

Present Status and Future Perspectives of Soybean Production in Indonesia

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Abstract

In order to meet the demand in Indonesia for soybean and to increase national self-sufficiency, it needs to be an increase in production area and productivity. Acceleration of technology dissemination is crucial, such as implementation of integrated crop management program in the soybean producing areas in Indonesia as well as revitalization of the extension system. Improvement in the agricultural supportive facilities and infrastructure, like opening new areas for soybean production and providing facilities for processing would enhance the development of the domestic soybean industry. Soybean breeding programs should give priorities to the development of new varieties that are drought tolerant as well as tolerant to acid soil conditions, resistance to major insect pests (pod suckers, pod borers and leaf feeders) and diseases (rust and virus) and for good quality of seed.

Introduction

Soybean is the third most important food crop in Indonesia after rice and corn. Soybean has an important role and strategic position in the cropping system, and as food crop to improve nutrition for the community because of its high protein content. The demand for soybean has increased along with the growth of population and food industry such as fermented soybean (tempe), soybean milk, tauco, and snacks. Soybean consumption per capita in 1998 was 8.13 kg and increased to 8.97 kg in 2004. This shows the need to increase soybean production.

Statistical data from FAO shows that from the period of 1990-1995, the harvested area of soybean increased from 1.33 million ha in 1990 to 1.48 million ha in 1995, an average increase of 2% annually. Since 1995, the harvested area declined from around 1.48 million ha to 0.83 million ha in 2000, or about 11% per year. In the period of 2000-2004, the total harvesting area is still declining by about 9.70% per year. In the last 15 years (1999-2004), the total soybean planting area has decreased from 1.33 million ha in 1990 to 0.55 million ha in

2004, an average reduction of 6% annually (Figure 1).

Development and production

In Indonesia, soybean production fluctuated during the period 1970-2008. Harvested area fluctuated from 0.69 million hectare (1970) to 1.33 million hectare (1990), with a peak for 1.66 million hectare in 1992, then decreased to 0.54 million ha (2002), and 0.46 million ha in 2007 (Table 1).

Decreasing harvested area was shown in the decade 1990-2000, with growth rate of -4.69%, and decreasing sharper in the period of 2000-2004 such -9.02% per year. The negative growth rate will threaten Indonesian self sufficiency in soybean production.

The soybean productivity tended to increase from 0.72 t/ha in 1970 to 1.11 t/ha in 1990, 1.23 t/ha in 2000 and 1.31 in 2008. The increasing productivity is still low and does not balance the decreasing harvested area thus overall soybean production is declining in Indonesia (Table 1).

During the period 1970-1992, national production grew positively i.e. 0.5 million ton in 1970, 0.65 million ton in 1980, 1.49 million ton in 1990, and 1.87 million ton in 1992 respectively. The increasing production was mainly due to increasing harvested area. Government Programs to reach soybean self sufficiency affected increasing harvested area during 4th Five Years Planning (1984-1988) and 5th Five Years Planning (1989-1993). The programs such as intensification of soybean development and development of marginal areas (Sihombing, 1995; Manwan dan Sumarno, 1996).

In 1992, the total national production peaked

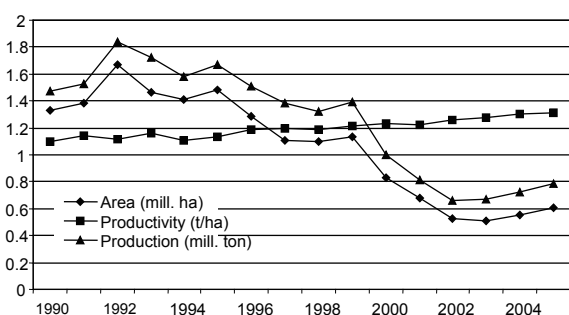


Figure 1. Planted area, yield potential, and soybean production in Indonesia

Table 1. The growth for harvested area, productivity and production of soybean in Indonesia, 1970 – 2008

Year	Harvested area (ha)	Productivity (t/ha)	Production (ton)
1970	695,000	0.72	497,883
1972	698,000	0.74	518,229
1974	753,499	0.78	589,239
1976	646,336	0.81	521,777
1978	733,000	0.84	616,599
1980	732,000	0.89	652,762
1982	607,788	0.86	521,394
1984	859,000	0.90	769,384
1986	1,253,767	0.98	1,226,727
1988	1,177,400	1.08	1,270,418
1990	1,334,100	1.11	1,487,433
1992	1,665,000	1.12	1,869,713
1994	1,406,920	1.11	1,564,847
1996	1,273,290	1.19	1,517,180
1998	1,095,070	1.19	1,305,640
2000	825,000	1.23	1,018,000
2002	544,522	1.24	673,056
2004	565,155	1.28	723,483
2005	621,541	1.30	808,353
2006	580,534	1.29	747,611
2007	459,116	1.29	592,534
2008	591,899	1.31	776,491
Growth rate (%)			
1970-1980	0.52	2.21	2.75
1980-1990	6.19	2.26	8.58
1990-2000	-4.69	1.02	-3.72
2000-2005	-5.51	1.00	-4.51

Source: FAO, 2006; BPS, 2006. .

then decreased sharply as well as harvested area i.e. 0.67 million ton in 2002 and 0.59 million ton in 2007. The decreasing production caused that Indonesia depend on imported soybean.

Production system of soybean

Production system of soybean in Indonesia is well adapted by farmers to produce high yield. Relatively advanced cultural practices are used. An adequate number of improved soybean varieties have been released. Indonesia has relatively fertile soils to grow soybean. Soybean development could be introduced to new provinces (Table 2).

Table 2. Potential field for soybean development in Indonesia.

Location	Area (ha)
Sumatera	480,714
Java	879,650
Kalimantan	23,148
Bali & NTB	152,388
Sulawesi	124,551
Maluku & Papua	5,255
Total	1,665,706

Source: Directorate General for Food Crop(2004).

The soybean seed yield obtained by farmers (approx. 1.2 t/ha) is significantly lower compared to the genetic potential (>2 t/ha). The low yield of soybean at the farmers' level is primarily due to the use of low quality seed and improper cultural practices. The production technology of soybean consists of the use of improved variety and management techniques on soils, water, crops, weeds, insect and pests disease. Such management techniques are aimed at obtaining improved genetic potential. Improved varieties can be easily adopted by farmers and would contribute to an increase in crop productivity.

As a source of protein, soybean is generally consumed as a processed product such as tofu, tempe, soybean sauce, tauco, soy milk, and snack. FAO (2004) showed that soybean consumption in Indonesia per capita during the last decade is decreasing from approximately 11,38 kg/capita in 1990 to 8.97 kg/capita in 2004, the average decrease is about 1.69% per year. While, the average decrease during 1995-2000 was about 1.57% per year, and per capita consumption decreased from 11.82 kg in 1995 to 10.92 kg in 2000. A sharp decrease occurred

Table 3. Production, consumption and trade of soybean in Indonesia, year 1990-2004.

Year	Production (000 ton)	Consumption (000 ton)	Deficit (000 ton)	Import (000 ton)
1990	1,487	2,028	541	541
1991	1,555	2,228	673	673
1992	1,870	2,560	690	694
1993	1,709	2,431	723	724
1994	1,565	2,365	800	800
1995	1,680	2,287	607	607
1996	1,517	2,263	746	746
1997	1,357	1,973	616	616
1998	1,306	1,649	343	343
1999	1,383	2,684	1,301	1,302
2000	1,018	2,294	1,276	1,278
2001	827	1,960	1,133	1,136
2002	673	2,017	1,344	1,365
2003	672	2,016	1,343	1,193
2004	707	2,015	1,307	1,307
Growth (%)	-5.17	-0.05	6.51	6.5

Source: FAO (2004).

between 2000 and 2004, i.e. 4.81% per year. Total consumption, however, decreased approximately 0.05% per year (Table 3). Indonesia is highly dependent on imported soybean.

Soybean could be utilized as food to reduce blood cholesterol and could prevent from heart attack. Also, soybean could function as an antioxidant and prevent from cancer diseases. Therefore, a demand on soybean in the future will be increasing due to the increasing knowledge and awareness of healthy food.

The need of soybean during 2004 was 2.02 million ton, whereas the domestic production was 0.71 million ton, and the rest (1.31 million ton) were imported. Thus, only about 35% of soybean need could be fulfilled from domestic production. The efforts to reduce the rate of import could be carried out through increasing productivity, planting area, production efficiency, farmers' management and participation in production program, quality of the product, market accessibility, microfinance system, development of infrastructure, as well as the regulation of products' marketing and business incentive.

Research and development

The improved varieties could increase the productivity of soybean more than 2 t/ha. The newly improved varieties incorporated in integrated crop management could elevate the soybean seed yield and the farmer's income.

The newly improved soybean varieties (Table 4) is one of the technologies of the Indonesia Agricultural Research and Development Agency

(IAARD) that could easily be adopted by farmers and could contribute to increase the seed yield production. The program on the improved varieties, which are tolerant to the biotic and non-biotic environment constraints, is required to help increase the soybean seed yield.

The improved soybean variety is a significant production factor to be incorporated in elevating the productivity. However, only 10% of farmers use the labeled (indicator of good quality) improved seed (Ditjentan 2004). Therefore, an extension program to convince farmers of the usefulness of labeled seed needs to be realized.

Crop production management techniques consist of improved variety usage and the management of soil, water, insect and diseases as well as harvest and post harvest handling. An appropriate technology such as the labeled seed usage, good drainage system, adequate water supply, an integrated pest management, harvest and post harvest handling would result in soybean seed yield according to its genetic potential.

Soybean varieties tolerant to biotic and non-biotic environmental constraints needs to be assembled. The soybean varieties tolerant to insects and pest diseases such as c.v. Ijen which has characteristics tolerant to *Spodoptera litura* and high yield potential (>2 t/ha) could be used to maintain yield stability. Tanggamus, Nanti, Sibayak, Seulawah dan Ratai are newly released soybean varieties that are adapted to acid soils and drought.

High yielding soybean varieties could be assembled and the appropriate cultural practices could

Table 4. Newly improved varieties released in year 2001-2004.

Varieties	Yield potential (t/ha)	Maturity (days)	Seed size	Specific Agroecosystem
Sinabung	2.5	88	Medium	Lowland
Kaba	2.6	85	Medium	Lowland
Anjasmoro	2.5	85	Large	Lowland
Mahameru	2.5	87	Large	Lowland
Panderman	2.5	85	Large	Lowland
Ijen	2.5	85	Medium	Lowland, tolerant Spodoptera litura.
Tanggamus	2.7	88	Medium	Upland
Sibayak	2.5	89	Medium	Upland
Nanti	2.5	91	Medium	Upland
Ratai	2.6	90	Medium	Upland
Seulawah	2.7	90	Medium	Upland

be generated. The AARD could possibly realize these goals since we have: (1) sufficient soybean genetic resources, (2) enough budget for research and development program and (3) qualified human resources (researchers).

Around thirty soybean varieties had been released in Indonesia during the last 20 years. Sixty percent of the released varieties are classified into medium maturity (81-90 days) and the others belong to early maturity (less than 80 days) groups. The medium maturity group could produce 2.2 to 2.9 t/ha of seeds. Early mature varieties usually give lower yield than the medium ones. According to their seed size, the varieties could be classified into small, medium and large seeds. Island of Sumatra, Sulawesi, Irian Jaya, Nusa Tenggara and Kalimantan are potential areas for soybean production. However, of soybean varieties adapted for each region (agroecosystem) are needed. Based on the problems faced by farmers, soybean breeding program should give priority to develop new varieties that tolerant drought as well as to acid soil conditions, resistance to major insect pests (pod sucker, pod borer and leaf feeder) and disease (rust and virus) and for good quality of seed.

Genetic resources

A total of 1092 soybean accessions are stored at the Indonesian Legume and Tuber Crops Research Institute (ILETRI). A catalogue of the collection contains all available information on ILETRI's soybean collection, i.e. registration data; standard evaluation data; evaluation for specific traits; rejuvenation list and accessions status.

Evaluation for specific traits has been done for traits, i.e.:

1. Screening for resistance to bean flies, *Ophiomyia phaseoli* (Tryon) and *Melanagromyza sojae* (Zehntn.), using methods described by Chiang and Talekar (1980).

2. Screening for resistance to podborer (*Etilla* spp.) is based on visual inspection of the pods at harvest time.

3. Screening for tolerance to water-logging.

4. Screening for bacterial pustule disease, caused by *Xanthomonas campestris* pv. *sojensis* (Smith) Young et al., is one of the most common diseases of soybean in Java (Sri Hardaningsih et al. 1989).

5. Screening for pod-sucking insects. There are three main species: *Nezara viridula* L., *Riptortus linearis* F. and *Piezodorus rubrofasciatus*.

6. Screening for Peanut Stripe Virus (Pstv). Peanut stripe virus was the first of the grain legume viruses prevalent in East Java. Crops attacked are soybean, groundnut and others.

7. Screening for Rust. It is caused by fungus *Phakopsora pachyrhizi* Syd.

8. Screening for tolerance for storage of seed under ambient conditions. Soybean seeds deteriorate rapidly, especially under the warm and humid conditions of Indonesia. Poor seed quality might be one of the causes of poor plant stand, one of the major constraints of soybean production in Java. Possible solutions for keeping good seed quality are improvement of storage conditions and breeding varieties with better seed storability.

9. Screening for CPMMV (Saleh et al. 2005).

10. Screening for physical and chemical properties. Physical characteristic include seed color, 100 gram weight, equivalent diameter, water density and seed porosity, chemical characteristic include water content, ash, protein and lipid contents.

11. Screening for good soymilk production (Ginting and Antarlina, 2002).

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