The History of Vegetable Soybean Development, Current Status and Future Development in Thailand

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Introduction

Vegetable soybeans [*Glycine max* (L.) Merrill] are predominantly used in Asian countries. From the time the soybean was introduced from China to the northern part of Thailand the vegetable soybean was consumed for more than hundred years in Thailand. The medium seed size (15-20 g/100 seeds) soybeans grown for food or oil extraction is also traditionally used as vegetable soybeans (called "TUA RAE"). Green pods attached to the stem are commonly boiled and sold countrywide in the local markets. However, the quality requirements for export market are entirely different from those for the traditional domestic market. In addition to grain soybean, research on vegetable soybean began in the 1980s to improve yield and quality for both domestic consumption and export.

Vegetable Soybean Development

Production and Market Promotion

The initial stage of vegetable soybean development for export was the establishment of a frozen vegetable soybean factory as a joint venture between Thais and Japanese in the late 1980's. Export of a small quantity of vegetable soybean from Thailand to Japan commenced in 1990. The export volume dramatically increased to approximately 9,000 t in 1999 ranking the third country to export vegetable soybean to Japanese market after China and Taiwan. The export quantity is expected to increase to more than 10,000 t per annum beyond 2000. At present, there are five frozen vegetable soybean factories that play a major role to produce vegetable soybean for export. The factories supply the seeds and the necessary inputs to the contract farmers in areas scattered around the factories. The farmers use the improved technologies mainly from government research institutes.

The demand for high quality vegetable soybean for domestic consumption has increased particularly in the big cities. The annual quantity of vegetable soybean consumed by Thais is about 1,000-2,000 t. The domestic consumption is increasing steadily, particularly among the middle class.

Lack of experience in the production of high quality vegetable soybean for export was a major obstacle in the early stages of development of vegetable soybean industry. Due to the cooperation between people concerned in the government, private sectors in Thailand, and AVRDC staff, vegetable soybean production was promoted on a scientific footing. The training course on vegetable soybean production was organized for extension experts in Chiang Mai,

Thailand in 1991 (THDAE and AVRDC, 1991). Later, the Department of Agriculture and the Department of Agricultural Extension organized a five-year development program (1992-1996) to encourage the production and market promotion (THDA, 1991). As a result, the annual area planted to vegetable soybean increased to about 2,000 ha in 1999 and the area is expected to reach 2,500 ha in 2001 excluding the area planted to traditional vegetable soybean.

About 70 to 80 percent of the vegetable soybean production areas are in the upper north of the country. The crop is grown in three main seasons. The dry season crop (50 percent of the total area) is grown, from mid December to mid January, after rice harvest. The second crop is grown in the early rainy season, from April to mid June and the remaining vegetable soybean crop is grown in the late rainy season, in August. The average yield of grade A vegetable soybean is about 4.5-5.0 t/ha. The cost of production ranges from 44,000-50,000 Baht/ha. The price of grade A pods at the factory is about 14-16 Baht/kg while the price of vegetable soybean pod in the domestic supermarkets is 33-45 Baht/kg (45 Baht = US$ 1 in June 2001). The net profit for farmers is about eight - ten fold higher than that for grain soybean. In the future, if the market demand increases, vegetable soybean will be very competitive to other crops in this country.

Research

The initial research in collaboration with AVRDC was instrumental for vegetable soybean development in Thailand. A number of varieties/lines were introduced from AVRDC and Japan to Thailand since 1986. Subsequently, two varieties, KPS292 and Chiang Mai 1, were released by Kasetsart University and the Department of Agriculture in 1992 and 1993, respectively. KPS292 was selected from AGS292 (Kaohsiung # 1) and it produced a graded pod yield of about 5.1 t/ha. KPS 292 is well suited for export. Chiang Mai 1 was selected from Vesoy # 4 (AGS190) and it gave somewhat higher total pod yield than KPS292 but was suitable only for the domestic market. (Chotiyanwong and Chotiyanwong, 1997). At present, AGS292 and a new variety No.75 are recommended for farmers' cultivation and export to Japan. A large number of AVRDC materials have been introduced to Thailand. It was found that two lines were very promising, producing significantly higher graded pod yield than that of Chiang Mai 1 (Srisombun *et al*., 1991). AGS346 and AGS347 were found to have better quality than Chiang Mai 1 (Table 1).

Based on research results a recommended package of technologies for vegetable soybean production has been developed and promoted to farmers to ensure good pod yield and superior quality product (Chotiyanwong, 2000).

Yield Constraints

The constraints to vegetable soybean production are biotic and abiotic. The major diseases are rust (*Phakopsora pachyrhizi* Syd.), bacterial pustule (*Xanthomonas campestris* pv. glycines), downy mildew (*Peronospora manshurica* (Naum) Syd.) and anthracnose (*Colletotrichum truncatum* Schar) (Nuntapunt, 1992). A new major disease is soybean crinkle leaf virus. The key pests are beanfly (*Melanagromyza sojae*), pod borer (*Etiella zinckenella*) and stinkbugs (*Nezara viridula, Riptortus linearis, Piezodorus hybneri*) (Pitak *et al*., 2000). These diseases and pests can reduce pod yield and/or quality. Crop management and judicious use of chemicals are recommended to control these diseases and pests. Kinds, rates and times of chemical use are carefully chosen to minimize or to have no residues in the product. Abiotic constraint is low daily minimum temperature (8-14^{o}C during the 1st to 3rd week of January) for the dry season crop in the upper northern part of Thailand resulting in either low yield or poor pod quality. As a

result the lower north and northeast regions where the daily temperature in January is quite warmer than that in the upper north are being considered as alternative locations for vegetable soybean production. For the rainy season crop, the amount and distribution of annual rainfall vary significantly and therefore it is hard to predict the quantity and quality of pod yield. With additional timely irrigation (in the absence of rain) and proper drainage both quantity and quality of vegetable soybean produced during rainy season can be ensured.

Table 1. Pod yield and some agronomic traits of three promising vegetable soybean varieties introduced from AVRDC, rainy season, 2000, Khon Kaen Field Crops Research Center, Northeastern Thailand.

Variety	Pod wt (t/ha)	≥ two seed pods wt.(t/ha)	Pod (cm)		100 bean wt. (g)	Days to harvest
			length	width		
AGS 346	12.2	11.6	5.34	1.48	60.6	74
AGS 347	11.6	10.3	5.74	1.56	69.1	74
SSRSN 35-19-4	11.2	10.1	5.43	1.46	52.5	80
CHIANG MAI 1	10.6	9.8	5.40	1.43	49.7	80
Mean[1/]	10.5	9.4	5.48	1.47	59.5	75
LSD (P<0.05)[1/]	2.0	2.1	0.46	0.17	8.4	-

[1/]data from 11 entries
Seed sown: 10 July 2000
AGS 346 = [Ryokkoh x (Shih Shih x SRF 400)] x Emerald
AGS 347 = (Ryokkoh x Mikawashima) x Kahori
SSRSN 35-19-4 = [Kahori x (TVB6 x Mikawashima)]

Future Prospects

First, vegetable soybean production for both domestic consumption, as a source of protein for the Thai people, and export to earn valuable foreign exchange will continue to be promoted. The private sectors have a major role to produce vegetable soybean mainly for export. The Department of Agriculture and the Department of Agricultural Extension promote vegetable soybean production mainly for domestic consumption. Second, future research and development of vegetable soybeans in Thailand would focus on three main categories: (1) variety improvement with emphasis on adaptation to specific areas with at least 10% higher pod yield and better quality than Chiang Mai 1, (2) development of appropriate package of technologies for the new production areas and (3) monitor the maximum residue limit (MRL) of the products under good agricultural practices.

Conclusion

The vegetable soybean industry in Thailand began with the establishment of frozen food factory in the 1980s to export frozen vegetable soybeans to Japan. The cooperation between AVRDC and Thailand in research, development, extension and market promotion stimulated the growth of the industry. The export volume frozen vegetable soybean is expected to reach more than 10,000 t per annum beyond 2000. Thailand is committed to further promote the export and domestic consumption of vegetable soybeans. The research will focus on higher yields,

adaptation to other production areas and seasons, better quality raw material for export, reducing cost of production and ensuring the minimum pesticide residue levels acceptable for the export market. Product diversification and market promotion efforts will also be undertaken vigorously.

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