

# Farming Systems and Ecotypes of Vegetable Soybeans in China

Tianfu Han, Institute of Crop Breeding and Cultivation, Chinese Academy of Agricultural Sciences, Beijing 100081, China, hantf@ihw.com.cn

## Current Status of Vegetable Soybean Production

Vegetable soybeans or *maodou* in Chinese, are cultivated in almost all the soybean production regions in China, especially in the middle and lower valleys of Yangtze River and the southeastern coastal provinces. Since 1980s, the production of *maodou* in the above-mentioned regions has developed greatly, along with the increasing demand from both domestic and international markets. In 1997, *maodou* area in Fujian Province reached 6700 hectares, the average yield was about 6 tons per hectare, and about 30 000 tons of frozen *maodou* products were exported (Xu and Liu, 1999). The area of *maodou* in Zhejiang Province was even greater than that in Fujian. In 1998, *maodou* occupied 20 500 hectares and accounted for 20.0% of total soybean hectareage in Zhejiang (Wu and Lu, 2000). Xiaoshan City is one of the biggest *maodou* producers in Zhejiang. In 2001, farmers in Xiaoshan planted 5600 hectares of *maodou*, accounted for 45.88% of spring-sown soybeans there (Agriculture Bureau of Xiaoshan City, 2001). Jiangsu, Guangdong, Anhui, Shanghai, Sichuan, Yunnan and other southern provinces also produce *maodou* at a quite large scale.

## Farming Systems of Vegetable Soybeans

*Maodou* is cultivated in single cropping, intercropping or on the dike of paddy fields. Single cropping is predominant in commercialized *maodou* production. In order to harvest fresh pods earlier, plastic mulching, vinyl channel, greenhouse and other protective cultivation methods are popularly used in *maodou* production in recent years. In 2001, 62.34% hectareage of *maodou* was planted with protective methods in Xiaoshan City, Zhejiang Province (Agriculture Bureau of Xiaoshan City, 2001).

### Single Cropping

Single-cropped spring-sown *maodou* is planted in open or plastic mulched fields in late February to early April in Jiangsu and Zhejiang Provinces. The fields are usually winter-fallowed. Some farmers sow the seeds in the unheated vinyl channel or greenhouse to nurse seedlings and transplanted later. After harvest of the single-cropped *maodou*, farmers usually grow paddy rice. Summer-sown *maodou* are planted after winter crops such as winter wheat and rapeseed and followed by winter crops also. In the Huanghe (Yellow River)-Huaihe-Haihe Valleys, summer *maodou* is sown after winter wheat, and the spring-sown *maodou* is planted in the winter-fallowed fields. *Maodou* is a full season crop and sown in spring in the northeast and northwest provinces.

### **Intercropping**

Intercropping is popular in the regions with rich labor resource and limited land. In south China, *maodou* can intercrop with many crops, including wheat, cotton, corn, peanut, sweet potato and vegetables.

In Zhejiang, Fujian, Hunan and other southern provinces, spring-sown *maodou* is sown between the rows of winter wheat or barley when wheat or barley is near to mature. When *maodou* blooming and podding, sweet potato or autumn-sown corn can be transplanted or sown in *maodou* fields. In Jiangxi Province, *maodou* is planted in the following multiple-cropping systems: wheat or barley/(intercrops with) spring-sow *maodou*—(followed by) sesame or sweet potato or rapeseed, rapeseed/spring *maodou*—sweet potato, and spring-sown corn/spring *maodou*—sweet potato. *Maodou* can also intercrop with fruit trees, tea bush, white mulberry and sugar cane.

### **Dike *maodou***

Dike *maodou* (*tiangengdou* or *tianchengdou* in Chinese) means the *maodou* sown or transplanted on the dikes of the rice paddies. Dike *maodou* has a long history in China. During the period from 1441 (Ming Dynasty) to 1941 (Republic of China), at least 41 local annals recorded this type of *maodou* cultivation (Guo, 1993). Nowadays the dike *maodou* is still very popular in the regions where the paddy rice is the predominant crop. Dike *maodou* plants develop well and yield highly because they enjoy ample light and favorable moisture. Dike *maodou* supplies nutritious vegetable for the rice farmers and their families.

## **Ecotypes of Vegetable Soybean Varieties**

### **Spring-sown type**

Spring-sowed *maodou* is the main type of vegetable soybeans in China. In the south, sowing dates of spring-sowed *maodou* vary from late February to early April depending on the latitude; fresh pods are harvested in late May to early June. In unheated plastic greenhouse, the spring-sown *maodou* can be sown in late January and fresh pods can be harvested in early May.

Like other early soybean varieties, spring-sown *maodou* varieties are less sensitive to the photoperiod and adapted to a larger span of latitudes than summer- and autumn-sown types. For example, AGS292, introduced from Taiwan, was planted in Fujian, Zhejiang, Jiangsu and other southern and northern provinces.

### **Summer- and Autumn-sown types**

Summer-sown type soybeans distribute in both south China and the Huanghe-Huaihe-Haihe Valleys, and the autumn-sown type soybeans mainly distribute in the south. Summer-sown soybeans are planted after winter crops and autumn-sown soybeans are after early paddy rice. In Zhejiang, autumn soybeans are sown in late July to early August. The harvesting dates of fresh pods can be delayed to late October or even early November.

Landraces are the main sources of summer-sown and autumn *maodou* varieties in south China. There are only several developed ones, including Chuxiu released by Huaiyin Agricultural Institute in Jiangsu Province and Xinliuqing released by Aihui Academy of Agricultural Sciences.

## The Roles of Local and Introduced Varieties in the Vegetable Soybean Production

South China is rich in soybean germplasm. Many landraces are planted as *maodou*. In the last century, soybean-breeding programs in China focused mainly on varieties for seed purpose, and only a few *maodou* varieties were developed and released. Since mid-1980s, many foreign (mainly Japanese) and Taiwanese *maodou* varieties have been introduced to the mainland of China. The introduced varieties play major role in *maodou* production.

### Local varieties

There are some local early *maodou* landraces in Jiangsu and Zhejiang Provinces, including Shanghai Zaohongmang, Suzhou Wuyuema, Benniu Qingdou, Wuyueba, Wuyuebaimao, etc. Jiangsu Academy of Agricultural Sciences released several spring-sown *maodou* varieties including Ningzhen No.1, Ningzhen No.3 and Huijia No.2 (Gu *et al.*, 2000) The most popular improved summer-sown *maodou* varieties are Chuxiu and Xinliuqing. Almost all the autumn-sown *maodou* varieties in production are the landraces, such as Lanxi Daqingdou, Bayueba and Shanghai Ruiliqingdou.

### Introduced varieties

Some northeast seed soybean varieties are introduced to the south and planted as early *maodou*, although their pod traits could not fully meet the demand of the international markets. In 1988, Fujian Academy of Agricultural Sciences introduced *maodou* varieties from Taiwan. AGS292 and 305 (Ryokkoh, a Japanese variety) were screened and released. AGS292 was mainly planted for frozen products. In 1995, the planting area of AGS292 reached 2600 hectares in Fujian Province. 205 (Tzurunoko), Kaohsiung No.2 and Kaohsiung No.3 were also planted in Fujian. More recently, Green 75 (a Japanese variety) is becoming the leading *maodou* variety in Zhejiang and Fujian Provinces.

Japan is the major importer of the Chinese *maodou* products. The Japanese *edamame* (a Japanese term for vegetable soybean) varieties fit the need of their own market well. Taiwanese *maodou* varieties are also good in pod traits and adaptability. In the near future, Japan and Taiwan Province will still be the main sources of *maodou* varieties for the Chinese mainland.

## Prospect of Vegetable Soybean Production in China

*Maodou* production of China developed very fast in the past two decades, but we still have many problems to solve. In the major producing regions, the introduced varieties are susceptible to the local races of soybean mosaic viruses, which have caused great loss in the coastal provinces. We also need to breed new late varieties for summer- and autumn-sown *maodou* production and adaptable varieties for the protective cultivation. The latter should be tolerant to low temperature, wetness and weak luminance.

Along with the further exploration of domestic and international markets, *maodou* production in China will be continuously developed. In the near future, the southern coastal provinces will still be the major producers, and the northeast and northern coastal provinces will also develop their *maodou* production and export based on their superiorities of rich land resource and cheaper labors. Therefore, the producing regions will be decentralized.

## Summary

China has a long history of vegetable soybean cultivation. In the past two decades, China became a big producer and exporter of vegetable soybean products in the world. The farming systems of vegetable soybean production in China are quite complicated. The vegetable soybeans are cultivated in single cropping, intercropping or on the dikes of rice paddies. Spring-sown type varieties are the main ecotype of vegetable soybeans in China and the summer- and autumn-sown types are also popular. Although Chinese mainland is rich in soybean germplasm, the major varieties in production were introduced from Japan and Taiwan in recent years. The disease-resistant early varieties and the elite late varieties are thirstily needed for the further development of vegetable soybeans in China.

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