

## C.2. Regional

# Environmental pesticide pollution and its countermeasures in China

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## Abstract

The present paper introduces systematically the major types and varieties of pesticides currently in use and analyses specifically the status quo of the pesticide pollution and its hazards on the environment. The paper also stated that the main cause of the serious environmental pesticide pollution is the lack of the necessary supervision and management. This recommended for immediate formulation of China-specific policies and measures to control pesticide pollution.

## Keywords

Pesticides, environmental pollution, countermeasures

## Introduction

China is a large agriculture-based country and a large pesticides producer and consumer as well. As a result of decades of high-rated pesticide application, the environment has been deteriorating, causing serious damage to the structure and function of the eco-system in the country. Moreover, the yearly economic loss incurred by environmental pesticide pollution is appalling. Because a huge variety of pesticides are extremely toxic, tens of thousands of users get hurt or even die every year. Consequently, it seems essential to control pesticides from polluting and damaging the environment, while efforts are made to develop agricultural economy. Particularly, pesticides may pollute the environment from the cradle to the grave. It is, therefore, the common duty for environmental protection agencies at all level, from the state to the local, to improve their knowledge about pesticides and intensify earnestly environmental management of the pesticides, in order to control environmental pesticide pollution.

Currently, China witnesses the production of about 200 kinds of pesticides, and the processes of over 500 kinds of formulated products every year. This is making up a total output of 400,000 tonnes (100% active ingredients) of pesticides of technical grade, and also up to 300 millions ha of farmlands and forests, with pesticides being applied for disease, insect and weed controls. As a result of decades of high-rated pesticide application and the lack of rational scientific supervision and management in this aspect, their pollution of the environment and their detriment to human health are very serious. This paper will address the status quo of environmental pesticide pollution in China and some of the related problems in the following paragraphs.

## Status quo of environmental pesticide pollution

### *Higher death toll and a direct threat to human safety*

During the 1950s and 1960s, DDT, BHC, aldrin, dieldrin and some other organochlorine pesticides prevailed in China as well as in other countries of the world. As they persist long in the environment and accumulate inside the human organisms, causing serious damage to a number of organisms, their use has been prohibited since the 1970s, beginning in the western countries. China began to stop the use of organochlorine pesticides in 1983. They were replaced by a large number of "substitute pesticides". The so-called "substitute pesticides" here refer mainly to pesticides of organophosphorus and carbamate types. Although these pesticides have low persistence and readily degrade in the environment, they are highly toxic. Since their extensive use during 1983, death incidents of pesticide poisoning have been a protruding problem during their production and application. According to incomplete statistics of the 5 years between 1992 and 1996, 247,379 cases of pesticide poisoning were reported in 26 provinces and cities, including 24,612 deaths, with a death rate being about 9.95%. Insecticide is the major type of pesticides that cause poisoning, responsible for 86.3% of the incidents (Table 1). 63.3% of the poisoning cases and 58.5%

of the fatal cases reported in Jiangsu, Shandong, Zhejiang and Hubei Province were caused by insecticides. This problem is not only affecting agricultural production, but also posing a threat to the lives of the farmers and has become a social one calling for urgent solution.

**Table 1. The reported 247,349 cases of pesticide poisoning during in the period 1992 - 1996**

| Year               | 1992   |      | 1993   |      | 1994   |      | 1995   |      | 1996   |      | Total   |      |
|--------------------|--------|------|--------|------|--------|------|--------|------|--------|------|---------|------|
|                    | Case   | %    | Case   | %    | Case   | %    | Case   | %    | Case   | %    | Case    | %    |
| <b>Insecticide</b> | 61,497 | 87.1 | 45,231 | 86.5 | 37,446 | 87.5 | 41,404 | 85.6 | 27,999 | 84.2 | 213,577 | 86.3 |
| <b>Fungicide</b>   | 766    | 1.1  | 681    | 1.3  | 446    | 1.0  | 403    | 0.8  | 1,401  | 1.2  | 2,697   | 1.1  |
| <b>Rodenticide</b> | 1,497  | 2.1  | 1,407  | 2.7  | 1,141  | 2.7  | 1,389  | 2.9  | 1,079  | 3.2  | 6,513   | 2.6  |
| <b>Herbicide</b>   | 773    | 1.1  | 607    | 0.9  | 417    | 1.0  | 531    | 1.1  | 502    | 1.5  | 2,830   | 1.2  |
| <b>Mixed</b>       | 1,170  | 1.6  | 452    | 0.9  | 486    | 1.1  | 1,120  | 2.3  | 468    | 1.4  | 3,696   | 1.5  |
| <b>Others</b>      | 4,915  | 7.0  | 3,909  | 7.5  | 2,876  | 6.7  | 3,530  | 7.3  | 2,806  | 8.4  | 18,304  | 7.3  |
| <b>Sum</b>         | 70,168 | 100  | 52,287 | 100  | 42,812 | 100  | 48,377 | 100  | 33,255 | 100  | 247,349 | 100  |

Pesticide is a peculiar industrial product, being both an important agricultural production input and a toxic good containing various toxic elements. Therefore, the sales and post-sales service of pesticides have become a key link affecting interests of the farmers and success of the agriculture. Nevertheless, in most provinces now, departments involved in selling pesticides are diverse in nature. In some provinces, even units that have nothing to do with agricultural input are also engaged in the sales. Because the sellers are not responsible for post-sales service, incidents of pesticide poisoning happen so frequently to the farmers using it. In August 1994, a serious sphinge hazard occurred on sweet potato in a certain county in Shandong Province. Originally, only some common insecticides like trichlorphon were needed to control the hazard. Unfortunately, as the local farmers lacked the expertise in this aspect, they instead chose parathion, very high in toxicity. And within a short period of three days, over 1 million farmers came into the fields to combat the sphinges, resulting in over 300 people poisoned and 3 died.

Recently, poisoning incidents due to exceedance of the permissible limit for residue of highly toxic pesticides have occurred at a high frequency. For instance, carbofuran was used on Chinese cabbage in Heilongjiang Province, leaving millions of kilograms of the vegetable contaminated. In Jiangxi Province, dimethoate was once detected 5 times over the permissible limit for residue on some Chinese cabbage on sale in a city market. In 1994, the first half of the year alone saw more than one hundred poisoning incidents occurring just in one place in Guangdong Province because of the pesticide residue on vegetables. In one incident, 66 people were poisoned by eating water convolvulus sprayed with methamidophos. In 1992, one pesticide-poisoning incident took place, killing 11 people in Anqing City of Anhui Province. Eventually, it turned out that they had a breakfast made out of the wheat flour that had been contaminated with organophosphorus pesticide during transport on a truck that had once been used to carry organophosphorus pesticide. During 1998, the Huaxia School in Zhuhai City had a large number of students poisoned, leaving 23 hospitalised, just because they ate vegetables still containing pesticide residue. The above-cited facts suggest a social problem that calls for an urgent solution.

### ***Disturbing ecological equilibrium and endangering biodiversity***

Because quite a number of substituted pesticide varieties are highly toxic and have a wide range of killing abilities, when applied, they not only poison and kill human beings, but also exterminate all environmental biomasses. The use of these highly toxic pesticides has disturbed the balance originally existing between injurious insects and their natural enemies (such as beneficial insects, frogs, snakes, birds, etc.) in nature. This means that, when pesticides are applied, both the injurious insects and the on-targeted biomes are killed indiscriminately and simultaneously. However, the survivors of the injurious insects soon reproduce rapidly by depending on the crops while their natural enemies are inhibited in regeneration due to food shortage till their preys restore their populations. Moreover, the applied pesticide will transfer and accumulate through the food chain, posing greater poisoning risks for lives high on the top of the food chain. Currently, quite a number of high grain yield regions have become consumer of high-rated pesticides. According to spot checks, the consumption of pesticides rose rapidly from 4.65 kg/ha in 1985 up to 15.9 kg/ha in 1991, (over three times as much as the former) at an annual increase rate of 41.8%. And also in September 1998 the PIC Convention signed by over 60 nations as was advocated and promoted by UNEP

and FAO specifies methamidophos, monocrotophos, parathion, parathion-methyl and phosphamidon as detrimental pesticides, among which some are still in extensive use as dominant means for controlling plant diseases and injurious insects. Due to the over-rated application and abuse of pesticides, the water bodies in these areas are contaminated and the ecological equilibrium is disturbed. In these regions, frogs and fish have been decreased drastically in population and paddy eel and loach exterminated; silkworms being raised indoors often die of pesticide contamination of mulberry leaves. Application of the pesticides even brings misfortune to birds in forests and mountains. Birds are often killed by eating pesticide-poisoned insects. Meanwhile, the killing of large numbers of insects has deprived some birds of their food sources, thus leading to decline and even extermination of their populations. In this way, the use of the pesticides has gravely damaged the biodiversity, directly threatening the entire eco-system.

China is very rich in bird resources, consisting of 1,244 species or genus, of which 37 enjoy the first class protection from the State and 74 the second class. The use of some of the highly toxic pesticides has already done serious harm to these protected birds. Carbofuran, for instance, is one kind of pesticides that China produces in large quantities and uses in almost every corner of the country. The carbofuran in use is mainly in the form of granule, 3% only in concentration, or seed coating mixture, 3 - 5% in concentration. Its  $LC_{50}$  to birds is lower than 1 mg/kg. Experiments have demonstrated that one granule of the pesticide is enough to kill a small-sized songbird, and that a songbird is doomed even if it happens to eat up an earthworm contaminated with carbofuran applied at the lowest rate in the cornfields. A bird will get paralysed or killed when it eats anything contaminated with carbofuran, no matter whether it is a plant, an insect, a living or dead soil invertebrate or water, since there is almost no safe dose of carbofuran to any wildlife. The US EPA stated that carbofuran is so virulent that there are no effective measures to reduce its risk to birds. For the safety of birds and wildlife, the USA and Canadian Governments decided to prohibit the use of carbofuran granules in 1997. China began, in 1995, to investigate the use of carbofuran and its potential threat to birds in Northeast China. The results showed that of the 86 species or subspecies of birds under the first- and second-class protection from the state, 85% were likely to be threatened by carbofuran. During an investigation, only 3 earthworms were found within one square meter of the plough layer soil in a sugar cane field that had been treated with carbofuran for years, whereas more than 30 were discovered in the control field nearby. It is also quite obvious that the populations of birds are shrinking. It hence can be concluded that the use of carbofuran has been threatening the safety of both common and rare birds. Consequently, how to control virulent pesticides from endangering birds and protect the safety of rare and endangered bird species has become a problem of urgency for the environment protection agencies to solve.

### ***Tremendous economic losses caused by pesticide contamination***

Because not all the processes of the production, transport, distribution and utilisation of pesticides were put under any effective environmental supervision and management, various incidents of serious pesticide pollution occurred more often than not, bringing heavy losses to the national economy. From July 1995 to August 1996, more than 2,000 incidents took place over an area of 1.3 million ha of farmland in 19 provinces (or regions, including Heilongjiang, Jiangsu, Guangdong, etc.), resulting in an economic loss of 500 million Yuan. If the damage caused by pesticide pollution in other provinces is counted, the economic losses might total 1 billion Yuan. So, pesticide pollution will not only bring about enormous impact and losses to the agricultural production, but also affects directly the economy and life of the farmers involved. Also in the summer of 1996, for controlling injurious insects in cotton fields, the farmers in Hengshui Prefecture, Hebei Province, bought from a pesticide plant in Jingxian County a kind of unwanted pesticide. Right after the pesticide was sprayed on to the crop, the green plants began to wither. About 60 ha of cotton all died in a few days. This pesticide-induced disaster led to 1 million Yuan of direct economic losses. The above-listed incidents are only two typical examples of the large number of serious pesticide pollution incidents that occur every year in China.

The extensive use, particularly abuse, of pesticides often leaves high residue in agricultural products. The agricultural products with exceedance of the permissible limit of pesticide residue will not only endanger lives of the people, but also affect the reputation and the import and export trade of the country in the world. The over-limit pesticide residue in the agricultural products and by-products for export often leads to rejection or return of the goods, which brings about tremendous economic losses as well as seriously affects reputation of the country in foreign trade. For instance, over-limit DDT in tea, methamidophos in cider, over-limit pesticide residue in frozen pork, rabbit and chicken, etc. These problems should attract more attention from environmental protection agencies at all levels.

### **Imminent urgency for intensified environmental supervision and management of pesticides**

The pollution problems discussed in the preceding paragraphs are cruel but true facts, which demonstrate that the lack of scientific and rational utilisation of pesticides has polluted the environment, jeopardised human health and disturbed the ecological equilibrium. The problem reached an extent that it has posed a grave threat to

the survival of the people in the broad rural areas and a potential hazard to the health of the broad masses in the country, too.

Pesticides, however, have to remain in use. For a long period in future, chemical prevention will remain to be a major means for 80% of the sanitation tasks and the control of injurious insects in agriculture. Consequently, how to exert effective environmental supervision and management of the application of pesticides has become a problem of paramount importance and urgency China is confronted with.

In short, China lags a certain distance behind the developed countries in controlling pesticides from polluting the environment. For instance, the environmental supervision and management system is not yet sound and complete, and the administration of pesticides started late. Only in 1982, several ministries and commissions worked out "Regulations for Registration of Pesticides" jointly, stipulating mainly that any new pesticide product must be registered beforehand prior to being put into production in China. Regulations also prohibited producing, distributing or utilising unregistered pesticides, and that foreign companies must have the pesticide registered before it can be sold in the market. The enforcement of the regulations has helped control to a certain extent the disorder that has existed in the production and distribution of pesticides in China. Then in 1997, authorised by the State Council, "Rules for Administration of Pesticides" was promulgated. This is the first official document of the law nature concerning pesticide management in China. The key contents of the document however, are still limited to administration of the production, distribution and utilisation of pesticides. The document untackled whether these registered pesticides, when put into use, would contaminate the environment, and jeopardise human health, and how these that have already caused contamination and damage should be controlled.

Therefore, in a sense, it is still virgin in China how to effectively supervise and manage the pesticides after they enter the environment in large quantities. In such a case, it seems inevitable that pesticides cause serious pollution to the environment. For instance, among the several organochlorine pesticides specified in the POPs convention, at the end of May 2001 been ratified by a large number of governments in Stockholm, some are still in use in some regions of the country. And also in September 1998 the PIC Convention signed by over 60 nations as was advocated and promoted by UNEP and FAO specifies methamidophos, monocrotophos, parathion, parathion-methyl and phosphamidon as detrimental pesticides, among which some are still in extensive use as dominant means for controlling plant diseases and injurious insects. In addition, some herbicides are already determined to be able to cause cancers, deformity and mutation and hence prohibited in other countries. But China has not yet taken any action to prohibit their use. It is quite obvious that earnestly intensifying environmental management of pesticides is something of real importance and something that allows no delay.

In intensifying environmental management of pesticides, environmental protection agencies should take a leading position and play a leading role in formulating corresponding rules, regulations, and measures for environmental supervision and management. They should put pesticides under strict supervision and management from the cradle to the grave. Currently, the attention should be focused on supervising and monitoring pesticides after they enter into the environment. Those with acute toxicity, high application rate and extensive use should be put first under environmental supervision. And at the same time, corresponding measures should be worked out to eliminate and destroy those that have already been listed as prohibited or restricted in international conventions. The measures for intensifying environmental management of pesticides should be really and earnestly put into effect so as to guarantee strategically and technically protection of the living environment of the people and maintenance of the ecological equilibrium in China.

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