Chapter 5

SOYBEAN CULTIVATION AND BNF IN CHINA

J. E. RUIZ SAINZ¹, J. C. ZHOU², D.-N. RODRIGUEZ-NAVARRO³, J. M. VINARDELL¹ and J. E. THOMAS-OATES⁴

¹Department of Microbiology, Faculty of Biology, University of Sevilla, Apdo-1095, 41080-Sevilla, Spain.
²Department of Microbiology, Huazhong Agricultural University, Shi Zi Shan Street, P.O. Box 430070, Wuhan, People’s Republic of China.
³Centro de Investigación y Formación Agraria “Las Torres y Tomejil”, Apartado Oficial 41200-Alcalá del Río, Sevilla, Spain.
⁴Department of Chemistry, University of York, Heslington, York, YO10 5DD, U.K.

1. SUMMARY

China is the geographical origin of cultured soybeans and is where they have been cultivated for more than 5,000 years. Soybean is grown in nearly all provinces of China, the exceptions being Qinghai and the Tibetan Plateau. Based on climatic differences, China can be divided into five main geographical regions as regards soybean cultivation. As a complementary classification, Chinese soybean varieties have also been classified according to the sowing date; they were divided into winter-, spring-, summer-, and autumn-sowing varieties. In spite of the soybean acreage in China (9.4 million ha in 2001), which ranks fourth in the world, China has also become the largest soybean importer in the world. Although China has greatly improved soybean productivity in the last 20 years, its total production (or average seed yield) is still clearly lower than that reached in western countries. The symbiotic interaction, which soybean forms with different rhizobia, is a key factor in increasing soybean productivity in China within the context of agricultural sustainability. Research efforts in China have mainly concentrated on the identification and characterisation of biological material, both soybean accessions and rhizobial strains that effectively nodulate soybeans. As a result of this activity, a large collection of soybean germplasm is available and the existence of a broad spectrum of bacteria that nodulate soybeans (which we will collectively call “soybean-rhizobia”) has been demonstrated. However, although soybean
inoculation is increasing as a soybean-cropping practice in China, the available scientific information on the results obtained in field experiments is negligible. Consequently, this review will be mainly focused on a description of: (i) the Chinese geographical areas devoted to soybean cultivation; (ii) the diversity of soybean-rhizobia and their populations in Chinese soils; and (iii) the collection of soybean germplasm available in China. Information about crop rotation (soybean with non-legumes) and the undesirable effects that frequently accompany continuous soybean cropping is also provided.

2. SOYBEAN CULTIVATION IN CHINA: HISTORICAL ASPECTS AND CURRENT SITUATION

2.1. Historical records and world-wide dissemination of soybean cultivation

China is the geographical origin of cultured soybeans and the use of this crop in agricultural practices is more than 5,000 years old. The first written record is found in the book, “Pen Ts’ao Kong Mu”, in which the plants of China are described (2838 B.C.). Further, in similar ancient writings, Zou Zhuan said that “one of Zhou Zi’s brothers was so foolish that he could not tell Shu (an ancient name for soybean) from wheat”. Soybean was also one of the five sacred grains (or “Wu Ku”), that include rice, soybean, wheat, barley, and millet. In Hubei province, soybean ashes have been found in a Han tomb (second century B.C.). Although it is clear that the soybeans used in agriculture originated from wild soybeans, it is not clear in which location soybean was cultivated for the first time. It may be that the Yellow River valley was the first place ever at which soybean was cultivated.

Although soybean is now grown in many countries, its expansion outside Asia only took place during the last three centuries. 2500 years ago, soybean cultivation was exported to what is now Korea and, 500 years later, to the islands we now call Japan. By the 7th century A.D., soybeans were grown in all southern countries neighbouring China. In 1712, the German botanist Kaempfer brought soybeans to Europe. Soybean was exhibited in the Botanical Garden of Paris in 1739 and in the British Royal Botanic Gardens in 1790. In 1804, the United States of America started to grow soybeans as a forage crop rather than for harvesting for seed consumption. Soybean cropping was initiated in other countries in Europe (1875-1877) as a result of its successful exhibition at an International Exposition in Vienna in 1873. Although soybean was not cropped in Brazil until the 1960s, this country is at present the second largest soybean producer after the United States of America. Soybean cropping was spread through Africa during the twentieth century.

2.2. Current soybean production in China

At the present time, China ranks third internationally in soybean acreage and production. In spite of this position, however, the increasing domestic demand for