Estimation and temporal-spatial variation analysis of non-point source pollution in China's planting industry

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Nitrogen (N) and phosphorus (P) are important elements of the life system. China is the most populous country and the population continues to grow, causing an increasing demand for food. But China’s arable land resource is limited, and as is the effective means to improve crop yields, fertilization also has resulted in the excessive use of nitrogen and phosphorus in crop planting systems at the same time. Non-point source pollution of planting industry is becoming more and more serious, which poses a great threat to water quality.

In this study, 14 kinds of major crops accounting for 76% of the sown area and 87% of the yield in China were selected. Based on land use/cover data, crop spatial distribution data and agricultural economic statistical survey data (from the 2010 China Statistical Yearbook), the data were distributed by spatial allocation model according to the county code, and the results of different crop fertilizer application rates were obtained. Then, the results were summed up to get the overall fertilizer application status of N and P in China.

Under this premise, combined with terrain data (DEM), arable land information (distribution of paddy fields and upland), planting patterns of 14 kinds of crops and non-point source pollution control division classified by climate types, the cropland is divided into 56 different N and P loss modes. In the first national agricultural non-point source pollution census, N and P loss coefficients under different modes were obtained through field monitoring and local investigation. On the basis of the coefficient table and fertilizer application rate, the N and P loss of planting industry in 2010 was calculated, and the results were analyzed to reach the following conclusions:

1. Fertilization of cultivated land in China covers a wide range, and the amount of fertilization varies greatly between different regions. The basic distribution law of N and P fertilizer application is relatively consistent across the country, and both more in the north than in the south, more in the east than in the west, more in the plain than in the mountain and plateau, and more in the dry land than in the paddy fields. The areas with high fertilization account for about 1/4 of the total fertilizing area in China, presenting a state of spatial aggregation.

2. Fertilizer loss amount of each kind of crops are not identical. Taking winter wheat, one of the most important major food crops in China, as an example, its P loss mainly concentrated in the semi-humid plains of the Huang-Huai-Hai Sea, the Chengdu Plains in the southern wet plain area and parts of Jiangsu Province and Anhui Province, while the central and southern are of Henan
and Hebei provinces and Hanzhong plain area suffered the most severe loss.

The above research can provide scientific theoretical basis and decision-making support for the formulation of sustainable agricultural development strategy in China, and it can also be for the reduction of N and P loss and the control of water eutrophication worldwide.