6. PROBLEMS OF SOYBEAN PRODUCTION IN INDONESIA

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Introduction

Though soybean has long been known as food crop in Indonesia, its cultivation, however, has steadily been practised since the beginning of the 20th century. The cultivation is exerted in different systems, which are generally grouped into a simple, a semi-intensified and an intensified method of cultivation.

Simple method of cultivation is mostly applied by farmers in the regions with pronounced dry season. In this method, land preparation or soil tillage is not practised. The purpose of avoiding soil tillage is to hasten the planting time, that the crop can make a good use of soil moisture, which is still available at the end of the wet season. Seeds are sown either after or before rice is harvested. Most farmers, however, broadcast or dibble the seeds in the field after rice is harvested. The planted fields are usually covered with straw in order to prevent or to reduce the evaporation.

Semi-intensified method of cultivation is done with soil tillage and usually found in the regions without pronounced dry season. Seeds are either broadcast or dibbled, 2 to 5 cm deep with 2 to 3 seeds per hill on plant distances of 25×25, 30×20, 40×15 or 20×20 cm, depending on the growth type of the plant.

Intensified method of cultivation is carried out with soil tillage, dibbling the seeds on regular plant distances, weeding operations, irrigation and pest control. Fertilizers are usually not used in soybean cultivation. It is commonly believed that soybean is not quite resopnsive to fertilizers, while soybean grown on rice field usually benefits from residual effect of fertilizers in the previous crops.

Average Yield

The average soybean yield in Indonesia seems to be constant, namely about 6.81 quintals per hectare. This is too low when compared with the average yield in other countries such as Canada, U.S.A., Brasil and Japan (Konno 1970). There is indeed a steady incerase in production, which is mainly attributed to the additional acreage of cultivation (Table 1).

Table 1. Five year average harvested acreage and production of soybean in Indonesia, 1950–1969**

Years	Acreage harvested (hectares)	Production (tons)
Average 1950–1954	431, 742	294, 834
〃 1955–1959	549, 830	378, 115
〃 1960–1964	596, 210	401, 577
〃 1965–1969	601, 644	410, 197

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** Resource data: Directorate General of Agriculture, Directorate of Agr. Economy.

Factors Affecting Yields

The most important factors which are affecting the yields of soybean are seed supply, pests diseases and cultural practices applied by farmers.

1. Seed supply

Farmers are rarely able to obtain good soybean seeds. This naturally results in a poor stand of the crop, which in turn lowers the yields. One may observe many gaps in soybean planting, which is due to the low germinability and weakness of seeds. In practice the number of plants harvested ranges from 50 to 60 percent of the total number of seeds planted per unit area.

2. Insect pests

Insect infestation on soybean plants may be divided into two groups (Iman et al. 1972),

a. Infestation on vegetative parts caused by *Phaedonia inclusa, Prodenia litura, Plusia chalcites, Longitarsus suturellinus, Lamprosema indicata, Agromyza phaseoli, Agromyza dolichostigma, Agromyza sojae,* and *Stomopterex subsecivella.*

b. Infestation on generative parts caused by *Etiella zinckenella, Phaedonia inclusa, Nezara viridula,* and *Riptortis linearis.*

Table 2 shows the highest percentage of damage on soybean plants caused by the most harmfull insects during the dry season 1971.

Table 2. Infestation and percentage of damage on soybean plants, caused by several insects during dry season 1971*

Species	Percentage of damage	Part of the plants	Days after sowing	Region
Phaedonia inclusa	75. 08	leaves	42–46	Madiun
id	61. 16	leaves	42–46	Ponorogo
id	15. 53	pods	75–79	Madiun
Prodenia litura and *Plusia chalcites*	44. 31	leaves	72–85	Ngandjuk
id	43. 93	leaves	75–79	Madlun
id	37. 49	leaves	75–79	Ponorogo
id	41. 07	leaves	34–36	Malang
Longitarsus suturellinus	34. 70	leaves	81–87	Malang
Etiella zinckenella	48. 67	pods	75–79	Madiun

Resource data: Staff Meeting Central Research Institute for Agriculture, May 29–30, 1972.

3. Diseases

Up to 1961 the diseases of soybean were not considered so importantly as the insect pests. The occurence of rust disease in Kuningan in the wet season 1961/62, however, teached us the significance of the disease of soybean.

Rust disease caused by *Uromyces sojae* may occur in regions with high relative humidity and destroy the whole crop. Other diseases such as bacterial wilt caused by *Xanthomonas solanacearum,* bacterial disease on leaves caused by *Xanthomonas phaseoli* and *Pseudomonas glycinae*; sclerotial blight caused by *Sclerotium rolfsii;* anthracnose caused by *Colletotrichum* and witches broom caused by "Virus" are also observed.

4. Cultural practices

As already stated above, soybean are cultivated in three different methods. Simple method of cultivation is the most commonly practised by farmers. This is because they

regard this method of cultivation as the most efficient and practical way of growing soybean. On the contrary results of the experiments conducted in Muara 1965/66 showed, that soil tillage and weeding operation gave an increase of 30 percent in yield as compared with the check plot (=11 quintals per hectare). Similarly the yield increase of 65.66 percent was obtained by intensive method of cultivation in the experiment conducted on rice field with previous fertilizer application in East Java (Check plot 5.9 quintals per hectare, Brawidjaja University).

Efforts to Increase Soybean Production

1. Varietal improvement

At present there are eight varieties recommended to the farmers, (Table 3). Six of them are old varieties and cultivated throughout the country. Variety no. 29 comprises about 50 percent of the soybeans cultivated in East Java, which is considered as the main soybean center in Indonesia (Somaatmadja et al. 1968). In addition to these improved varieties, several local varieties are considered to be suitable to local conditions, such as Gendjah Slawi for Brebes and Tegal, Petek for Pati, Sinjonja for Lumadjang and Pasuruan, and Davres for Garut.

Table 3. Improved soybean varieties

Variety	Color of seed	One thousand kernel weight (grams)	Maturity (days)
No. 16	black	70	90–100
No. 27	black	70	100–110
No. 29	yellow (nasty colored)	70	100–110
No. 317 (Ringgit)	yellow	80	85–90
No. 452 (Sumbing)	yellow	75	80–85
No. 520 (Merapi)	black	70	80–85
No. 945 (Wakashima)	yellow	120–160	80–85
No. 1248	yellow	120–160	85–90

It is to be mentioned that the potential yield of the existing varieties is not so low as it is usually presumed. With good cultural practices variety no. 29 yields 1.50 tons per hectare. The same is true for no. 27, Ringgit and Sumbing. The objection against these varieties is that the grain quality, especially that of no. 29, is poor. The maturity of varieties no. 27 and no. 29 is too long to fit in the cropping pattern. Wakashima and no. 1248 are varieties for high elevation, such as Garut (700 meters above sea level) and Kuningan (500 meters above sea level).

A large number of varieties have been introduced from foreign countries. This introduction was aimed to obtain the "new blood" in the breeding work as well as the varieties which can directly adopt to local conditions. Not all of the introduced varieties thrive equally well, many of them are sensitive to the daylength, and therefore not able to give a good yield. Two introduced varieties are rather promising, namely TK-5 and Taichung.

Study on agronomic characters related to high productivity has repeatedly been conducted. Artificial crossings and local trials have been made and intensified. The facts, however, indicate the difficulty of obtaining varieties superior to no. 29 in term of yield per hectare. For this reason the objective of soybean breeding now is focused to shorter maturity and better grain quality, while maintaining the yield potential of variety no. 29.

Results of variety trials conducted during the dry season 1970 and wet season

Table 4. Yield of new breds of soybean in the variety trials conducted during the dry season 1970 and wet season 1971/72 (quintals per hectare)*

Variety	Exp. Sta. Tjikeu-meuh	Exp. Sta. Muneng	Exp. Sta. Modjosari	Exp. Sta. Djambe-gede	Exp. Sta. Genteng	Ngandjuk	Buleleng
No. 1338	22. 17**	18. 98	22. 16	22. 01**	21. 96**	—	—
No. 452 (check)	11. 20	16. 01	15. 26	9. 35	16. 70	—	—
No. 1340	19. 35	—	23. 37	20. 56**	15. 17**	22. 54**	21. 81**
No. 945 (check)	16. 90	—	24. 37	16. 86	11. 32		
Local variety (check)						12. 21	14. 45
No. 1341	20. 53	—	22. 85	23. 24**	14. 89**	19. 46**	18. 90
No. 945 (check)	16. 90	—	24. 37	16. 86	11. 32		
Local variety (check)						12. 21	14. 45
No. 1343	20. 27	—	23. 09	22. 06	12. 53	25. 31**	17. 91
No. 945 (check)	16. 90	—	24. 37	16. 86	11. 32		
Local variety (check)						12. 21	14. 45

Resource data: * Staff Meeting Central Research Institute for Agric, April 1, 2, 1971.
** Variety trials wet season 1971/72 with Directorate Technics.

1971/72 show several promising new breds (Table 4).

2. The use of good seeds

A problem in the extension of improved varieties to farmers is the insufficient supply of good seeds. Up to now the supply of seeds for most soybean growers is being served by the seed merchants. In some regions the flow of seeds is coordinated by the Koperta (Farmers Cooperation). The trouble in soybean seed production is that one is not able to maintain the germinaiblity in a rather long period of time. The germinability usually drops very fast after three months of storage. This naturally points out the need of good storage facilities. In order to overcome this handicap the farmers usually use the seeds from wet season harvest in upland for their planting in the following dry season in the rice field.

3. Insect pests control

The significance of insect pests as the main factors reducing yields in soybeans is shown in the experiments conducted at Ngandjuk, Kebumen and Sidoardjo in the dry season 1969. Results of these experiments point out the necessity of insect pests control in soybean cultivation, (Table 5).

Unlike the experiment conducted in Muara in the wet season 1965/66, in these experiments weeding operation did not show significant increase in yields.

Table 5. Yields (quint/ha) of soybean with or without weeding and pests control at 3 locations, dry season 1969*

Treatment	Ngandjuk	Kebumen	Sidoardjo
No weeding, no pests control	4. 40	12. 55	4. 00
No weeding, with pests control	8. 40**	14. 77	6. 26*
Weeded, no pests control	4. 67	13. 98	5. 60
Weeded, with pests control	8. 67**	15. 65**	8. 00**
H. S. D. 5%	1. 53	2. 28	2. 09
1%	2. 15	3. 07	2. 95

Resource data: Staff Meeting Central Research Institute for Agriculture, March 31–April 1, 1970.

4. Disease control

No direct control against soybean diseases has been practised. Crop rotation in usually applied as a measure to prevent disease infestation. Search on resistant varieties, especially against rust disease should be promoted.

5. Fertilization

Fertilizer experiments on soybean have repeatedly been conducted, however, no stable results have been obtained. Most experiments did not show significant differences in yield obtained by various fertilizer treatments.

6. Other approach

The use of good seeds of a recommended variety, practising pest and disease control and good cultural method to provide favorable conditions for growing plants are a must. Information of these factors should be gained through research activities, which are a long term program. Other approach in increasing soybean production is the expansion of acreage. This expansion can be achieved by intensified land use with soybean, such as:

a. Expansion of soybean as a second crop in rice fields through: (a1), introduction of soybean culture to rice regions, where the culture is not recognizable; (a2), giving the priority to soybean as a second crop after rice; (a3), cultivation of soybean after dry season rice.
b. Soybean as a mixed crop and as a catch crop in plantation.
c. Expansion of soybean cultivation in the dry land in the rainy season.

Summary

1. The average yield of soybean in Indonesia is still too low, namely 6.81 quintals per hectare. This seems to be constant, while the increase of production is primarily attributed to the increase of acreage.
2. The increase of production can be achieved through the improvement of cultural practices (intensification) and through expansion of soybean acreage (extension) by intensified land use with soybean.
3. The yield potential of the existing varieties and the management practices carried out by farmers are already recognized. These all need improvement so that it will be advisable to find means to support a strong research project of staff and line activities that will develop varieties and cultural practices leading to stable high yields of quality soybean.
4. A major problem of soybean production, is a fairly high loss in plant population during the growing season. This loss will depress yields and prevents development of the inherent potential that soybean crop has for food production and capital formation. This problem of plant stand is a complex one and needs special attetion.

Discussion

G. W. E. Fernando, Sri Lanka: What are the main uses of soybean in Indonesia?

Answer: Almost the same uses as in Japan.

S. Konno, Japan: How many percentage is possessed by the paddy field planted with soybean in the total acreage of soybean cultivation in Indonesia?

Answer: About 80% of soybeans are planted in the paddy field in the dry season. For the comparison, we can say that annual harvested acreage of soybean is roughly about 600,000 hectares, and the annual harvested acreage of rice is about 7 million hectares.

J. Fukui, Japan: What controlling method against the rust disease of soybean has been tried in your country?

Answer: We have tried Dithane M-45. Significant difference between treated and untreated plots was observed, however the yield of untreated plot was very low (about 3 gt/ha) compared with 6 gt/ha of that of the treated plot, which is also still too low.

N. Hatai, Japan: Please tell me the method of "pests control" in Table 5.

Answer: Five days after planting we start with BHC spray. Spring should be done every other day (1 day interval). Three to five times spraying is usually effective enough to combat with *Agromyza phaseoli* in the seedlings stage. In later stage of growth endrine 2 cc/l, 500–100 l/ha is used to combat with other insects. Two times spraying is usually enough.

N. Yamada, Japan: I understand from your report that the sowing of soybean seed is practiced either on well-prepared land with soil tillage in the case of intensified cultivating method or on the un-prepared land usually covered with straw. Is there any difference in the attacking of insect on the seeds during germination between these two methods of sowing?

If I remember correctly, sowing seeds on well-prepared land is apt to induce a serious failure of germination caused by an attack of some kind of insect, while seeds sown on un-prepared land covered with straws can escape from the attack of that insect.

Answer: Yes, and it is commonly believed that straw cover reduces the attack of insects primarily the *Agromyza phaseoli* in the seedling stage. Result of the experiment before the war proved this supposition.

Good management practices however provide favorable conditions for growing plants, while insect attack during the seedlings stage can now be strongly reduced by proper application of chemicals.

T. Sanbuichi, Japan: In Thiland, usual native varieties have higher protein contents than introduced ones. Did you see any different chemical components between usual Indonesian native varieties and introduced ones?

Are there any considerably high protein varieties in your country?

Answer: Before the war it was known that Fava soybean had higher protein content than others. That time the highest content of protein was 38%. At the present time, chemical analysis shows the highest protein content of introduced varieties lies between 40–41%. I would think that fertilization may increase the protein content.

T. Yamamoto, Japan: What is the main reason to drop germination percentage after as short as three months of storage? How much water content is at the harvest time?

Answer: Water content at the harvest time is between 20–30%. The seeds are usually dried up to 10–12% moisture content. The drop of germinability after three months of storage usually happens in large seeded varieties. The seeds of variety no. 29 which is a small seeded variety can be stored up to 12 monthes without a strong decline of the viability. The main reason is naturally the equilibrium between the relative humidity and the temperature, the answer of which can only be found in good storage facilities.

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