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A Review on the Agriculture Non-point Source Pollution Research

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Abstract

Agricultural non-point source pollution is an important problem at present. By analyzing the amount and intensity of fertilizer application and the proportion of different types of fertilizer application in the past 10 years, the paper makes clear that the excessive application of fertilizer and the imbalance of fertilizer structure are the main causes of agricultural non-point source pollution.

Keywords

Agricultural Non-point Source Pollution; Fertilizer Application Structure; Fertilizer Application Balance.

1. Introduction

The agricultural non-point source pollution is becoming increasingly serious in China [1]. Agricultural non-point source pollution poses a serious threat to the agricultural ecological environment, water environment, quality and safety of agricultural products and human health [2,3]. Agricultural non-point source pollution is mainly caused by excessive nitrogen and phosphorus and other nutrients in the soil, or by excessive atmospheric pollutants produced in fertilizers and pesticides [4]. The formation mechanism of non-point source pollution is complex, and farmland drainage and irrigation, soil and water loss, surface runoff and groundwater pollution, rain and snow climate, etc. have a certain impact on the formation of non-point source pollution [5]. Therefore, there is no absolute source of non-point source pollution, and the excessive application of pesticides and fertilizers is the direct cause of agricultural non-point source pollution [6].

2. Organization of the Text2. Characteristics of Agricultural Fertilizer Application

In the process of agricultural production, chemical fertilizer input causes severe erosion and damage to the agricultural ecological environment. By 2019, although the use of chemical fertilizers in China has achieved negative growth for four consecutive years, and the use of pesticides has achieved zero growth for four consecutive years, but looking back at this series of figures in China and its comparison with European and American countries, the threat of agricultural chemical inputs to China's agricultural ecological environment has slowed down, but it is still very serious. Among them, the excessive application of chemical fertilizer is one of the reasons why the problem of agricultural non-point source pollution is becoming more and

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more serious. The input of chemical fertilizer reflects the situation of agricultural non-point source pollution in China to a certain extent. The total amount of chemical fertilizer application can reflect the input trend of chemical fertilizer in China from a macro perspective (as shown in Figure 1).

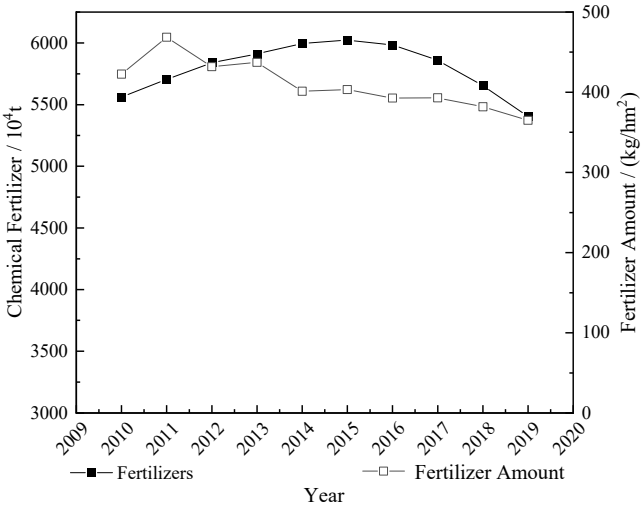

Figure 1. Fertilizer application amount and intensity in China from 2010 to 2019

According to the China Rural Statistical Yearbook, in 1952, the total amount of chemical fertilizer application in China was 7.8×10^3 t, and the intensity of chemical fertilizer application was only 3.9 kg/hm^2. However, with the continuous evolution of agricultural production, the level of chemical fertilizer application in China has also undergone a series of changes, especially the increasing amount of chemical fertilizer application per unit cultivated area, that is, the intensity of chemical fertilizer application, which has caused a great burden on the ecological environment. It can be seen from Figure 1 that the amount and intensity of fertilizer application increased slowly from 2010 to 2015. The amount of fertilizer application increased from 5.54×10^7 t in 2010 to 6.02×10^7 t in 2016 with an increase of 8.63%. On the other hand, the fertilizer application intensity has been maintained at 400-470 kg/hm^2 for a long time, which is far higher than the internationally recognized upper limit of the safe value of 225 kg/hm^2, about 1.78~2.09 times of the upper limit of the safe value, and also higher than the ecological upper limit standard set by the environmental protection department of China, that is, the upper limit of the fertilizer application intensity of 250 kg/hm^2.

The increase in the amount and intensity of chemical fertilizer application has limited significance for the formation of agricultural land non-point source pollution. However, the trend of simultaneous increase of the two has greatly caused land pollution and serious soil degradation.

3. Comparative Analysis of Fertilizer Application Structure

According to the changes of different fertilizer application conditions in the cause of fertilizer non-point source pollution, the classification and statistics are carried out to clarify the main causes of fertilizer pollution in non-point source pollution, which is the basis for the specific allocation policy. The following statistics are made on the intensity of nitrogen, phosphorus, potassium and compound fertilizer application in China from 2010 to 2019, in order to clarify the impact of different intensities of application of non-point source pollutants on non-point source pollution. The specific statistical data of nitrogen, phosphorus, potassium and compound fertilizer application intensity in China from 2010 to 2019 were shown in Figure 2.

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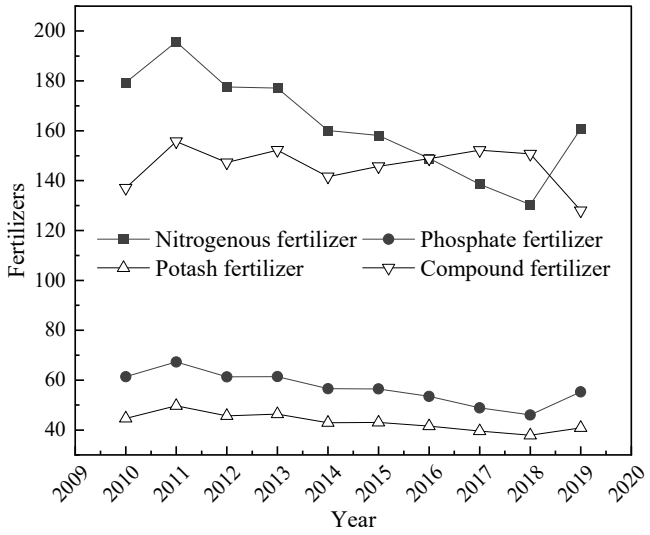

Figure 2. Fertilizer application amount and intensity of various types in China from 2010 to 2019

As shown in Figure 2 above, from 2010 to 2019, the application intensity of nitrogen fertilizer, phosphorus fertilizer and potassium fertilizer in China showed a slow downward trend, and the application intensity of compound fertilizer was relatively stable, among which, the application intensity of nitrogen fertilizer slowly decreased from 179.4 kg/hm^2 to 160.9 kg/hm^2, the application intensity of phosphorus fertilizer slowly decreased from 61.4 kg/hm^2 to 55.3 kg/hm^2, and the application intensity of potassium fertilizer slowly decreased from 44.7 kg/hm^2 to 40.9 kg/hm^2, The application intensity of compound fertilizer decreased slowly from 137.1 kg/hm^2 to 128.0 kg/hm^2, but the application intensity remained high. The continuous increase of the above fertilizer application and the lack of internal balance have directly caused the continuous deepening of non-point source pollution in China. Excessive application will cause non-point source pollution and soil degradation based on single chemical elements and products, while excessive application of compound fertilizer will cause deep degradation of soil quality, and have a continuous negative impact on the formation and deepening of non-point source pollution.

4. Comparison of Fertilizer Application Balance

Table 1. Changes in fertilizer application and proportion in China from 2010 to 2019

Year	Nitrogenous fertilizer /(10^4t)	Phosphate fertilizer /(10^4t)	Potash fertilizer /(10^4t)	Compound fertilizer /(10^4t)	N:P_2O_5:K_2O
2010	2353.7	805.6	586.4	1798.5	1:0.34:0.25
2011	2381.4	819.2	605.1	1895.1	1:0.34:0.25
2012	2399.9	828.6	617.7	1990	1:0.35:0.26
2013	2394.2	830.6	627.4	2057.5	1:0.35:0.26
2014	2392.9	845.3	641.9	2115.8	1:0.35:0.27
2015	2361.6	843.1	642.3	2175.7	1:0.36:0.27
2016	2221.8	797.6	619.7	2220.3	1:0.36:0.28
2017	2065.4	728.9	590.3	2268.8	1:0.36:0.28
2018	1930.2	681.6	561.1	2230.7	1:0.35:0.29
2019	2381.4	819.2	605.1	1895.1	1:0.35:0.29

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In addition to the large intensity and scale of chemical fertilizer application in China, the irrational and unbalanced chemical fertilizer application structure is also one of the inducements that cause the negative impact of chemical fertilizer environment, which has a direct impact on the formation of non-point source pollution in China. In response to this problem, the following is a summary of China's fertilizer application and proportion changes from 2010 to 2019, trying to understand the non-point source pollution caused by irrational and unbalanced fertilizer application structure, and then explain the negative effect of structural imbalance on the formation of non-point source pollution. The results are shown in Table 1.

As shown in Table 1, the amount of nitrogen fertilizer, phosphorus fertilizer, potassium fertilizer and compound fertilizer applied in China in 2010 was 23.537 million tons, 8.056 million tons, 5.864 million tons and 17.985 million tons, respectively. The proportion of N: P_2O_5: K_2O was about l: 0.34: 0.25, and the proportion of potassium was relatively low. In 2019, the application rates of nitrogen fertilizer, phosphorus fertilizer, potassium fertilizer and compound fertilizer in China were 23.814 million tons, 8.192 million tons, 6.051 million tons and 18.951 million tons respectively, of which the proportion of N: P_2O_5: K_2O was about 1:0.355:0.29. Although from the perspective of trend, China's fertilizer application structure is continuing to develop towards a relatively reasonable proportion structure, compared with the fertilizer application structure of developed countries 1:0.5: 0.5, China's fertilizer proportion structure still has a large space for improvement. To some extent, the problem of irrational fertilization structure has interaction with the improvement of fertilizer application rate and intensity in China.

5. Conclusion

The impact of fertilizer non-point source pollution on agricultural economy is direct. The continuous encroachment of soil and the imbalance of soil material, as the foundation of agricultural economic development, will ultimately lead to the sharp reduction of the quality of agricultural land and the reduction of the scale of agricultural land. The problem of land pollution has led to the expansion of its pollution degree and the associated loss of surrounding land. In fact, the problem of pollutant diffusion of fertilizer non-point source pollution has great correlation and correlation. The interaction between land pollution and water pollution has an important impact on food security, human health and long-term development.

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