years, some scholars at home and abroad have carried out partial research on the above influencing factors and studied the load of non-point source pollutants on a single scale. However, systematic studies on different scales (types of land use and rainfall features in different ecological zones) Not yet seen.

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