

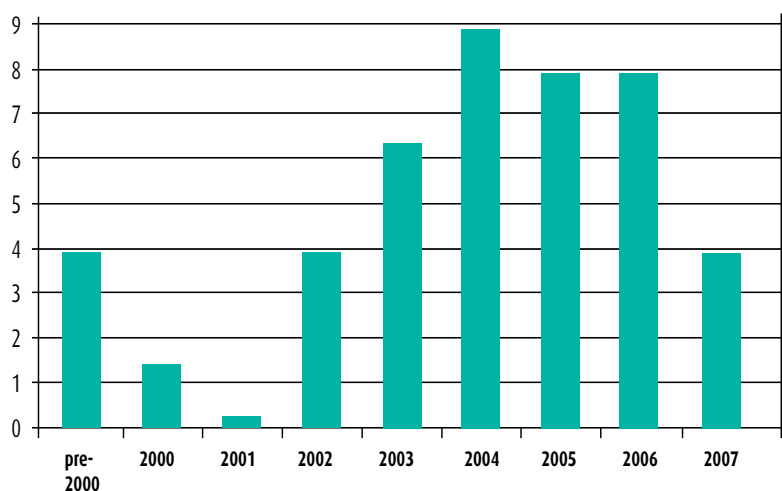
# New developments in Chinese agrochemical R&D

No longer just manufacturers of generic pesticides, Chinese agrochemical companies and research institutes are increasingly developing their own active ingredients, says **Rob Bryant**

Although China has become a major force in the manufacture of pesticide active ingredients (ais) and formulated agrochemicals over the past 10–15 years, its role in the development of novel agrochemicals is more recent and possibly less well-known. Since 2002, a steady flow of new developmental compounds has emerged from the major Chinese research institutes, universities and chemical factories, which are actively involved in basic research (see Figure 1 and Table 1).

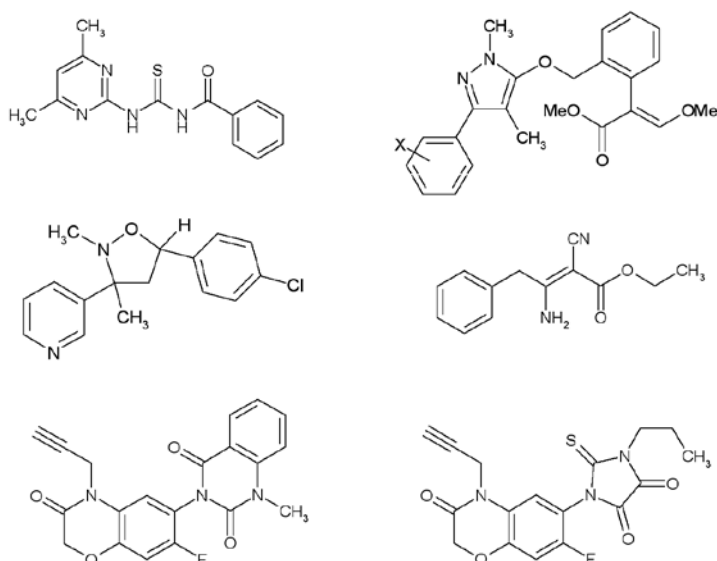
The majority of the research institutes are owned and administered by China's central and provincial governments. In order to undertake original research, they receive funding through the state's regular five-year plans. However, some institutes have also set up pesticide manufacturing companies, many of which have become considerable businesses. There are three outstanding research institutes of this type: HRICI (Hunan Province), SYRICI (Liaoning Province) and ZCIRI (Zhejiang Province), which have been responsible for introducing more than half of the new developmental compounds identified by the UK agrochemical publisher Agranova.

Figure 1: Number of new pesticide ais development in China (2000 – 07)



Source: Ag Chem Supplementary Report (published by Agranova in October 2007).

Figure 2: Examples of interesting developmental compounds



- HRICI (Hunan Research Institute of Chemical Industry) has set up Hunan Haili Chemical Industry, which produces a range of generic ais and formulations.
- SYRICI (Shen Yang Research Institute of Chemical Industry) also carries out research into dyestuffs and fine chemicals. Its agrochemical researchers have collaborated with several multinationals, including Dow, FMC and Rohm & Haas. As well as selling a range of generic agrochemicals, SYRICI has launched four successful commercial pesticide products that it developed internally. In 2007, it was announced that SYRICI will be merged with another state-owned company, Sinochem, which is China's biggest petroleum and chemical company. SYRICI also produces and sells optical brighteners through its Cenkey Chemical subsidiary.
- ZCIRI (Zhejiang Chemical Industry Research Institute) became Zhejiang Chem-Tech Group Co Ltd in 1999. As well as playing a leading role in China's agrochemical research in a number

**Table 1 – Agrochemicals developed by Chinese companies**

Name	Lead	Code, name, BRAND, type
China Agriculture University, Jiansgu Gengyun Chemical	fungicide	pyrimorph (ZNQ0317)
Huazhong University	herbicide	HW-02 (phosphonate)
Huanye Biological Pesticide Factory	other	HUANYE No2
Hunan Research Institute of Chemical Industry (HRICI)	herbicide	HNPC-C9908 (LIUWOMI)
	insecticide	HNPC-A3061
	insecticide	LIUWOMI (pyrethroid)
Jiangsu Pesticide Research	insecticide	HNPC-A2005 (pyrethroid)
	insecticide	JS118
	fungicide	JS399-19 (QING XI JUN ZHI)
Kunming Institute of Botany	insecticide	munroniamide
Kunming Institute of Botany	other	KNB-050
Liyang Chemical Factory	insecticide	nerestoxin
Nankai University	herbicide	H-9201 (OP-type)
Shanghai Nong Le Biological Products	fungicide	M18 antibiotic
Shanghai Zhong-Xi Pharmaceutical Co. Ltd.	insecticide	flubrocylthrinat
Shenyang Research Institute of Chemical Industry (SYRICI)	herbicide	SYP-298 (imidazolone)
	herbicide	SYP-249
	herbicide	SYP-300 (imidazolone)
	herbicide	SYP-185
	herbicide	SYP-1924 (KUI CAO XI)
	fungicide	flumorph (SYP-L190)
	fungicide	coumoxystrobin (SYP-3375)
	fungicide	coumethoxystrobin (SYP-3200)
	fungicide	SYP-Z048 (JUN SI QI)
	fungicide	SPRI-WM-005 (LVBEN WOZUO)
	fungicide	SYRICI diazole
Shanghai Institute of Organic Synthesis (SIOC)	fungicide	SYP-1620 (XI WO JUN AN)
	fungicide	enestroburin
	herbicide	SIOC0163
	herbicide	SIOC0171
- Shandong Qiaochang Chemical	herbicide	SIOC0171
	herbicide	SIOC0172
	herbicide	ZJ0207 and ZJ0273 (joint devlp)
University of Shanghai (East China Normal University)	herbicide	Bdpt
Unknown	fungicide	RZI-02-003 (fipronil-type)
Yangling Pesticide and Chemical Company	fungicide	propamidine
Zhejiang Chemical Industry Research Institute (ZCIRI)	herbicide	ZJ0453
	insecticide	ZJ0777 (also fungicidal)
	herbicide	ZJ0862
	herbicide	ZJ1348
	herbicide	ZJ0273 pyrimidine
	herbicide	ZJ0702 pyrimidine
	insecticide	ZJ0967
	fungicide	ZJ0712 (BEN MI JUN ZHI)
	fungicide	ZJ1621
	fungicide	ZJ1954
	fungicide	ZJ2211

Source: Agranova's Ag Chem Base (Oct 2007)

of areas, Zhejiang Chem-Tech also specialises in producing fluorochemicals for polymers, flame retardants, refrigeration and agrochemicals.

The other research organisations listed in Table 1 either carry out applied research but no manufacturing (such as the Kunming Institute of Botany, which is part of the Chinese Academy of Sciences) or are manufacturers that have set up their own R&D programmes.

The majority of the companies within the Chinese agrochemical industry are now private or owned by shareholders. The restructuring of China's chemical industry over the past 10–15 years has allowed the government to rationalise its manufacturing base, with many of the more polluting sites now closing as the central government tightens up environmental compliance.

Attempting to develop an understanding of Chinese agrochemical research has proved difficult. Participants are often suspicious of enquiries about their R&D and generally decline to comment on information gathered from published sources. It is also hard to determine whether a new developmental ai has been commercialised, since the dividing line appears to be less clear than in many Western countries. The time taken from invention to first commercial launch appears to average some three to five years, which is significantly faster than in Europe or the US.

Analysing the chemistries of the ais shown in Table 1 allows some generalisations to be made.

- Herbicides and fungicides have been the most important targets.
- Several strobilurins have been developed.
- A wide range of herbicidal activities, including novel chemistries, are being tested.
- Only two natural products have been developed to date.

Agranova has identified the majority of the structures of these ais and some of the more interesting ones are presented in Figure 2.

There seems little doubt that China will continue to improve its agrochemical R&D activities and can be expected to make an ever-increasing contribution during the 21st century.



*Dr Rob Bryant runs Agranova, which has published information on new agrochemical developments and the global agrochemical industry since 1982 (www.agranova.com).*