

## DEVELOPMENT OF SOYBEAN CULTURE IN INDONESIA

Sadikin SOMAATMADJA\*

### Abstract

Since the initiation of the PELITA Plan the production of soybean has generally increased, primarily due to the expansion of the area planted.

At the same time the demand for soybean, especially in the last six years, has also been increasing. As the production could not meet the increasing demand, importation of large quantities of soybean has taken place. This situation necessitates the promotion and development of soybean cultivation.

Since 1974 an intensification program has been initiated. To date the government has recommended technological packages for boosting soybean production. These packages will be applied in the intensification and areal expansion programs as well.

Multilocational trials followed by demonstrations and seed production are the main activities supporting the technological packages. These trials are conducted by Research Institutes and the Directorate of Production, in farmers' fields.

Soybean cultivation is associated with a large number of constraints hampering production. The use of important components, as specified in the intensification program, and of suitable varieties is essential.

With the government support and policies followed by the action program, soybean cultivation appears to have a good prospect for further development.

### Area and production

#### Share in national food production

Food legumes occupy the fourth place among the food crops cultivated in the country. Among the food legumes soybean gets first priority in farm operation.

The latest data from 1981 recorded a harvested area of 811 thousand, 519 thousand and 273 thousand hectares for soybean, groundnut and mungbean, respectively. Data of the same year indicated that rice accounted for 9,376 million, corn for 3,013 million, cassava for 1,395 million and sweet potatoes for 265 thousand hectares of agricultural land.

#### National soybean production

Soybean production tends to increase in every PELITA Plan (Five-year development plan) implemented in the country. The increase of production was 19.7%, 38.2% and 54.7% in PELITA I, PELITA II and PELITA III, 1977-1982, respectively, as compared to that of the five-year average before PELITA that covered the period 1964-1968. The average relative increase per PELITA Plan was 15.7% (Table 1) .

During the period 1977-1981 (Table 2) , in spite of fluctuations, the production generally increased. The increase of production was primarily due the increase of the harvested area. The increase of yield per hectare was too small to be considered as having made a significant contribution to the national production. In 1982 the production decreased, because of a long period of dry weather (Table 2) .

---

\*Central Research Institute of Food Crops, JL. Merdeka 99, Bogor, Indonesia.

**Table 1 Annual average of soybean production during and before PELITA**

Years	Harvested area		Yield		Production	
	1,000 ha	Relative increase %	ton/ha	Relative Increase %	1,000 ton	Relative increase %
1964—68*	605 (100)	—	0.68 (100)	—	411 (100)	
1969—73	674 (111.4)	11.4	0.73 (107.2)	7.2	492 (119.7)	19.7
1974—78	709 (117.2)	5.2	0.81 (118.9)	11.0	568 (138.2)	15.4
1979—81 (4 years)	733 (121.2)	3.4	0.87 (127.5)	7.2	636 (154.7)	12.0
Average		6.7		8.5		15.7

Source : Directorate General of Food Crops.

\* Five years before PELITA ( ) percentage.

**Table 2 Soybean production in the last six years, 1977—1982**

Years	Harvested area		Yield		Production	
	1,000 ha	Relative increase %	ton/ha	Relative increase %	1,000 ton	Relative increase %
1967—71	689	—	0.70	—	478	—
Average						
1972—76	721	—	0.77	—	552	—
Average						
1977	646	-10.4	0.81	5.6	523	-5.0
1978	733	13.5	0.84	4.0	617	18.0
1979	784	7.0	0.87	3.1	680	10.0
1980	732	-6.6	0.90	2.8	653	-4.0
1981	811	-10.8	0.85	-4.9	687	5.0
1982*	604	-25.5	0.87	2.2	523	-23.7

Source : Directorate General of Food Crops.

\* 1982 : Longer drought period.

### Producing centers

Soybean has been and is being grown widely throughout Java. On the other islands, except for West Nusa Tenggara and Sumatra, it is only grown to a limited extent. Table 3 lists the six provinces, which during 1977-1981, had more than 20 thousand hectares planted to soybean annually.

In addition to these centers, Aceh, Bali, North and South Sulawesi also contribute to soybean production besides Java (Table 4). Aceh tends to show a steady increase in soybean culture. Aceh,

**Table 3 Soybean production in six provinces\*, 1977—1981**

Year	Province	Harvested area (1,000 ha)	Production (1,000 ton)	Province	Harvested area (1,000 ha)	Production (1,000 ton)
	East Java			Central Java		
1977		334	275		132	104
1978		350	343		174	119
1979		374	361		171	136
1980		373	372		136	100
1981		393	363		171	139
	Yogyakarta			Nusa Tenggara Barat (NTB)		
1977		31	25		42	34
1978		39	25		48	38
1979		49	31		49	43
1980		48	37		38	30
1981		55	40		35	29
	Lampung			West Java		
1977		31	27		21	15
1978		32	24		31	21
1979		38	31		25	17
1980		29	24		29	19
1981		47	36		31	20

Source: Directorate General of Food Crops.

\* as producing centers.

**Table 4 Soybean production in four additional centers, 1977—1981**

Year	Province	Harvested area (1,000 ha)	Production (1,000 ton)	Province	Harvested area (1,000 ha)	Production (1,000 ton)
	D. I. Aceh			Bali		
1977		6.50	4.90		9.80	8.30
1978		8.40	6.10		10.00	8.70
1979		1.70	1.40		10.60	9.40
1980		17.90	13.80		9.30	9.30
1981		22.20	16.80		10.40	7.60
	N. Sulawesi			S. Sulawesi		
1977		6.20	4.50		11.70	8.10
1978		1.80	1.40		14.90	10.40
1979		2.10	1.40		21.30	13.70
1980		9.30	6.10		17.20	13.90
1981		7.60	5.50		12.20	9.00

Source: Directorate General of Food Crops.

North and South Sulawesi are new soybean-producing regions. Although in North Sulawesi the area planted to soybean is smaller as compared to the other regions, it has a potential for expansion. In this province, Bolang Mangandow has three crops of soybean annually on the same land.

### Soybean area

Lowland rice (sawah) fields and dry land fields (tegalan) are used for soybean production.

Sawah fields account for the largest soybean production area in the country. The sawah fields give an average yield which is always higher than that of the dry fields.

Data from 1979-1981 indicated that approximately 59% of soybean was produced in the sawah fields. On Java approximately 60% of the soybean area is on sawah fields, whereas outside Java it amounts to only 20% (Table 5).

**Table 5 Soybean production in sawah and tegalan, 1979—1981**

Year	Harvested area 1,000 ha			Yield t/ha			Production 1,000 ton		
	Sawah	Tegalan	Total	Sawah	Tegalan	Average	Sawah	Tegalan	Total
1979									
Java	371 (60)	248 (40)	619	0.98	0.73	0.88	364 (67)	181 (33)	545
Os Java	32 (20)	132 (80)	164	0.89	0.79	0.82	29 (21)	106 (79)	135
Indonesia	403 (51)	380 (49)	783	0.97	0.75	0.87	393 (58)	287 (42)	680
1980									
Java	350 (62)	236 (38)	586	1.01	0.74	0.90	355 (67)	174 (33)	529
Os Java	28 (19)	118 (81)	146	0.90	0.84	0.85	25 (20)	99 (80)	124
Indonesia	378 (52)	354 (48)	732	1.00	0.77	0.89	380 (58)	273 (42)	653
1981									
Java	390 (60)	260 (40)	650	0.99	0.68	0.86	386 (69)	176 (31)	562
Os Java	32 (20)	129 (80)	161	0.87	0.75	0.78	28 (22)	97 (78)	125
Indonesia	422 (52)	389 (48)	811	0.98	0.70	0.85	414 (61)	273 (39)	687

Source: Directorate.

( ) = Percentage; Sw = Sawah, rice field, Tg = Tegalan, dry land.

## Supply and demand situation

### Export and import

The demand for soybean in the country has been on the increase, especially in the last six years. National production of this crop is far from being sufficient to meet the demand. This situation has resulted in the importation of the product. It is worth noting that before 1978 Indonesia was able to export soybean, though the quantity was small. In 1969 the exports amounted to 750 tons. Up to 1973 the exports had tended to increase and in 1973 they amounted to 36 thousand tons. Since then there has been a decreasing trend, and finally in 1977, the quantity of soybean exported was too small to be considered significant (Table 6).

The imports of soybean before 1978 fluctuated annually. The largest quantities of imported soybean during the period 1969-1977, were recorded in 1976, amounting to 172 thousand tons. In 1977 the imports decreased to 89 thousand tons. In addition to the import of soybean as grain, a small amount of soybean oil had also been imported (Table 6) .

**Table 6 Export and import of soybean, 1969—1982**

Year	Export (1,000 ton)	Import (1,000 ton)
1969	0.75	
1970	3.95	
1971	0.73	0.28
1972	3.06	0.18
1973	36.00	0.10(0.03)
1974	4.15	0.15(0.04)
1975	0.03	17.8 (0.01)
1976	0.60	171.75 —
1977	0.01	89.10(0.02)
1978	0	130.45
1979	0	137.35
1980	0	248.25
1981	0	308.08
1982	0	476.00

Source: Central Bureau of Statistics.

( ) = Soybean oil

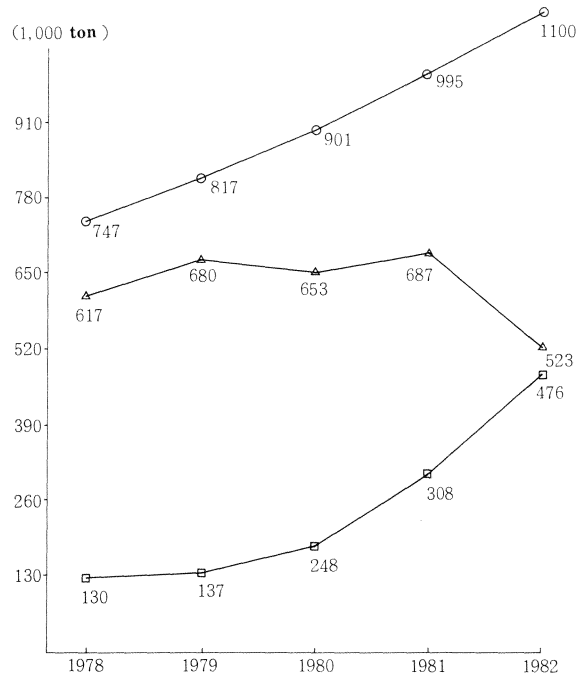
Since 1978 the situation has changed completely. To date Indonesia is no more in position to export. The increasing demand for soybean has compelled the country to import a large amount of this commodity. Since 1978 the imports have been steadily increasing. In 1978 the imports of soybean amounted to approximately 130 thousand tons or 20.0% of the demand. The imports increased up to 476 thousand tons or 43.0% of the demand in 1982. Figure 1 illustrates the demand, production and imports of soybean during the period 1978-1982.

### **Future demand and production**

The prevailing situation in which the national production cannot meet the demand and the imports are increasing, is a cause for concern. In this connection the government determined the "targets" of production directed toward self-sufficiency for this crop within a rather short time.

The target of production for 1983 is one million tons with a harvested area of 985 thousand hectares. For 1988, which corresponds to the end of PELITA IV the target of production will be 2,098 million tons with a harvested area of 1,596 million hectares. The demand for soybean in 1983 was estimated to be as high as 1,112 million tons, and in 1988 it will amount to 1,661 million tons. Table 7 shows that the demand for soybean should be met in 1984 by the latest.

In order to reach the target of production, the development of soybean culture will be directed especially to the dry land area. Therefore soybean cultivation on dry land will expand. In 1988 soybean area on dry land will involve 897 thousand hectares, whereas that on sawah fields 699 thousand hectares (Figure 2) .



**Fig. 1 Demand, production and import of soybean, 1978–1982.**  
 ○ = Demand ; △ = Production ; □ = Import

**Table 7 The estimated demand for soybean and production target, 1983–1988**

Year	Demand 1,000 ton	Production 1,000 ton	Harvested area 1,000 ha	Yield ton/ha
1983	1,112	1,011	985	1.03
1984	1,223	1,231	1,127	1.10
1985	1,305	1,496	1,263	1.20
1986	1,413	1,764	1,381	1.25
1987	1,530	1,943	1,491	1.30
1988	1,661	2,098	1,596	1.30

Source : Directorate General of Food Crops.

### Utilization

Soybean may be used as side-dish with rice, as beverage, as vegetable or as cooking oil. Recently synthetic meat made from soybean is beginning to draw the attention of the people. In addition, soybean is also utilized for animal feed. More specific uses of soybean for food in the country are:

1 Side-dish with rice: Tempe (fermented soybean cake) , tahu (soybean cake) , taucu (soybean paste) , taugé (soybean sprout) , kecap (soy sauce) and goreng kedelai (fried soybeans) . Of these, tempe and tahu are very important in the diet of the people.

2 Snacks: Roasted soybeans, kerupuk tahu (tahu chips) , boiled young soybean pods.

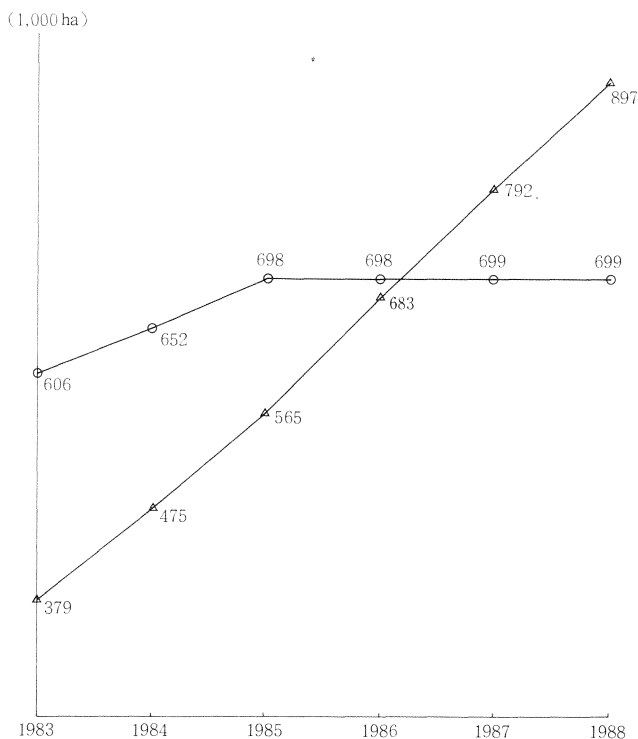


Fig. 2 Target of soybean area, 1983—1988.

○ = Sawah fields ; △ = Tegalan fields

## Methods of cultivation

### Cropping system

Soybean may be grown alone or in mixed condition with other upland crops in the local cropping systems. The cropping systems may differ from region to region. Area of production such as sawah and tegalan also determines the pattern of the system. Whereas in the sawah fields the cropping system is rice-based, in tegalan the cropping may be soybean-based or based on other crops depending on the importance of the crop. It is worth noting that in some districts such as Dumoga in North Sulawesi and Langsa in East Aceh, soybean is grown three times a year on the same tegalan land.

### Cultivation

In the sawah fields soybean is cultivated in three different ways: a) simple, b) semi-intensified and c) intensified method of cultivation, (Somaatmadja, 1972). In tegalan a semi-intensified or an intensified method of cultivation can be applied.

Most farmers apply the simple method of cultivation, which is performed without soil tillage. The seeds are either broadcast or dibbled in the fields after rice is harvested. In some occasions seeds may also be sown before rice is harvested.

The semi-intensified method of cultivation is performed with light soil tillage and the seeds are dibbled at regular intervals with 2 or 3 seeds/hill. The intensified method of cultivation is carried out with soil tillage (plowing and harrowing), in dibbling the seeds at regular intervals along with

weeding, applying irrigation and pest control. Fertilizers are usually not used in soybean cultivation, particularly when soybean is grown in the sawah fields.

### Pests, diseases and other problems

During the growth period soybean is subject to insect attacks and diseases which may cause serious damage to the crop and lower the yield. Iman *et al.* (1972) , divided the most important insects that attack soybean into those attacking the vegetative and reproductive parts respectively (Table 8) .

**Table 8 The important insects of soybean**

On vegetative parts	On reproductive parts
<i>Phaedonea inclusa</i>	<i>Etiella zinckenella</i>
<i>Prodenia litura</i>	<i>Phaedonea inclusa</i>
<i>Plusia chalcites</i>	<i>Nezara viridula</i>
<i>Longitarsus suturellinus</i>	<i>Riptortis linearis</i>
<i>Lamprosema indicata</i>	
<i>Agromyza phaseoli</i>	
<i>Agromyza dolichostigma</i>	
<i>Agromyza sojae</i>	
<i>Stomopteryx subseccivella</i>	

Soybean diseases have also become important in the country. In addition to rust diseases caused by *Phakopsora pachyrhizi*, some virus diseases seem to affect soybean cultivation (Iwaki *et al.* , 1975) . Other diseases commonly found, but still of minor importance are bacterial wilt, bacterial diseases on leaves, sclerotial blight, anthracnose, powdery mildew and purple seed stain.

In addition to pests and diseases, a serious problem encountered in soybean cultivation is the seed supply. Good quality seeds with high germinability are difficult to obtain. Therefore the stands of soybean crop in the farmers' fields are generally poor. This is one of the reasons for low yield which also influences the national production. The quantity of seed also can not meet the demand, especially for the intensification program and expansion of the soybean area.

Selection of cropping system, method of cultivation and use of products are important factors determining the use of varieties. In addition soybean also differs in its adaptability to the various areas of production. Therefore a specific variety recommended as well as local may thrive in a certain region, surpassing the other varieties.

The reason why early-maturing varieties (70 -80 days) are generally more acceptable, is related with the locally prevailing cropping system. Seed size is also an important factor for the farmers' soybean cultivation. This is especially related with product's utilization. The most prominent local varieties are Genjah Slawi and Petek in Central Java; Pressi and Sinyonya in East Java; Klungkung in Bali and Kipas in North Sumatra. The varieties are in mixed condition and need purification.

As the expansion of soybean cultivation is directed to the dry land areas, selection of varieties may become important. Most of the transmigration areas have Al-toxicity problem which needs correction and requires the cultivation of specific varieties. In new areas soybean cultivation is a new agricultural activity with which the local farmers are not familiar. For that reason most of the good soybean crops in the transmigration areas are usually those cultivated by Java and Bali transmigrants. In addition, soybean cultivation in the new areas requires the supply of *Rhizobium* inoculant for successful cultivation. Failure of the first crop may discourage the farmers from growing soybean henceforth.



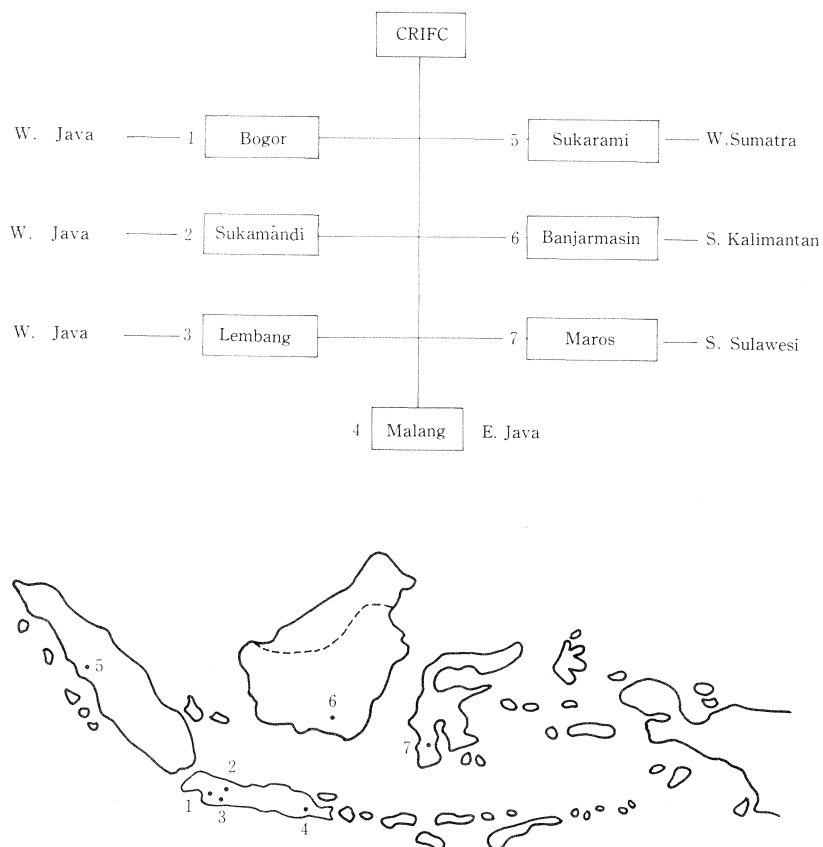


Fig. 3 Research Institutes under Central Research Institute for Food Crops (CRIFC).\*

\* Taken from 5 years AARD, 1976—1980.

### Research

The Central Research Institute for Food Crops (CRIFC) is responsible for soybean research in the country. The universities such as Bogor Agricultural Institute, Padjadjaran University, Gajah Mada University and Brawijaya University are also engaged in soybean research. These universities are conducting fundamental research, and to some extent also applied research in cooperation with the institute.

CRIFC has seven Regional Research Institutes (Figure 3). Bogor and Sukamandi research institutes are conducting most of the soybean research activities, whereas other institutes also carry research to a limited extent.

The Agency of Agriculture Research and Development (AARD) has designated Malang in East Java as the main center for soybean research. The choice of Malang as the main center appears to be a good decision, because East Java is the main center of soybean cultivation. This institute however still needs improved staff training.

### Research program and activities

Soybean research program has two broad objectives: varietal development and crop management. Research activities are problem-and production-oriented. These are related to areal expansion, cropping systems and cultural practices applied by farmers. In this way the experiments conducted will be significant for identifying the main constraints and for promoting the transfer of technology to increase production and farmer's income. The activities of research disciplines are as follows:

## RESEARCH ACTIVITIES

### A. BREEDING

1. Germplasm collection : assemblage, maintenance, evaluation.
2. Varietal development : hybridization, induced mutation, selection, preliminary yield trials, advance yield trials, multi-locational trials.
3. Multiplication : promising lines, breeder seed

### B. AGRONOMY

1. Cultural practices : tillage practices, planting methods, population dynamics, crop rotation.
2. Fertility aspects : fertilizer application/liming (macro-micro-elements) , method of placement and time of fertilizer application.
3. Weed control : mechanical, chemical, culture techniques

### C. PESTS AND DISEASES

1. Resistance : screening for resistance to important pests, screening for resistance to important diseases.
2. Chemicals : pesticide screening, fungicide screening.
3. Pest and disease control : use of insecticides, use of fungicides.
4. Eco-biological study of important pests and diseases.
5. Study of losses caused by insects.
6. Control of pests and diseases in storage

### D. PHYSIOLOGY

1. Adaptation : screening for adaptation to acid soils, screening for drought tolerance, screening for tolerance to low light intensity, screening for adaptation to "problem soil" .
2. Seed quality : methods and time of harvest, seed processing, seed storage.
3. *Rhizobium* : inventory, collection, identification, utilization.

### E. POST-HARVEST

1. Product quality : method and duration of storage, processing.

### F. CROPPING SYSTEMS

1. The use of soybean in agricultural systems: cropping pattern, inter-cropping, mixed cropping,

- catch cropping
2. Cropping system model : improvement of cropping systems, introduction of new cropping systems.
  3. Production practices following the result of cropping system model.

The progress of research is only manifest if the research institute releases new varieties. After the establishment of the Sukamandi research institute, the release of new varieties became accelerated compared with the time when only Bogor was doing most of the research activities. It is therefore expected that with the designation of Malang as main center of research and the assistance of other institutes, soybean research will make further progress. Table 9 shows the soybean varieties released by the institute, CRIFC.

**Table 9 Improved soybean varieties**

Variety	Flower color	Seed color	Kernel weight (1,000 seed)	Maturity (days)	Origin
No. 16	purple	black	70—80	90—100	Introduction
No. 27	purple	black	70—80	100—110	Selection
No. 29	purple	yellow (nasty colored)	60—70	100—110	id
No. 317 (Ringgit)	purple	yellow	70—80	85—90	Hybridization
No. 452 (Sumbing)	purple	yellow	70—75	80—85	id
No. 520 (Merapi)	white	black	70—80	80—85	Selection
No. 945 (Shakti)	purple	yellow	120—160	80—85	Introduction/ Selection*
No. 1248	white	yellow	120—160	80—90	Selection
No. 1291 TK 5	purple	yellow	120—160	80—85	Introduction
No. 1343 (ORBA)	purple	yellow	120—140	80—85	Hybridization
No. 1667 (Galunggung)	white	yellow	130—140	80—90	Hybridization
Gm 1293 Si (Lokon)	white	yellow	100—110	72—78	Hybridization
Gm 1300 Si (Guntur)	purple	yellow	100—110	75—80	Hybridization

\* In Garut named Metro, selected from Wakashima.

In cooperation with the Directorate of Production, the Research Institute conducts multilocal trials. These may include varietal, fertilizer or other agronomic trials. These trials are then followed by demonstrations, such as demonstration plots (Demplot) or demonstration areas (Demarea). Demplot and Demarea may eventually contribute to the promotion of seed production.

### Support for soybean production

The government shows a keen interest in soybean production. Since 1974 an intensification program has been initiated in connection with BIMAS (mass guidance) and INMAS (mass intensification) programs. The program aimed at boosting the production. The important components of the intensification program are the use of good quality seed, insecticides and fertilizers. In the BIMAS program the government provides credit for these components. To encourage the cultivation and promote the marketing of soybean, since 1979, the government has fixed the floor price of soybean.

The increasing demand for soybean which results in increasing importation makes the government aware of the need to speed up the increase of production. In this context the government has recommended packages of technologies which will be applied in the intensification and the areal expansion programs as well (Table 10).

**Table 10 Packages of technology in the intensification and areal expansion programs**

Components	Package I *	Package II	Package III
Varieties	Local	Released varieties (Lokon, Guntur, Galunggung, ORBA).	Released varieties (Lokon, Guntur, Galunggung, ORBA).
Seed quality	Improved	Improved	Improved.
Seed rate	70 kg/ha		
Cultural practices	Improved	Improved	Improved
Inoculum	<i>Rhizobium</i> (Legin) 150 gr/ha	<i>Rhizobium</i> 150 kg/ha	<i>Rhizobium</i> 150 g/ha
Weed control	Weeding operations Herbicides Mulch	Weeding operations Herbicides Mulch	Weeding operations Herbicides Mulch
Pest control	Pesticides 4—6 l/ha	Pesticides 4—6 l/ha	Pesticides 4—6 l/ha
Fertilizers	Especially P <sub>2</sub> O <sub>5</sub> ; K <sub>2</sub> O	Especially P <sub>2</sub> O <sub>5</sub> ; K <sub>2</sub> O	Especially P <sub>2</sub> O <sub>5</sub> ; K <sub>2</sub> O
Soil tillage	No	Especially in tegalan	Especially in tegalan
Area	Sawah	Sawah, tegalan	Sawah, tegalan
Liming	—	—	a. 4,000 kg/ha, then b. 500 kg/ha every year after the fifth year

Source : \* Must be readily practiced.

### Further prospects and main constraints

The increasing demand and import of soybean necessitate the increase of the production of this commodity. Government support and encouragement in the intensification and areal expansion programs are likely to accelerate the development of soybean cultivation which in turn should lead to an increase in the production. Recent survey indicates greater possibility for areal expansion and increase of productivity.

There are however several constraints hampering soybean production, such as seed supply, problem soils, pests and diseases, capital and variety. The government however is taking the necessary steps to overcome these difficulties, directly or gradually. In this connection the action program which is being and will be implemented appears to be a good solution for speeding up soybean production.

Soybean is still considered as a secondary crop. This fact therefore accounts for the poor management practices resulting in lower productivity. A fairly high loss in plant population and insect infestation depress the yield and the inherent yield potential of the varieties cannot develop.

## References

- 1) Iman M. , A. Kartohardjono, E. Surachman, D. Sukarna, Panoedjoe, Hartono and Suartini, 1972. Result of soybean pest survey and insecticidal experiment during dry - season 1971. CRIA Staff meeting, May 29 - 31, 1972.
- 2) Iwaki M. , M. Roehan and D. M. Tantera, 1975. Virus diseases of soybean in Indonesia. Kongres Nasional PEJ III : February 22 - 23, 1975.
- 3) Sadikin Somaatmadja, 1972. Problems of soybean production in Indonesia. Symposium on Food Legumes 12 - 14 September 1972. Tropical Agriculture Research Series No. 6.

## Discussion

**Bhatnagar, P. S.** (India) : What is the main use of soybean in Indonesia?

**Answer:** In Indonesia, soybean is mainly used for human food in preparations such as tempe, tofu, soy sauce, etc. It is also used as feed for poultry along with various industrial uses. In Indonesia, most of the proteins consumed by the people originate from soybean.

**Dutt, A. K.** (India) : What is the cropping pattern adopted in the highlands with acid soils affected by aluminum toxicity?

**Answer:** The cropping patterns are as follows: rice-corn-soybean, rice-soybean-corn and corn-soybean-peanut. It is also recommended to apply lime every 5 years.

**Yap, T. C.** (Malaysia) : I understand that your country wishes to increase soybean yield from the present 0.9 ton/ha to about 1.3 ton/ha within a very short period of time (from 1983 to 1985) . Could you outline the measures to be taken to achieve this objective?

**Answer:** The three packages of technology recommended by the government are as follows: 1. Use of local varieties with good seed quality for the rice fields, 2. Use of improved varieties on dry land as well as rice fields 3. Lime application (4 ton/ha) in problem soils and use of legume inoculant in problem soils, dry land and rice fields for the improved varieties. The objective is to increase the yield within a short period of time as in the case of the BIMAS program for rice.

**Palaniyappan, K.** (India) : In India we obtain reasonable results with a seed rate of 30-35 kg/ha. I noticed that in Indonesia you recommend a seed rate of 10 kg/ha.

What is the reason for adopting such a high seed rate? I would also like to know which is the population size you recommend.

**Answer:** The seed rate is high due to low viability of seed. The population is 500,000 plants /ha.

**Yang, C. Y.** (AVRDC) : In the areas where you have 3 crops of soybean in the same piece of land, what is the time interval between the crops. What are the soybean varieties used in this cropping system?

**Answer:** We are using early-maturing varieties (85-90 days) . The time interval between the crops is about one month. In this region the farmers are using Orba. In other regions, they are using 75-day varieties such as Genjah Slawi and Petek. We have also developed Lokon and Guntur which mature within 75 days for the northern part of West Java.