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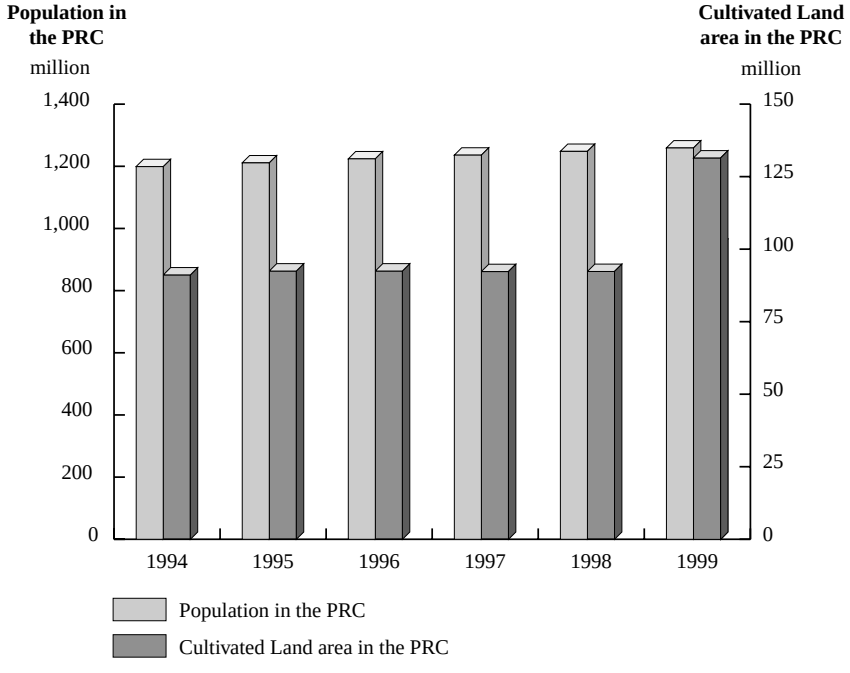
INDUSTRY BACKGROUND

The PRC Agriculture Industry

In 1999, the population of China was approximately 1.26 billion, comprising approximately 21.2% of the world population. In the same year, China had approximately 130.04 million hectares of cultivated land. From 1994 to 1999, the population of China increased by approximately 5.1% from 1.20 billion to 1.26 billion. The cultivated land in China increased by approximately 37.0% from 94.9 million hectares to 130.04 million hectares during the same period. The production volume of pesticides in China increased by approximately 60.6% from 264,000 tonnes to 424,000 tonnes during the same period. The population in China has continued to grow and reached approximately 1.29 billion in 2000. Hence, in formulating its agricultural policies in recent years, the PRC government has placed strong emphasis on increasing agricultural output to keep pace with population growth.

In 中央農村工作會議 (Central Agriculture and Rural Work Meeting) held in January 2001, the PRC government stated that the strengthening of agricultural industry and stabilisation of agricultural output were China's top priority tasks. In the work report presented by Premiere Zhu Rungji to 第九屆全國人民代表大會 (the Ninth National People's Congress) held in March 2001, the strengthening of the foundation of the agricultural industry was listed as one of the primary goals of the PRC government. In 當前優先發展的高技術產業化重點領域指南 (the Guidelines on Preferred High Technology Industries for Immediate Development) jointly prepared by 國家發展計劃委員會 (the State Commission of Development and Planning) and the 國家科學技術委員會 (Ministry of Science and Technology) in June 1999, modernisation of the agricultural technology was again stated as one of the top priorities for development.



Source: China Statistical Yearbook 1995 to 2000

History and development of the pesticide industry of the PRC

Coincide with the increase in the agricultural production output and production value, the PRC agricultural industry has been seriously threatened by industrial pollutions, destruction of vegetation cover, excessive plantations and improper applications of pesticides, which led to incessant deterioration of the overall ecological environment for agriculture. In particular, the applications of large volume of chemical pesticides with high toxicity have resulted in destroying the biological balance chain, strengthening of pests resistance to drugs, increasing reliance on pesticides as well as causing direct and indirect harm to applicants of pesticides and consumers of grains and produces.

In June 1999, the State Development and Planning Commission (國家發展計劃委員會), and the Ministry of Science and Technology (科學技術部) have jointly announced the "Guidelines on Preferred High Technology Industries for Immediate Development" which has stressed the modernization of the agricultural technology as one of the top priorities for development. At the same time, the PRC has placed strict pollution controls over chemical matters and environmental protections as the directions of continual development of the PRC.

The continual increase in living standards and the increase in demands for meat, marine products, fruits and vegetables will drive up the levels of pesticides required for fruits and vegetables. The development of the rural economy, in particular, the exploitation of the central and western regions, will lead to captive increases in paddy herbicides. In China, certain changes in the structure of paddy herbicides will evolve as the techniques of paddy plantation are currently undergoing changes from transplanting to direct sowing and from body transplant to off-body transplant. With the increase in the area being sowed, the area under pests and rodents will also increase. As a result of the development of the rural economy and the enhancement in prevention and cure techniques, the speed with which the increase in the area being treated will supersede that of the area being affected. The development of pesticides towards the directions of high efficiency and exceptional high efficiency means that the application of pesticides will reduce to a level below that of the present level. Despite the increase in the area being treated, the total demand for pesticides will maintain at 370,000 tonnes.

Currently, the PRC pesticide market has immense potential. The trend of the market is towards stability in demand. According to the Tenth Five-year Plan, the target of the PRC pesticide industry is to satisfy the demands of agricultural productions with the support of the two scientific research and development centres. The core issues are to adjust the product and industry structures, accelerate the development of new products, forms and prescriptions, and strengthen the prevention and cure of three wastes and foreign cooperation to upgrade the overall level of techniques of the PRC pesticide industry.

Through adjustments made during the Tenth Five-year Plan, the number of key pesticide production enterprises will be reduced to 40, of which 15 are large pesticide production enterprises. This would mean that the production of raw pesticides will be much more concentrated as the volume of raw pesticides produced by key pesticide production enterprises will take up over 60% of the total production volume.

The PRC pesticide industry has come from scratch with quick development being achieved during the two decades of open reforms. It has now formed a more complete system of scientific research and development, industrial production, production marketing and sales and a complete industry system of raw materials, intermediaries, integrated raw pesticides and processing of prescriptions. With the enhancements in the level of scientific research and development as well as industrial production, the quality of some of the old products produced since the sixties and seventies and the new products being developed within the last two decades have reached international standards. In 1999, the total production of pesticides in the PRC was over 420,000 tonnes. It can basically satisfy domestic demands with certain volumes left for exports. However, the product structure of the pesticide industry is far from rational, with insecticides being the major product accounting for approximately 70% of the total production volume of pesticides. Over 70% of the insecticides are organophosphorus insecticides, of which approximately 70% are highly toxic.

By 2015, the number of key pesticide production enterprises will be reduced to around 30, of which large production enterprises will be reduced to around 10. The raw pesticide production of these enterprises will account for 80% of the total production volume. During the Tenth Five-year Plan Period, the key adjustment of the product structure of pesticides will still be the rationalization of the proportions of insecticides, germicides and herbicides, coupled with the upgrade of the level of satisfaction towards pesticide production and the grading of pesticides exported.

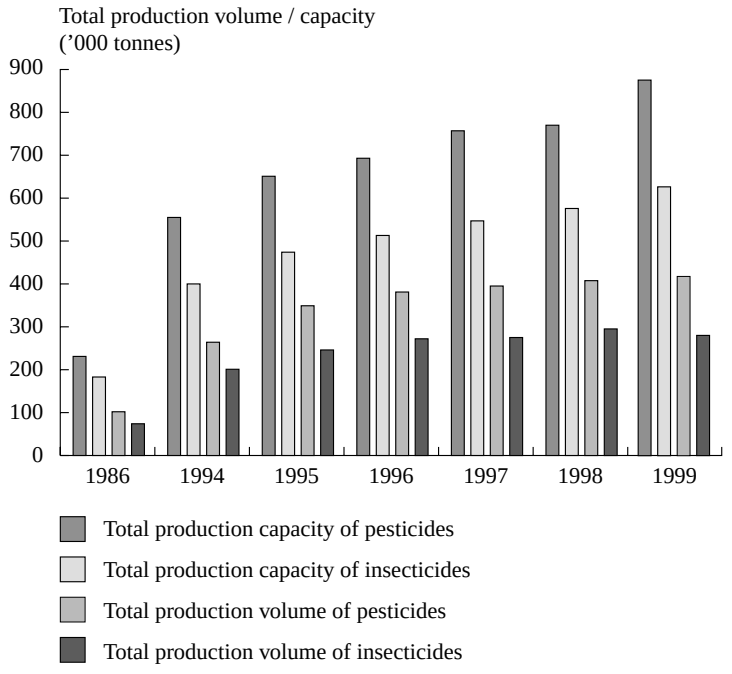
SUPPLY AND DEMAND CONDITION OF PESTICIDES IN THE PRC

Changes in annual production capacity of pesticides in the PRC

In 1999, the production capacity of pesticides in PRC reached approximately 884,000 tonnes, which was approximately 3.8 times that of 1986. The production volume of pesticides has also increased significantly from 102,000 tonnes in 1986 to 422,000 tonnes in 1999, an increases of over 3.1 times. In the PRC, pesticides are mainly classified into four different forms, namely, insecticides, fungicides, herbicides and plant growth regulators. In the PRC, pesticide production is dominated by insecticides. For instance, in 1999, insecticides accounted for approximately 68%

of the total production volume of pesticides. Besides satisfying demands of domestic agricultural production, China is also exporting pesticide. The following graph shows the changes in production capacity and production volume of pesticides and insecticides during the period between 1986 and 1999:

Production volume/capacity of pesticides in the PRC in recent years (measured at 100% contents, '000 tonnes)



Sources: *China Agriculture Yearbook 2000*
Petrochemical Statistic Yearbook issued by the previous Petrochemcial Ministry
Data from United Nations Technology Information Promotion System Fujian Centre

In the coming 50 years, chemical pesticide will still dominate pesticide market in the PRC with the highest market share. However, new chemical pesticides are different from the original concept of traditional pesticides. Future pesticides will be safe prescriptions with high activity and selectivity so as to satisfy the increasing strict requirements of environmental protection. New pesticides with high effectiveness, low toxicity, low residue and low dosage will be the development direction of chemical pesticide in the future.

Pertaining the trend of pesticide consumption, it is worthwhile to note that, due to the time-consuming and laborious nature of prevention and cure of paddy pest, the cost of deploying pesticide has largely exceeded the cost of purchasing pesticide on a combined cost basis. Hence, the requirements of new product developed by pesticide companies in the future will not only be on the competitiveness of sales price but also on the continuing reduction of usage cost of the product which in turn will provide the farmers with high quality products at low combined costs.

Brief status of paddy producing areas in the PRC

The annual area for growing paddy in the PRC in 1999 was approximately 31.6 million hectares with an annual production of over 200 million tonnes. *(Source: China Paddy Rice, Issue No.3)* There are six major paddy producing areas which are the major grain producing bases of the PRC.

Major paddy producing areas	Paddy seasons	Climatic conditions	Major paddy pests
Chuanxi Plain	One season paddy only	Continental climate	Chilo suppressalis, rice planthopper
Jianghuai Plain	One season paddy only	Warm temperate	Rice Planthopper, chilo suppressalis
Taihu	Two seasons paddy area with long grained nonglutinous and followed by round-grained nonglutinous	Maritime climate	Rice Planthopper
Jianghan Plain	Odd and even mixed cultivation area	Sub-tropical windy and humid climate	Yellow rice borer
Dongtinghu	Two seasons paddy area with pure long-grained nonglutinous	Transitional between mid sub-tropical to north sub-tropical	Rice Planthopper
Pearl River Delta	Two seasons paddy area with pure long-grained nonglutinous	Maritime climate	Rice Planthopper, yellow rice borer, Asian rice gall midge

Major paddy pests in the PRC and the traditional pest control

According to the information of the《2000 China Agriculture Yearbook》, "in 1999, the total area subject to paddy pests nationwide was 353 million hectare times", major pests in the PRC are rice planthopper, rice leaffolders and Asia rice gall midge. In recent years, rice water weevil has also become one of the destructive paddy pests.

A. Rice planthoppers

Rice planthoppers (稻飛蝨) are categorised into brown planthoppers (Nilaparvata Lugens (Stal)) and white-backed planthoppers (Sagatella furcifera (Horvath)) which have the habits of long distance migration. Currently, they are the most common pests on paddy in China and many other Asian countries. Generally, their adults and larvae gather at the lower part of paddy stem and pierce into the paddy tissue with their proboscis to suck juice. When the population of rice planthoppers is large enough, they will cause the lower part of the paddy stems become blacken and even drop off. As a result, there will be serious reduction of yield or no harvest. In addition, the rice planthoppers can also transmit paddy viruses.

Rice Planthoppers are the most common pests of the PRC paddy plantation industry with frequent occurrence throughout the years. Damaged areas accounted for 20-25% of the total paddy plantation areas in a year of light famine, but up to 70% in a year of heavy famine. According to "2000 China Agriculture Yearbook", in 1999, the affected areas due to this pest amounted to 16.0 million hectare times.

Prevention and cure of Rice Planthoppers

In China, the common practice of controlling rice planthoppers is the spraying of buprofezin water powder. But the method of spraying buprofezin water powder is not effective enough.

B. Asian rice gall midge

Asian rice gall midge (稻癭蚊) is a kind of pest that is dangerous to paddy growth. It damages the paddy by boring, but there is no obvious symptom in the early stage. Once the growing point is destroyed, the paddy would grow leaves only but without any seed. It is very difficult to prevent and cure such pests by applying pesticide. In areas seriously affected by Asian rice gall midge, there is often complete loss of yield.

Since 1980s, the damages caused by Asian rice gall midge and the areas affected have been increasing over years due to the structural adjustment of plantation industry and the diverse types of paddy cropping as well as the obvious warming of winters caused by global green house effect. In China, Asian rice gall midge mainly occurs in the regions south of the Yangtsi River and has become the leading pest in the southern paddy planting regions. In 1999, the area of paddy planting regions in southern China affected by Asian rice gall midge amounted to 1 million hectare times.

Prevention and cure of Asian rice gall midge

The common practice is using the highly toxic pesticide of ethoprophos (丙綫磷). However, the application of such pesticide causes water pollution which would directly threaten the safety of human beings and animals, and also hinder the development of freshwater aquacultural industry. For example, Fujian province sustained heavy economic losses annually over the application of ethoprophos (丙綫磷) in controlling Asian rice gall midge, because the toxic paddy water kills fishes when flew into ponds and reservoirs.

C. Rice leaffolders

Rice leaffolders (稻縱卷葉螟) is a kind of paddy pest with the habit of migration, which mainly occurs in Southeast and Northeast Asia. They destroy paddy leaves, cause the degradation of spikelets and spike-stalk, increase the rate of empty seeds, and reduce seed-setting. Rice leaffolders appear in all provinces of the PRC, and are one of the pests which affect China's paddy production most frequently.

Prevention and cure of Rice Leaffolders

In the PRC, the commonly applied pesticides in preventing and curing rice leaffolders are 25% bisultap water powder, 50% methamidophos emulsion cream, etc. Whilst controlling the pests, those pesticides have the drawbacks of application method and low level of environmental protection.

D. Rice water weevil

Rice water weevil (稻水象甲) is a kind of highly damaging quarantined paddy pest. It originated from the regions along the Mississippi River in the USA. It spread into Japan in 1976, and became the most disastrous paddy pest of Japan. It then spread into South Korea and North Korea in 1980s. In 1988, rice water weevil arrived in the PRC. Since then the areas which have been affected by rice water weevil include Liaoning Province (遼寧省), Hebei Province (河北省), Tianjin Municipality (天津市) and Zhejiang Province (浙江省). Once the rice water weevil pestilence is found in a certain region, it may cause yield reduction of approximately 30%.

Prevention and cure of Rice water weevil

Pesticides for controlling rice water weevil include the domestic Lushawei (氯殺威), the French Regent emulsion cream and Japanese etofenprox grains, which are relatively expensive. Currently, the pesticide used by farmers in China includes carbofuran (呋喃丹) and etofenprox (甲基異硫磷) which are strictly forbidden in China for application in paddy fields in controlling rice water weevil. During the application, creatures in the field such as frogs, spiders, fish and shrimps which are the major natural enemies of rice water weevil are also killed. The reports on the death of cattle and sheep that had mistakenly drunk the water in ponds and rivers polluted by the residue of pesticide and the poisoning of users are often resulted.

Regulations of the PRC Pesticide Industry

In the PRC, pesticide is a specialized industry that is under the regulation of a number of government authorities and subject to a registration and licensing system. According to the "Administrative Regulations on Pesticides of the PRC" ("Pesticides Regulations"), the primary legislation governing the pesticide industry, the whole process of development, production and distribution of pesticide products must possess 3 certificates, namely, pesticide registration certificates (or provisional pesticide registration certificate), pesticide producing permit and product GMP compliant certificate. In recent years, as a result of the sophisticated structural adjustments implemented by the PRC government in respect of the pesticide industry, the supervision and regulation over pesticide production are getting much more stringent.

Pursuant to the provisions of the Pesticides Regulations, the development production of pesticides (including raw material production, processing and packing) and the imports of pesticides must undergo registration. Pesticide registration certificates are issued by the PRC Ministry of Agriculture and all applications together with various requisite submissions shall be vetted jointly by a number of State administrative authorities in charge respectively of agriculture, forestry, chemical industry, public health, environmental protection and nationwide agriculture production materials supply and distribution. The integrated evaluation is in terms of the chemistry, efficacy, residues and environmental implications of the pesticide. Certificates will be issued to those that have complied with the relevant standards. The registration of a pesticide is divided into three phases, namely, the field trial phase, the provisional registration phase and the formal registration phase.

The field trial phase requires a field trial of the effectiveness of the pesticide over 2 years at 2 different locations. The provisional registration phase follows the completion of the field trial phase which covers the demonstration trial, experimental sales and utilization under exceptional circumstances. The provisional registration is valid for one year and renewable. After the completion of the provisional registration phase, the formal registration may be applied by the developer for commercial production and must be heard within one year. The formal registration certificate is valid for 5 years and renewable.

A production licence shall also be required for production which is granted by the National Petroleum and Chemical Industry Bureau (國家石油和化學工業局) and valid for 5 years for raw material production, 3 years, for preparation processing and 1 year for packaging.

Pesticide registration certificate and pesticide provisional registration certificate have specific expiry dates of registration. Applications for extension of the registration date for the purposes of continual production or sale of pesticides in the PRC must be made prior to their respective expiry dates.

Lastly, prior to the delivery of pesticide products from the factory, all product packaging must have labels or with instructions attached. Products that have failed quality testing and do not possess product quality testing pass certificate or ailed to comply with GMP standards are not allowed to be delivered ex-factory.

The Pesticides Regulations and its implementary rules are administrative measures designed to strengthen the administration over pesticides through stringent assessment in accordance with established standards and procedures in terms of development, production and distribution. Under such regulatory frame work, it takes years to have a new or imported pesticide registered for production and distribution purpose and therefore the entry barrier of the industry is relatively high.

GOVERNMENTAL SUPPORT ON HI-TECH PESTICIDE INDUSTRY

All levels of local governments in the PRC have also set up series of special policies for supporting the development of hi-tech companies. The Fujian provincial government has set up a special policy that uses tax preferences in promoting the development of hi-tech companies (including the hi-tech pesticide producers). Hi-tech companies are to be exempted from income tax for two years and a reduction in tax rate to 15% for indefinitely thereafter. In particular, whilst conducting macroeconomic controls over the pesticide chemical industry and adjusting the structure and volumes of pesticide types, the government emphasizes on supporting the new hi-tech companies in developing and producing new pesticides. The Ministry of Finance and the State Tax Administration promulgated policies which enhance the external condition of pesticide production under the "Notice on the question of exempting value added tax relating to certain production materials" by imposing a 13% defensive value-added tax on pesticide products, which were later exempted in respect of major pesticide products; a guaranteed exemption of US$100 million over imported raw material intermediaries with import VAT being paid and later refunded; low season reserve capital of pesticide; an annual amount of RMB150-200 million of low interest or interest free loans for technology improvement of pesticides and to promote the increase of economic interest of the industry and companies. The PRC government also actively protects and supports highly effective, non-polluted new pesticide products.

CHINA'S ENTRY TO THE WTO AND ITS IMPACT ON THE PESTICIDE INDUSTRY

Upon China's entry to the WTO, international agricultural products will have a significant effect on the structure of Chinese agricultural products. In order to lighten the impact brought about by the accession of the WTO, the PRC government will conduct a necessary adjustment on the plantation industry by adjusting and upgrading plantation structure, regional distribution, upgrading species and increasing the ratio of foliage and green manure plants. Taking actions that suit local circumstances to develop high quality new fruit types regionally, the agricultural product structures mentioned will be subject to significant changes.

However, the accession of the WTO will also provide good opportunities for expansion and development of new pesticides in the PRC market and international market. In order to change the existing conditions of the pesticide industry in China to cope with competition subsequent to the accession of the WTO, the PRC government has been actively conducting a macroeconomic-control over pesticide chemical companies by adjusting industrial policies to support the healthy pesticide producers to grow, adjusts the structure and production volume of pesticide, and supports the development of brand-name products with hi-tech features, which will create good external development environment for new pesticide companies.

The impact of the accession of the WTO on the pesticide industry in the PRC will be tough at first and then loosen. At the initial stage, foreign companies need 3 to 5 years to invest and set up their plants in the PRC. During this period pesticide companies can deploy their advantages by fully developing products whose international patents will expire shortly and the substitution of major import types. In addition, by basing on the high speed of agricultural planting structure, pesticide companies can also rationalize the internal structure of various products, increase forestry and grassland insecticides, develop new types of prevention and cure of ground pests and insecticides of creatures, increase types and volumes of bactericide used in vegetables and fruits, tapeworm curing agents and seed regulators, increase types and volume of herbicide especially dry farmland herbicide, and adjust the structure of paddy field herbicide in order to strengthen their leading position in domestic market.