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Research on the Prevention Methods of Agricultural Non-point Source Pollution based on Food-security

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Abstract

Agricultural resources and environment suffer from exogenous pollution and endogenous pollution, and the sustainable development of agriculture encounters a bottleneck. And we need to pay enough attention to agricultural non-point source pollution that is widely distributed and affects large geographic areas. Agricultural non-point source pollution leads to increasing soil and water pollution and agricultural products quality and safety risks. Previous researches have focused on the environmental impact of point source and industrial pollution. However, that is insufficient attention to the importance of agricultural non-point source pollution. It is necessary to explore the balance between food safety, food security and the prevention and control of agricultural non-point source pollution. This paper presents the sources, pathways, pollutants and prevention methods of agricultural non-point source pollution, which have guiding significance for the protection of the agricultural environment and the sustainable development of agriculture.

Keywords

Agricultural Non-point Source Pollution; Prevention Methods; Food-security; Agricultural Environment.

1. Introduction

Agricultural non-point source pollution is the pollution of water layer, lake, river bank[1], waterfront and atmosphere ecosystems caused by scattered pollution sources such as sediment, pesticide, waste and pathogenic bacteria. Agricultural non-point source pollution is distributed at random and affects large geographic areas. The locations of agricultural non-point source pollution are scattered. Long-term application of fertilizer to agricultural soils has resulted in elevated levels of soil N and P. N and P move from agricultural lands to freshwater bodies[2], which can accelerate eutrophication of lakes and streams[3]. Especially, the pollutants discharged from agricultural land usually have no defined or identifiable point of outfall[4] and enter the aquatic environment system in small quantities at a large number of points[5]. Moreover, the sources of agricultural non-point source pollution are complex and diverse, such as chemical fertilizers, pesticides, agricultural film, straw combustion, animal husbandry, and soil and water erosion, etc[6]. In fact, agricultural non-point source pollution leads to soil fertility and productivity declining[7]. Arable land were degraded by agricultural non-point source pollution. There were 12% of 1.2 billon hm2 degraded arable land were caused by agricultural non-point source pollution in the world[8]. It is difficult to stop water pollution and eutrophication are caused by agricultural non-point source pollution. Because agricultural non-point source pollutants can not be centralized as point source pollutants and more expensive to treat its effects than to cure the cause of agricultural non-point source pollution. Chemical fertilizers and pesticides accumulated in water and soil not only cause damage to the environment, but also lead to the existence of harmful residues in food, resulting in a decline in crop yield and quality, directly affecting food security and food safety, and endangering the health of people. Therefore, source controls are critical for the mitigation of environmental

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pollution[9]. It is necessary to explore the balance between food safety, food security and the prevention and control of agricultural non-point source pollution. This is a urgent requirement, which not only effectively curb agricultural ecological degradation and control agricultural non-point source pollution, but also strengthen the supply capacity of grain, vegetables and fruits to increase farmers income[10].

In this paper, we focus on the sources and prevention methods of agricultural non-point source pollution to explore the balance between food safety, food security and the prevention and control of agricultural non-point source pollution. Altogether, the present study could provide a theoretical basis for non-point source pollution control and management.

2. The Sources of Agricultural Non-point Source Pollution

There are three main sources of agricultural non-point source pollution including cropland, livestock and poultry husbandry, and rural life, etc.

Farmers use their own methods to implement means of production ignoring the environmental pollution[11], which lead to excessive inputs of N and P fertilizer and pesticides. The use of pesticides and fertilizers is not standardized and the utilization rate is low[12]. In addition, agricultural wastes such as crop straw and agricultural film would cause water pollution in rivers or reservoirs[13], as a low dealing rate.

Arbitrary sewage discharge of livestock and poultry breeding industry directly causes water pollution, such as animal excrement produced by livestock and poultry and aquaculture farms, washing farm wastewater and animal slaughterhouses sewage discharge, etc.

Both random littering of domestic waste and discharge domestic wastewater at will would intensify agricultural non-point source pollution.

Areas with serious soil erosion are often also the key source areas of agricultural non-point source pollution[14]. In addition, other environmental pollutants can also cause non-point-source pollution in agriculture. For example, farmland pollution caused by environmental emergencies such as crude oil, hydrochloric acid, sulfuric acid and so on.

3. The Prevention Methods of Agricultural Non-point Source Pollution

A previous study indicated that the key source areas of pollution constitute only a small part of the entire basin and are mainly distributed in areas close to the river[15]. Therefore, identifying critical agricultural non-point source pollution areas contributes to achieving good control effect and reducing the cost of agricultural non-point source pollution control. First identify the high pollution load area in the basin, and then according to the pollution risk order, the control focus and limited resources into the basin of the highest, and the most sensitive areas and areas. It is necessary that priority to strengthen management measures and arrange the layout of the project, which can improve the investment efficiency and save land resources, greatly reduce the difficulty of pollution control work, coordinate the contradiction between human development activities and environmental protection work.

It is important to strengthen the comprehensive technical research and experiment on the prevention and control of agricultural non-point source pollution, such as planting techniques, livestock and poultry breeding techniques, and rural household garbage and sewage treatment techniques.

We should vigorously develop ecological agriculture and promote the production of pollution-free agricultural products. Make full use of the existing resources and environmental advantages to further strengthen the construction of ecological agriculture. Building efficient ecological agriculture demonstration counties in those with foundation gradually drive the ecological agriculture construction of the whole region, with the point to the surface.

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Farmers use their own methods to implement means of production ignoring the environmental pollution, which lead to excessive inputs of N and P fertilizer and pesticides.It is an urgent need to add agricultural extension services[16]. The application of chemical fertilizers and pesticides in farmland should also be based on the actual local situation[17], the local soil survey sampling, according to local conditions, the choice of suitable fertilizer products, fixed-point quantitative application of fertilizers, rather than a single excessive application of fertilizers.

Effective measures should be taken to prevent and control organic pollution in large-scale livestock and poultry farms[18]. First of all, reasonable layout, scientific planning, so that the new large and medium-sized livestock and poultry farms as far away from drinking water sources, rivers. Secondly, it is to use advanced technology, add pollution treatment facilities, the effective treatment and comprehensive utilization of the existing livestock and poultry farms manure, the establishment of large and medium-sized energy and environment demonstration projects. Altogether, it is recommended to develop clean farming.

The environmental behavior of farmers plays an important role in exploring the causes of non-point source pollution and taking scientific control and management measures. Their environmental intention further impacted their behavior[19-20]. As a consequence, increasing the publicity and popularization of the harm of agricultural non-point source pollution and prevention methods are very important and meaningful.

Improving the agricultural environment monitoring system can help us better targeted control agricultural non-point source pollution to reduce the intensity and harm.

Controlled point source pollution has been significantly attributed to the implementation of systematic laws, standards, and comparatively high-quality engineering measures in recent years. Hence, it is essential to accelerate the legal construction of agricultural environmental protection, and strengthen the supervision and management of agricultural non-point source pollution according to the law, while implementing specific policies to restrict and optimize the behavior of farmers.

Domestic garbage and domestic sewage should be collected together for centralized treatment. Therefore, it is necessary to increase the number of sewage treatment plants and waste treatment stations for reducing such incidents random littering of domestic waste and discharge domestic wastewater at will.

Taking effective measures controls water and soil loss such as increasing vegetation coverage by afforestation and natural vegetation restoration[21]. Meanwhile, we should check and diagnose environmental risks frequently to reduce and prevent the occurrence of sudden environmental incidents that cause farmland pollution.

4. Conclusion

Agricultural non-point source pollution should be comprehensively prevented and controlled from various aspects, such as technical research, technology promotion, disposal of rural domestic sewage and garbage, enhancing farmers awareness of environmental protection, improving the agricultural environmental monitoring system, and building the legal system of agricultural environmental protection. The comprehensive prevention and control system of agricultural non-point source pollution is a trinity and cooperative system composed of scientists, agricultural producers and the government to mobilize the initiative of scientists, stimulate the enthusiasm of agricultural producers and play the functions of the government, and realize the development goals of national food and environmental security.

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