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Effects and Prevention of Cadmium Pollution on Crops

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ABSTRACT. *China is one of the largest agricultural countries in the world. In order to ensure the healthy growth and food safety of crops, we need to pay attention to the heavy metal pollution of crop soil and water. Cadmium pollution of crops occurs from time to time, which has seriously affected people's food safety and the country's crop export. Therefore, it is very important to study the impact of cadmium pollution on crops and to make clear the control methods of cadmium pollution.*

KEYWORDS: *Cadmium pollution, Heavy metal pollution, Crops, Pollution prevention*

1. Cadmium pollution

Cadmium (Cd) is a rare metal element, it is silver-white. In nature, cadmium is usually associated with zinc. It is one of the "five toxic" elements of heavy metals, has strong biological mobility and toxicity, and is difficult to degrade. It is easily absorbed and enriched by crops, affecting their growth, reducing their yield and quality, and can also accumulate in the human body through the food chain, endangering human health[1]. There are many reasons for cadmium pollution in farmland. One of the important reasons is that the waste gas, waste water and waste residue from mining and smelting industry pollute farmland through irrigation and produce deposition. In addition, farmers use a lot of phosphate and organic fertilizer will also cause cadmium pollution in crop soil. In addition, there are also cadmium metals in some pesticide components. If farmers use them improperly, they will cause cadmium pollution in farmland.

2. Effects of Cadmium Pollution on Crops

Cadmium pollution has a great influence on the growth rate, yield and quality of crops. There are five main effects of cadmium pollution on crops: first, it affects the physiological metabolism of crop roots. Second, it affects the photosynthesis, respiration and transpiration of agricultural leaves. Third, it affects the carbon/nitrogen/phosphorus metabolism of crops. Fourth, it affects the normal development of hormones (such as auxin, gibberellin, etc.) of crops. Fifth, it affects the nutrient stress and ecosystem of crop soil[2]. Among them, the first four effects can be summarized as direct effects, while the last one is indirect effects. Cadmium-contaminated crops usually show black roots, loss of green tissue, slow growth and reduced dry matter yield.

As far as the characteristics of crops are concerned, different crops have different absorption and accumulation capacities for cadmium metal. For example, rice, wheat and corn are very sensitive crops to cadmium pollution. Among them, rice has a strong ability to gather cadmium. According to relevant studies, the absorption capacity of vegetables to cadmium metal is as follows: leaf vegetable plants are larger than flowers and fruits, and flowers and fruits are larger than root plants. It should be noted that the same type of vegetables, specific varieties, will also have a great difference in cadmium absorption capacity.Rice and vegetables play an important role in the diet of Chinese people. According to research, more than 70% of Cd in human body comes from grain and vegetables [3].

3. Prevention of Cadmium Pollution in Crops

Cadmium pollution has a serious impact on the healthy growth of crops. If crops that containing excessive cadmium enter the market, the health of the masses will be seriously threatened[4]. Therefore, the prevention and control of cadmium-polluted farmland should be strengthened. This paper puts forward the prevention and control measures of cadmium pollution from three aspects: policy, treatment and technology.

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3.1 At the Policy Level, Improve the Construction of Cadmium Pollution Control Policy System

Provincial departments concerned should enhance their awareness of land environmental protection and further improve the policies, laws and regulations related to cadmium pollution. It is necessary to establish and improve the liability mechanism, clarify the legal liability of cadmium-contaminated farmland in various regions, and strengthen the investigation of liability. Once a problem is found, the legal liability of the persons responsible should be investigated and preventive measures should be taken. At the same time, the department managers should establish a control system for cadmium-polluted farmland, and delimit cadmium-polluted farmland control zones according to the distribution of farmland and the characteristics of crops. In addition, to strengthen cross-border cadmium pollution prevention, cadmium pollution control in a joint law enforcement, farmland, cadmium waste transfer across provinces and cities in areas such as establishing reasonable mechanism, together with the neighboring city of transboundary farmland cadmium pollution problem to carry out the on-site inspection and cross check, at the same time focus on cadmium pollution environmental protection measures to strengthen the implementation of supervision.

3.2 At the Governance Level, Further Strengthen the Governance of Mining and Smelting Enterprises

In strict accordance with the relevant national policies on closing down and withdrawing backward production facilities, provinces should encourage and supervise the withdrawal of mining and smelting enterprises involved in cadmium pollution, so as to cut off the important source of cadmium pollution in farmland. In order to ensure that the abandoned mine left by the enterprise will not cause cadmium pollution to the nearby farmland, the mine pithead should be closed in time, and the artificial dam should be built to protect it, so as to ensure that the cadmium pollution source is controlled within the local scope [5].

3.3 At the Technical Level, the Government Should Carry out the Remediation of Cadmium-Polluted Farmland by Various Means

Physical repair method. Physical repair is also called engineering repair. Common physical repair methods include soil replacement, guest soil, deep ploughing and so on. Among them, soil replacement and guest soil cover clean soil or replace soil contaminated with cadmium. These two methods are suitable for the restoration of highly cadmium-contaminated farmland; deep ploughing and soil turning is to turn up the deep soil and cover the shallow soil. This kind of crime is applicable to the rehabilitation of farmland with light cadmium pollution. Physical remediation is simple and easy to achieve, and results are quick, but it consumes more manpower, material and financial resources, and the cadmium contaminated soil that is eliminated is likely to cause secondary pollution. Therefore, physical remediation is usually only used when remediation of cadmium-contaminated farmland in a small area.

Chemical repair methods. Chemical remediation mainly depends on the chemical dissolution process, using lime, phosphate, silicate, etc. to reduce the solubility of cadmium in the soil. Taking phosphate as an example, farmers can spray phosphate in cadmium-contaminated farmland, so that the cadmium metal in the soil forms insoluble phosphate, reducing the accumulation of cadmium in crops[6]. In addition, there is a chemical measure that uses chemical leaching agent and co-solvent to separate cadmium auric acid in farmland soil, so that cadmium metal migrates into the liquid phase, and then the eluent is treated again. For now, the first chemical repair method is more researched and widely used.

Phytoremediation method. Phytoremediation is to purify soil by absorbing and degrading cadmium metal in farmland soil with specific plants. According to the relevant research findings, plants such as sedum alfredii, rose flower and solanum nigrum have strong tolerance or super accumulation characteristics to cadmium metal. Planting these plants together with crops can achieve the purpose of reducing, removing and stabilizing cadmium pollution. However, due to the influence of plant growth cycle, phytoremediation is generally applicable to the surface soil with slight cadmium pollution.

It should be noted that the restoration of cadmium-contaminated farmland requires strong technical and talent support. Therefore, local governments must make full use of the technical strength of scientific research institutions and scientific research enterprises, do a good job in scientific research and talent training, and continuously strengthen the research and application of cadmium-contaminated farmland restoration technology.

4. Conclusion

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China is a major agricultural country in the world, and agricultural production is dominated by food crops. Farmland contaminated with cadmium has slow crop growth, low yield and low quality. In recent years, agricultural products with excessive cadmium content have appeared on many markets in China, which has had a serious impact on the health of the people. Therefore, all provinces, especially major agricultural provinces, must attach great importance to cadmium pollution. In specific work, in addition to further improving the cadmium pollution control policy system, it is also necessary to actively carry out research and application of cadmium pollution farmland prevention and control technology, so as to effectively solve the problem of farmland cadmium pollution.

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