Five steps toward the Indonesian soybean self-sufficiency

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Abstract. Bogor Agricultural University in collaboration with the Ministry of Agriculture in 2016 doing mentoring and guidance to farmers in soybean cultivation in tidal swamp areas in six provinces namely Jambi, Lampung, South Sumatra, Central Kalimantan, South Kalimantan and North Kalimantan. Overall, soybean cultivation in the tidal swamp area of 10,000 hectares. The activities include tidal swamp land identification, mentoring of soybean cultivation in tidal swamp areas, training on land preparation to post-harvest, and marketing facilitation. In general, the implementation of soybean cultivation using water-saturated cultivation technology in tidal swamp land runs well. Soybean productivity is better than the previous year. High productivity achievement in Jambi Province, East Tanjung Jabung Regency in Berbak and Dendang District 2.7–3.3 Ton/ha, South Sumatera Province at Musi Banyuasin Regency in Lalan District reached 2.6 Ton/ha and Central Kalimantan Province, in Maliku District reached 2.7 Ton/ha. In addition to the mentoring activities are also carried out operations of tidal swamp land identification in the Provinces of Jambi, South Sumatra, Central Kalimantan and Lampung. The potential tidal swamp area for soybean development in those four provinces is 356,294 ha. Some of the constraints of soybean cultivation in tidal swamp land include long rainy season, poor irrigation infrastructure, availability of soybean seeds, land suitability for soybean cultivation, and market.

1. Introduction
Soybean is a source of protein that needed by the people of Indonesia. Increased population and awareness of protein needs will increase the demand for soybeans from year to year. The average annual requirement of soybean is about ±2.2 million tons of dry beans, but the current domestic production capability based on BPS (Indonesian Central Bureau of Statistics)¹ has only been able to meet 963,183 tons or 44.68% of the demand, and the remaining 53.32% fulfilled from import. This caused various losses for Indonesia, among others; considerable loss of foreign exchange, reduced employment opportunities and increased long-term dependence, thus affecting national food security.

The main problem of soybean development in Indonesia lies in the following three things: Firstly, low productivity (1.3 ton/ha) [2], uncompetitive (compared to rice and corn), so it only used as...
intercrop or crop rotation. Secondly, Soybean seeds have low shelf life (3 months) [2] so it is necessary to find the proper storage technology. Also, appropriate seed supply systems are needed so that seeds can be available at a time when farmers will plant in sufficient quantity and seeds are available continuously. Thirdly, unclear marketing and supply chain management, there is no market certainty and low price of soybean. Based on these problems soybean is not attractive to farmers.

Increasing the production of soybean needs to pay attention to these three problems. The productivity of 1.3 tons/ha of soybean so far achieved in the dry land at rainy season or in the rice field at the dry season. Various varieties and cultivation technologies are applied but have not been able to increase higher productivity significantly. Bogor Agricultural University has found a technique of water-saturated soybean cultivation (BJA). By using BJA technology, soybean productivity can reach 4 ton/ha[3]. The application of BJA soybean will use tidal swamp land[4][5]. Therefore, the expansion of soybean area is no longer in Java but must be out of Java Island where the tidal swamp land is widely available. To meet the national soybean demand, the tidal swamp land area needs to be around 800,000 to 1,000,000 ha outside the existing soybean area.

To solve the problem of soybean and speed up soybean self-sufficiency in Indonesia, Bogor Agricultural University (IPB) offers solutions through five strategic and practical steps namely; increase productivity through BJA (Water-Saturated Cultivation Technology), prepare tidal swamp land, provide seeds with JABALKEK (Intermediate Field Flow Seeds in Soybean Estate)[2], ensure soybean marketing at favorable selling price for farmers, and institutional revitalization of soybean pro-farmers trading system.

Bogor Agricultural University in collaboration with the Ministry of Agriculture in 2016 to provide mentoring and guidance to farmers in soybean cultivation in tidal swamp areas in six provinces under the title "Increasing Soybean Production through Water-Saturated Cultivation Technology." The goals to be achieved from this activity are as follows: water-saturated soybean cultivation technology (BJA) is socialized and applied by farmers, identify the problem of application of water-saturated cultivation technology, increasing of soybean productivity, identification of potential land for soybean development, and recommendation for government policies related to soybean.

2. Scope and method of activities

There are some programs in the scope of this activity, these are socialization program to the farmers participating in the program; training of trainer (TOT) for mentoring personnel, Agriculture Agency, and Agricultural Extension Service; mentoring in the application of water-cultivated cultivation technology; supervision and training of farmers (BJA technology, seed production, post-harvest, marketing); facilitation of soybean marketing, survey and identification of potential land for soybean development in tidal swamp areas; and recommendation for government policies related to soybean.

The activity carried out from February 2016 to December 2016. Location for mentoring activity is Jambi, South Sumatra, Lampung, South Kalimantan, Central Kalimantan, and North Kalimantan. Location for land identification activity is Jambi, South Sumatra, Lampung and Central Kalimantan.

Overall, soybean cultivation in the tidal swamp area of 10,000 hectares. During the planting activities were carried out mentoring with the following actions: Firstly, training of Trainer (TOT) was conducted in the framework of knowledge transfer from BJA soybean expert to Agriculture Agency and Agricultural Extension Service, and mentoring personnel; Secondly, supervision and Training of farmers in 6 Provinces. The training is provided by the expert team including land preparation, planting, crop maintenance, harvesting, and post-harvesting and seed production. Supervision is carried out by a team of IPB experts with the ministry of agriculture and the regional agricultural service (provincial and district); and thirdly, mentoring in each BJA activity area in 6 provinces is conducted by mentoring personnel. Each area of 500 hectares placed two mentors.

Land identification for BJA soybean development using participatory survey approach from relevant stakeholders, such as local government (province and district) and farmer group in survey location. Forms of participation from stakeholders include verification/validation of BJA soybean development land, on land area, land status, location (administrative) land, current land use, irrigation
facilities, BJA soybean development issues at survey location, and suggestions related to BJA's soybean development plan.

The identification of BJA soybean development land with the participatory approach done through the following three stages. First stage is preparation of potential land-use maps of BJA soybean development. Map required between field map of rice field audit outside Java Island, which is the base map for subsequent land surveys in four provinces, namely Jambi, South Sumatra, Lampung and Central Kalimantan. Second stage is participatory survey. Participatory survey activities conducted through FGD (Focus Group Discussion) activities and field observations. This stage begins with the FGD at the provincial level and compilation/inventory of potential land and administrative location to determine the potential location of the land to be surveyed to obtain a list of land covering the administrative location and land area. Further, FGDs undertaken at the district level to obtain a more accurate potential location; this FGD continued to the sub-district level and direct survey to farmers' land/groups, each with a different focus of discussion. FGD at the provincial / district level focuses on verifying/validating land status, land area, and land location, constraints faced, land use pattern/planting pattern, and suggestion for BJA soybean development. FGDs at sub-district/farmer groups focused on land tenure, land availability and land suitability, commodities cultivated, irrigation facilities/water supply conditions, problems encountered, and suggestions for BJA soybean development plans. Besides FGD, field observation of the land in several land locations also done according to the input/direction of the FGD results. To get a detailed overview of several aspects, namely soil conditions, cultivation patterns, irrigation, infrastructure, hydrology, tidal swamp, and socio-economic, depth interviews with farmers and irrigation personnel (the water gatekeeper). In this discussion, experts also provide suggestions for improvement on these aspects. Third stage is coordination the preparation of survey results report. The results of the survey then performed the process of compilation, processing, and analyzed for the purposes of reporting. The process is carried out jointly by the IPB Team and the Ministry of Agriculture Team (Directorate of AKABI/Directorate of various nuts and tubers), through coordination activities. The coordination of the activity process has done on a scheduled basis until the compiled reporting. This coordination has done so that the Ministry of Agriculture and IPB are involved intensively in the reporting process so that both parties have symmetrical information and common perception in the framework of soybean development.

3. Results of activities implementation

In general, mentoring activities of soybean development in tidal swamp land in 2016 run well ‘figure 1’. Soybean productivity is better than the previous year. The average productivity of soybean in 6 provinces in 2015 (non BJA) is 1.3 ton/ha increased to 1.8 ton/ha in 2016 (BJA technology) (table 1). High productivity achievement in Jambi Province, East Tanjung Jabung Regency in Berbak and Dendang District 2.7–3.3 Ton / ha, South Sumatera Province Musi Banyuasin Regency in Lalan District reached 2.6 Ton/ha and Central Kalimantan Province, Maliku District reached 2.7 Ton/ha [6].

Table 1. Soybean productivity using BJA technology (2016) compared to not BJA technology (2015).

| No | Province       | Area (ha) | Productivity using (BJA) (Ku/ha) | Productivity(not BJA) (Ku/ha) |
|----|----------------|-----------|-----------------------------------|--------------------------------|
| 1  | Jambi          | 500       | 21.80                             | 13.72                          |
| 2  | Lampung        | 1,000     | 9.01                              | 11.67                          |
| 3  | South Sumatra  | 4,000     | 17.63                             | 15.09                          |
| 4  | South Kalimantan | 1,000   | 18.47                             | 13.65                          |
| 5  | Central Kalimantan | 2,500  | 18.00                             | 12.00                          |
| 6  | North Kalimantan | 1,000   | 13.00                             | 13.29                          |
|    | Total/Average   | 10,000   | 17.67                             | 13.29                          |
The variation of soybean productivity is due to the application of BJA technology that has not been optimum, especially the condition of the drainage and the water filling in the channels is not suitable\cite{5}\cite{7}\cite{8}. Land conditions are often dry causing the growth of plants is not optimal. Productivity determined by various factors including land suitability, planting time, provision of production inputs, seed quality, plant spacing (population), and others. From all provinces in general, 30\% of the land is appropriate, and 70\% of the area is inappropriate for BJA. Land used is a land that has been established by the local government with the ministry of agriculture.

Therefore, in 2016 to ensure that the land used in appropriate with the requirements of water-saturated cultivation in the tidal swamp area, in addition to the activities of mentoring also carried out the identification of tidal swampland area in four provinces namely Jambi, South Sumatra, Central Kalimantan and Lampung. Potential tidal swamp area for soybean development in the four provinces after identification obtained a total area of 356,294 ha. Jambi Province 54,839 ha, South Sumatra 218,682 ha, Central Kalimantan 41,279 ha and Lampung 41,491 ha ‘figure 2’ \cite{6}.

Land suitability is based on physical aspects (soils and irrigation) of land in tidal swamp areas classified 1, 2 and 3. Class 1 for good soil and irrigation infrastructure condition. Class 2 there must be the improvement of watergate and irrigation infrastructure. Class 3 should be able to keep the water in the channels not to dry due to the superficial pyrite layer (<30 cm)\cite{7}\cite{8}. From the survey results of tidal swamp irrigation infrastructure identification covering an area of 356,294ha, obtained an area of 131,600 ha that can be immediately utilized for the development of BJA soybeans.
Figure 1. Mentoring activities for soybean cultivation using water saturated technology in 6 provinces.

Figure 2. Potential land for soybean development in tidal swamp areas in four provinces (Jambi, Lampung, South Sumatra and Central Kalimantan).

The seed supply is the most critical aspect. Almost throughout the province, the seeds used were of low quality. The average germination rate is below 50%. This is because the seeds are sent from Java Island and the seeds are already stored more than three months. Efforts to supply seeds through the
JABALKEK system still has difficulties because there is no guarantee of seed markets and short shelf life and the presence of concerns violating government regulations regarding seed certification. Only in Jambi province succeeded in providing soybean seeds. Farmers in Jambi province provide seed using save seed system. High quality of seed but not certified seeds. The seeds are produced by every farmer by choosing the good quality of seeds from the crop to be seeded. The seeds are stored in 20-liter plastic “jerry cans,” tightly closed and only opened when they are to be planted. Using this way seeds can be available at the time of soybean growing season. Farmer’s seed provision activities supported by local governments by facilitating “jerry cans” assistance to save seeds.

The marketing of farmers' soybean yield is still facing difficulties. And also, there is no clarity where to market also low price. Soybean prices range from IDR 3,000–5,000 per kilogram. The price is still far below the soybean economy price of IDR 7,000 per kilogram. The government in 2016 set the “HPP” (price of government purchases) of soybean IDR 8,500 per kilogram. But, the market does not buy soybean according to the HPP. Indonesian Agency for Logistics (BULOG) appointed by the government to buy soybean also cannot buy soybean in accordance with the HPP [9].

4. Conclusions and recommendations

4.1. Conclusion

The productivity of soybean through the application of water-saturated cultivation technology has increased on average in six provinces from 1.3 ton/ha to 1.8 ton/ha. In some areas, the productivity of soybeans reaches above 2.6 tons/ha. The diverse productivity of soybean is due to the application of BJIA technology that has not been optimum, especially the condition of the drainage and the water filling is not suitable. Potential tidal swamp area for the development of soybean in the four provinces after identification obtained the overall land area of 356,294 ha. Provision of seeds through the JABALKEK system has difficulties due to lack of seed market guarantees and short shelf life and fear of violating government regulations regarding seed certification. Soybean marketing is still facing difficulty. Also, there is no clarity where to market also low price.

4.2. Recommendation

Provision of Seeds suggests that soybean seeds should be provided at each soybean development site. Soybean seed supply system can use save seed system / non-formal (not certified) or with the formal system (certified) through “JABALKEK” model (Intermediate Field Flow Seed in Soybean Estate). Areas with high-solidity farming groups may choose formal seed supply systems, while areas where farming groups are not yet solid can use non-formal seed supply systems.

Land Identification recommends that Land suitability of grade 3 (less suitable because of the depth of pyrite layer less than 30 cm) should be careful in keeping the water in the drainage not to dry. Fertilization and liming recommendations should be based on soil analysis, including considering soil pH, pyrite content, interchangeable Aluminum and soil base content (Ca, Mg, K and Na).

Aspects of Cultivation suggests that the need for assistance to farmers and demonstration plots in the application of SOP (Standard Operational Procedure) of Water-Saturated Soybean Cultivation Technology. The need to improve seed quality of the system of provision of non-self-supporting seeds (not certified) and simplification of regulatory requirements for procurement of soybean seed. The time of soybean planting needs to pay attention to the condition of the location-specific season, the first three months need enough water, either from rainfall or irrigation channel and before harvest time the rainfall should be low.

Social and Economic Aspects recommends that need to be encouraged by marketing cooperation with soybean-based processing industry through cooperation / contract. The need for market and price guarantees through price subsidies and through the revitalization of farmer institutions. The empowerment of KOPTI (Indonesian Cooperative for "Topu" and “Tempeh”) institutions with the orientation of local soybean with the financing or capital facilitation from the government.
Five steps towards self-sufficiency of soybean need to be realized consistently with full commitment and support of government policy and support from all parties if Indonesia wants self-sufficiency of soybean.

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