

Selection of Soybean Varieties for Coastal Zones in Bengkulu

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Abstract— The coastal land has multiple stresses, i.e., lack of soil moisture, plant nutrients and organic matter, high temperature, and salinity, and strong wind. Cultivation of crops in these circumstances requires selected input in the forms of organic fertilizers and biofertilizers, which are environmentally friendly and easy to be developed by the farmers. The aim of this study is to select soybean varieties and their compatibility with bio-fertilizer according to the characteristics of coastal land. The experiment was arranged in a Randomized Complete Block Design and repeated five times. The tested factors were soybean varieties (i.e., *Anjasmoro*, *Detam1*, *Detam2*, *Grobogan*, *Malika*, and *Wilis*). Basal fertilization provided was 10-ton ha⁻¹ of organic fertilizer, 200 kg ha⁻¹ of agricultural lime, 50 kg Urea ha⁻¹, and 50 kg ha⁻¹ SP36, and 50 kg KCl ha⁻¹. The results show that *Anjasmoro* and *Wilis* varieties have the best growth; their seeds weights were 16.85 and 14.58 g per 100 grains, respectively, and their dry seeds production were 2.67 and 2.58 tons ha⁻¹ respectively. Both varieties also have plant tissue concentration of N (3.85%), P (0.32 to 0.37%), and K (2.44 to 2.50%), which indicate the equality of the needed fertilizers. The results also reveal that both soybean varieties (*Anjasmoro* and *Wilis*) are the best candidates for developing soybean cultivation in coastal areas of Bengkulu or anywhere with the same conditions.

Keywords— coastal land; soybean; bio-fertilizer.

I. INTRODUCTION

Coastal zones are the areas where interaction between the sea and land occurs. Indonesia, as an archipelagic country, has a coastline of ± 81 thousand km. The length of the coast thus shows the agriculture potential of coastal areas in Indonesia to be developed as a productive area. Coastal communities generally work as fishermen and shift to other jobs when the weather condition is not permissible to work as fishermen. However, they typically have no skill and the technology of coastal land management used for agricultural crop cultivation, and therefore, approximately 60% of poor Indonesian are from coastal communities.

Coastal areas have specific characteristics and can be distinguished from non-coastal areas. Their unique features are (1) strong winds with salt scattering from the sea, (2) low-to-high soil salinity, (3) high soil porosity and temperature, and (4) free sand movement [1]. The type of wind characteristic of the coastal area is the wind blowing from the sea that accelerates the transpiration rate of plants. A high-velocity wind will carry small drops of saltwater from the sea on to the sand at the beaches. Because it is salty, the water cannot be used by plants, and the salt seeps into the bud because of mechanical abrasion, and the chloride ions accumulate at the end of the branches to the detrimental

levels to the leaf facing the sea. In contrast, those facing the land, on the other hand, can develop well.

The coastal area has sand-textured soil, no structures, low-to-high salt content, but low nutrient content, and low organic matters. Therefore, coastal land cannot provide financial income from the agricultural sector for its inhabitants. However, the facts show that with the right technology, the coastal land can be utilized to improve the welfare of its inhabitants. For example, people in the Kulon Progo Regency on the southern coast of Java, Indonesia, have successfully cultivated soybean with a productivity of 2.16 tons ha⁻¹. Farmers in the Cirebon Regency in the northern coastal area of Java have also succeeded in cultivating black soybeans. Organic chili cultivation has also been successfully developed in the coastal area of Bengkulu city, Indonesia [2].

Successful cultivation of agricultural food crops and to overcome the environmental problems resulting from the loss of plant nutrients generally involves the use of organic fertilizers and biofertilizers. Organic fertilizers have various functions to increase the ability of soil binding water, nutrients, and also as a substrate of soil microorganisms. As the source of charge that holds nutrient ions, it is not easy to be washed, to detoxify pesticides and heavy metal compounds, and so forth. Researchers have reported positive

II. MATERIALS AND METHOD

effects of organic fertilizer on increased growth and yields of soybeans [3], and humid acid as a fraction of organic matter reduced or eliminated the influence of the salt stress on soybean [4].

It is well known that biofertilizers contain a variety of beneficial microorganisms (e.g., rhizobacteria, arbuscular mycorrhizae fungi, and phosphate solubilizing microorganisms). It can accelerate and improve plant growth, allow more efficient nutrient use or increase nutrient availability, promote soil aggregation, and protect plants from pests and diseases [5]. Many bacteria that living in plant root can promote plant growth through a wide range of mechanisms. These bacteria are commonly called plant growth-promoting rhizobacteria (PGPR). Chibeba et al. [6] concluded that the inoculation with indigenous rhizobia, i.e., *Brady rhizobium*, adapted to local conditions, represents a possible strategy for increasing soybean yields. Researchers found that inoculation of soybeans with *B. japonicum* alone or combined with other rhizomic organisms enhanced soybean growth under salt stress through altering root system architecture [7], [8]. Researchers also reported the uses of compost or manure on legume plants with appropriate rhizobia strain could increase the activity of rhizobia to colonize the roots and the activity of nitrogen fixation [9], [10].

Arbuscular Mycorrhizal Fungi (AMF) belong to the fungal phylum Glomeromycotina usually form a symbiotic association with vascular plants as their host [11]. AMF has been reported to increase the adaptability of crops grown in problem soils, such as low water content or high salinity at coastal land [12]. AMF found in Bengkulu Province has proven its capacity to improve the productivity of soybean and peanut varieties in acid mineral soil [13] and chili grown at the coastal area [2]. Similar importance is the symbioses of the Rhizobium bacteria [14] and the phosphate solubilizing fungi [3], [13] with soybean crops to increase soybean productivity in acid mineral soils. However, as far as this author is concerned, there is no information in the literature on the effectiveness of isolating biofertilizer from Bengkulu Province to increase soybean productivity in coastal land.

Phosphate solubilizing microorganisms (PSM) are myriad micro-organisms that have the ability to extract phosphate from the insoluble form into a form available for plants through secretion of organic acids produced to release P from the absorbed complex [15]. Some of the most common examples are the species of *Bacterium substiles*, *B. mycoides*, *B. mesentericus*, *Aspergillus niger*, *A. candidus*, *Fusarium*, *Penicillium*, *Schlerotium* & *Phialotobus*, etc. Researchers reported that the use of phosphate solubilizing fungus (PSF) has a significant effect on an increasing available soil P and dry root of corn crops on *Ultisol* [16] and increasing of fresh weight and P uptake of pepper on *Andisol* [17].

Therefore, it was hypothesized that the correct combination of soybean varieties, organic fertilizers, and biofertilizers (AMF, rhizobia, and phosphate solubilizing fungus) could increase soybean productivity in the coastal areas of Bengkulu. The success of this research could indirectly become a model of coastal empowerment for the cultivation of food crops, especially soybean, as well as to open opportunities for coastal communities to obtain the new business opportunity.

This research was conducted in the coastal area of Bengkulu in the village of Pekik Nyaring, Muara Bangkahulu District, Central Bengkulu Regency. Preparation for the research materials such as organic fertilizer inoculants and bio-fertilizers and analysis of plant and soil materials were carried out at the Soil Biology Laboratory and wire house owned by the Faculty of Agriculture of Bengkulu University.

The coastal soil used for the experiments had the following characteristics: pH (H₂O) 6.23, pH (KCl) 5.643, total N content 0.18%, 2.07% organic C, P₂O₅ (Olsen) available 11.72 mg kg⁻¹, K₂O exchange 1.79 mg kg⁻¹, Ca 2.23 mg kg⁻¹, and Na <0.107 cmol (+) kg⁻¹. In general, this soil had the following characteristics slightly acid, low total N content, moderate organic C, low available P, very low exchangeable K and Ca, and exchangeable Na is low. The soil can be classified as low fertility with nutrient deficiency problems of N, P, K, Ca, and organic matter.

Compost as organic fertilizer was prepared in Soil Biology Laboratory at Agriculture faculty of Bengkulu University. Coffee peel was crushed and sieved to pass the sieve of Ø 0.5 cm size. Coffee peels were mixed with cow dung with a 4: 1 ratio and 1% topsoil and 1% agricultural lime. 800 kg of coffee skin and 200 kg of cow dung and 10 kg of topsoil and 10 kg of agricultural lime were needed for every 1000 kg of compost. The solution containing *Trichoderma harzianum* culture was prepared in the following procedure: 1 kg of sugar, and 1 kg of urea mixed with 10 L water and fungal culture. Everything was mixed in a bucket and left for 24 hours so that *Trichoderma* can grow and develop. The compost raw materials were doused with a solution containing *Trichoderma* before they were put into the compost bin. All compost materials were put into the compost tub layer by layer. On each layer, ground shoots and agricultural lime were sown. In the center of the compost pit, the bamboo hollow was embedded by alternating it on the right-left side with a distance of about 10 cm. The composted material was then doused with water until a water-saturation condition was apparent by the flowing of water from the compost bin floor to the disposal drainage. The top of the compost tub was covered with plastic tarpaulin. The incubation of compost was carried out for ± 1 - 2 months until the composted material matured. The characteristics of mature compost are black in color, moist, and if clenched by hand; it did not remove the liquid in between the fingers; it did not emit the smell, and the temperature was equal to the air temperature. Monitoring was carried out by measuring the temperature using a thermometer, moisture meter moisture, and compost color using the *Munsell Soil Color Chart*.

The experiment began with the clearing of land from various weeds and then followed by tillage the soil, sowing basic fertilizers, and compost. The basic treatment was 10-ton ha⁻¹ peel coffee compost, 200 kg ha⁻¹ agricultural lime, 50 kg Urea ha⁻¹, 50 kg SP36 ha⁻¹, and 50 kg KCl ha⁻¹. Basic fertilizer was given by sowing it on the surface of the soil, and then the soil was tilled and leveled with a rake. The planting hole was set up with a wooden quadrangle quarry. The edges were pointed, so they were easy to press into the ground. Each of the adjacent edges was separated according

to the spacing of 30 cm x 30 cm. The planting hole was then leveled with a rake. Maintenance was done by watering plants, eradicating mechanical of weeds, eradicating pests by the spraying of *curracron*. Watering was carried out every two days except on heavy rain days.

It is periodically every two weeks, observation on plant height was conducted by measuring the height of the plant from the base of the stem to the top of the plant. Measuring was done by using a meter. Other plants variable observed were including (1) dry weight of biomass, (2) NPK-Na nutrient content (3) number of pods containing per plant, (4) number of seeds per plant, and (5) dry weight of seed per plant, (6) weight of 100 seeds, and (7) soybean production. Biomass weight and nutrient uptake were measured at the time when 10% of the plant population had flowered. The number of pods, seeds, and weight of the seeds were calculated and weighed at the end of the generative phase. The drying of pods indicates it. Plants were dismantled carefully to minimize fiber root loss. Plants were put into plastic bags and taken to the laboratory. Leaves, stems, and roots were separated from one to another. The roots were washed in running water to keep them clean of the soil remnants. The stems and leaves were inserted into separate envelopes of paper and then dried in an oven at 80 °C until the weights were constant. Each part of the plant was weighed using an analytical balance sheet.

After being weighed, the dried material was pollinated using a blender and filtered using size filter number 40 (325 mesh). This dry powder was ready for use for nutrient content analysis. Analysis of N, P, and K plant nutrient content was done by a method developed by Bogor Soil Research Institute, Agricultural Research and Development Agency, Ministry of Agriculture [18].

At the beginning of the experiment, a composite rhizosphere sample was collected in the experimental area. Plants were dismantled carefully so as not to break their roots. From the plant hole, the crops were taken with a trowel and put into plastic bags. Dirt, such as the left-over roots, gravel, and so forth, were thrown away. The soil samples were then mixed for each experimental unit. From the experimental area, about 2 kg of soil samples were taken and put into clear plastic bags, labeled with sample code, dated, and given the name of the take. Soil samples were taken to the laboratory and then analyzed for organic C, soil pH (H₂O and KCl), (3) total N, available P, and exchangeable K. The method of analysis used was the method routinely used by the Soil Research Institute [18]

All plant and soil data were analyzed by variance model (ANOVA) while the treatments were tested with Duncan Multiple Duncan Test (DMRT) at 5% significant level.

III. RESULTS AND DISCUSSION

A. The Plant Growth

The plant height of the six varieties of soybean shows differences (Figure 1). At the beginning of the experiment, Anjasmoro variety is the tallest among the six varieties, while the shortest one was Wilis. Gradually until week 8 (eight), other plants' height increased and roughly equaled

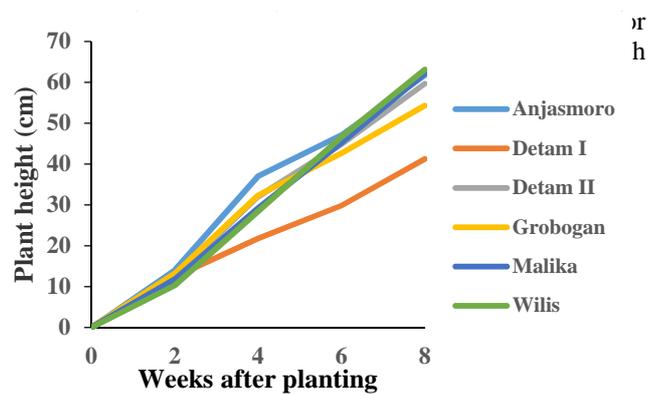


Fig. 1. Plant height of six varieties of soybean at 2 – 8 weeks after planting

This indirectly shows the different responses of soybean varieties when planted in coastal soil conditions. *Anjasmoro* is a soybean variety that does not take time to adapt to such an environment. Other varieties of soybeans require a longer time to adapt to the environmental conditions of the coastal soil. *Detam1* variety requires the longest adaptation time, and at the end of the vegetative phase, it still showed no maximum growth.

Grobogan variety has the shortest flowering age of 38 days, while the *Detam1* variety has the longest one with 48 days (Table 1). In terms of plant dry weight, *Grobogan* variety (7.93 g) and *Anjasmoro* (6.49 g) are more or less the same, and both are higher than other varieties.

In terms of nutrient content, *Wilis* has the highest P-tissue content (0.37%). In comparison, the lowest is *Detam1* (0.30%), *Grobogan* variety has the highest K tissue (2.83%) while the lowest *Malika* (2.20%), and all varieties containing Na of the same level. These data show that *Wilis* variety requires the P nutrient the most, whereas *Grobogan* needs K the most, and all varieties have a similarity in controlling the Na content.

B. Plant Yields

Wilis showed the highest yield productivity among the soybean varieties, especially in terms of the number of pods per plant, the number of contained pods, the number of seeds per plant, and the weight of seeds per plant (Table 2). The *Grobogan* variety has the lowest number of pods per plant, the lowest number of contained pods, and the lowest number of seeds per plant while *Detam1* variety has the lowest seed weight per plant.

The weight of 100 seeds is the size of the soybean seed, the higher the weight of 100 seeds, the larger the size of the seeds of soybeans will be. The ideal seed weight per plant for high yield soybean crops is about 17 g [19]. Soybean production can be predicted based on the yield of seed weight per plant with the ratio of area per plot to the area of 1 Ha. The size of the plot used in this experiment was 2 m x 3 m or 6 m² with the number of crops as many as 50 soybean crops. For every Ha of land, there were 83333 plants so that if the seed weight is 32 g per plant, then it is predicted to be maximal of 2667 kg ha⁻¹ or 2,667-ton ha⁻¹.

TABLE I
FLOWERING TIME, DRY WEIGHT, N-P-K-NA NUTRIENT CONTENT OF SIX VARIETIES OF SOYBEAN AT 8 (EIGHT) WEEKS AFTER PLANTING

Varieties	Flowering time (day)		Plant dry weight (g)		N level of tissue (%)		P level of tissue (%)		K level of tissue (%)		Na level of tissue (%)	
Anjasmoro	41.40	ab	6.49	ab	3.85	a	0.32	ab	2.44	ab	0.01	a
Detam I	48.00	a	5.86	b	3.72	a	0.30	b	2.32	ab	0.01	a
Detam II	41.40	ab	5.74	b	3.59	a	0.33	ab	2.30	b	0.01	a
Grobogan	38.00	b	7.93	a	3.67	a	0.34	ab	2.83	a	0.01	a
Malika	45.00	a	5.14	b	3.75	a	0.34	ab	2.20	b	0.01	a
Wilis	42.20	ab	5.10	b	3.85	a	0.37	a	2.50	ab	0.01	a

Notes: The mean followed by the same letters shows different unreal difference based on Duncan's Multiple Range Test at the real level of 5%

Such production is significant enough to help meet the needs of national soybean, considering the vastness of coastal areas in Indonesia. However, we have to keep in mind that there are times when coastal land is less potential for agricultural activities. In some parts of Indonesia, especially those facing the ocean, strong winds are often

blowing, which can destroy plant growth. Strong winds also have the potential to accelerate the spread of pests and diseases. Thus, the results of this study at least can provide information on the potential of bio-fertilizer and organic fertilizer to increase the growth and yield of soybean crops in coastal areas.

TABLE II
COMPONENTS OF SOYBEAN CROPS YIELD ON COASTAL LAND IN BENGKULU

Varieties	Number of pods per plant		Number of pods contained		Number of seed per plant		Seed weight per plant (g)		Weight of 100 seeds (g)		Soybean production (ton/ha ⁻¹)	
Anjasmoro	208	b	198	b	217	b	32.00	a	16.85	b	2.67	a
Detam I	220	ab	203	b	204	b	13.90	e	12.10	d	1.16	e
Detam II	150	c	150	c	144	c	15.50	d	12.85	d	1.29	d
Grobogan	140	c	135	c	127	c	21.65	b	18.00	a	1.80	b
Malika	223	ab	208	b	208	b	18.88	c	12.86	d	1.57	c
Wilis	261	a	250	a	250	a	30.93	a	14.58	c	2.58	a

Notes: The mean followed by the same letters show unreal differences based on Duncan's Multiple Range Test at a reality of 5%

C. Changes in Soil Characteristics

Cultivation of soybean crops has been reported to improve soil fertility under Kayubawang (*Scorodocarpus borneensis*) tree in Bengkulu Province [14]. This shows the existence of soybean plant rhizosphere dynamics that fertilizes the soil. The results of this study show that the rhizosphere soil of *Wilis* variety has the highest organic C content and the highest AMF population, whereas the soil rhizosphere of *Detam1* has the lowest organic C content and *Detam2* variety has the lowest AMF population (Table 3). Soil rhizosphere of *Detam1* has the lowest AMF population, but it is the highest PSF population. The pH of *rhizospheric* soil is substantially unchanged, all of which are still neutral.

The high AMF and PSF populations show that the tested soybean varieties need to be symbiotic with AMF and PSF in order to grow well and produce sufficient seeds. The existence of PSF and AMF helps soybean crops with the supply and uptake of nutrients, especially phosphorus. *Wilis*, whose highest nutrient content is also the one whose rhizosphere has the richest AMF even though the PSF population is not the biggest in number. The *Detam I* variety whose lowest P-content which has the largest population of

PSF in its rhizosphere. This indicates that the PSF population is not related to the effectiveness of nutrient uptake P for the genotype.

TABLE III
ORGANIC CARBON, SOIL pH (H₂O), ARBUSCULAR MYCORRHIZAL FUNGI POPULATION (AMF) AND PHOSPHATE SOLUBILIZING FUNGI (PSF) OF SOYBEAN PLANT RHIZOSPHERE

Varieties	C (%)	pH (H ₂ O)	AMF population	PSF population
Anjasmoro	2.54ab	6.88c	56a	593.14c
Detam I	2.21b	7.06abc	50ab	923.60a
Detam II	2.30b	7.06abc	30c	598.16c
Grobogan	2.61ab	7.12a	41ab	549.27c
Malika	2.60ab	7.10ab	40b	817.51ab
Wilis	2.74a	6.90bc	57a	686.26bc

Notes: The mean followed by the same letters show different unrealities based on Duncan's Multiple Range Test at a real 5%

If the results of this study are compared to previous study [20], the adaptive and non-adaptive variety will be shown (Table 4). Judging from the size of the seeds or the weight of

100 seeds and its productivity, only Anjasmoro and Wilis are the potential to be developed in the coastal areas of Bengkulu.

TABLE IV
THE COMPARISON OF 100 SEED WEIGHT AND SOYBEAN PRODUCTION OF THIS RESEARCH WITH THAT OF BALITKABI

Varieties	Balitkabi [20]		This Study		Δ	
	Size of seed (g per 100 seed)	Yields (ton ha ⁻¹)	Size of seed (g per 100 seeds)	Yields (ton ha ⁻¹)	Size of seeds (g per 100 seeds)	Yields (ton ha ⁻¹)
<i>Anjasmoro</i>	15.05	2.25	16.85	2.67	+	+
<i>Detam I</i>	14.84	2.51	12.10	1.16	-	-
<i>Detam II</i>	13.54	2.46	12.85	1.29	-	-
<i>Grobogan</i>	18.00	2.70	18.00	1.80	=	-
<i>Malika</i>	9.50	2.34	12.86	1.57	+	-
<i>Wilis</i>	10.00	1.60	14.58	2.58	+	+

The low dry weight of plants in some varieties of soybean crops grown in coastal soils can be caused by the presence of multiple stresses of drought, salinity, and low levels of nutrients and organic matters. Seed and salty texture cause a decrease in soil potential and an increase of Na and Cl absorption or both [21]. The decrease in soil potentials to low levels leads to the absence of groundwater so that the plant may experience physiological drought. The plants require water to maintain the cell turgor and to carry out the process of photosynthesis. The low water content causes the plants to lack water, and this will cause cell turgor to decline, and stomata close. Closure of stomata causes a low supply of CO₂ so that photosynthesis also becomes decreased.

Soil salinity also negatively affects the leaf chlorophyll index [22], [23]. The presence of high salt levels leads to shedding of salts inhibiting chlorophyll biosynthesis [23], [24]. The opposite occurs in cabbage and sugar beet plants [25], which indicates the influence of plant species on the effect of salinity on chlorophyll levels. The decline of chlorophyll biosynthesis will affect the photosynthesis. The dry weight of the plant is an indication of the shedding of photosynthesis. In the form of carbohydrates so that if photosynthesis decreases, it is followed by the decrease of the dry weight of plant and soybean yield components. The low dry weight of plants and the resulting components of some soybean varieties grown in high salt soil have been reported by other researchers [26], [27]. Aini et al. [22] concluded that of the eleven varieties tried out, *Wilis* and *Tanggamus* could be categorized as sensitive ones, whereas the relatively tolerant varieties were G8 (IAC, 100 / Bur // Malabar) and G11 (Argopuro // IAC, 100). The sensitivity of the soybean variety is indicated by the percentage of dry weight reduction, chlorophyll index, and dry weight of seed. The decrease of dry seed weight per plant at 8.58 dS m⁻¹ salinity occurred in *Wilis* and *Tanggamus* varieties followed by IAC, 100 / Bur // Malabar 10-KP-21-50 (G8), and *Argopuro* // IAC100IAC, 100 (G11) varieties by 99%, 52%, and 65% respectively.

The researcher has reported that the effectiveness of AMF in increasing the adaptability of plants in salty soil with low moisture content [12]. These mechanisms show, among other things, the presence of secondary metabolite formation

so that the plant becomes more adaptive to the stress of salt and drought. The presence of AMF has also been reported to increase soil aggregation [28], [29], they reported that all of the studied variables (soil organic matter, AMF community, humic acids, glomalin, and microbial biomass) contributed to explaining 55% of the variation in soil aggregate formation. Mycorrhizal mycelium physically can bind the soil particles into a stable aggregate. In addition, mycorrhizal mycelium also produces glomalin, which serves as an adhesive agent of soil particles. *Mycorrhizal mycelium* also has high water repellency. Overall, the existence of mycorrhiza in the soil can maintain water-stable soil aggregates, thus increasing the resistance of coastal soils to wind and sea waves. This is very beneficial because the structure of coastal soil can be stable. The presence of AMF activity also increases carbon stores in the soil so that groundwater holding capacity will also increase. Increasing the holding power of water makes the plants get enough water to ensure better growth.

In the AMF research, it is known that the existence of the amount of dependence on the mycorrhizae may increase or decrease the dry weight of mycorrhizal plants compared to plants without mycorrhiza and expressed in percentage. There are three categories: high (> 50%), moderate (25 - 50%), and low (<25%) [30]. Misbahulzanah et al. [31] concluded that cultivars of soybean can be divided by three categories the degree of mycorrhizal dependency which are highly (*Kaba*, *Wilis*, and *Baluran cultivar*), moderately (*Grobogan*, *Anjasmoro*, *Argomulyo*, *Petek*, *Garut*, *Malabar* and *Seulawah cultivar*) and marginally dependent (*Burangrang*, *Sibayak*, *Tanggamus*, *Panderman*, *Ijen*, *Galunggung*, *Gepak Kuning* and *Sinabung cultivar*). *Mycorrhizal* dependence is reported to be closely related to the number of leaves in soybean crops. *Wilis* is a soybean variety with high mycorrhizae dependence and yields the highest number of leaves. *Grobogan* and *Anjasmoro* have the same degree of mycorrhizae dependence but their number of leaves is different and *Anjasmoro* has more leaves than *Grobogan* does. Generally, *mycorrhizae inoculation* may increase leaf number, leaf area index (ILD), chlorophyll content and soybean photosynthesis rate. The larger leaf area index indicates that the larger leaf area the more chlorophyll content. The more chlorophyll content then more green leaves show. Leaves are used plants to perform the process of photosynthesis. The greener leaves the more chlorophyll content, the rate of photosynthesis can be higher and the higher biomass produced.

IV. CONCLUSIONS

Anjasmoro and *Wilis* are the main soybean variety candidates to be cultivated in the coastal areas of Bengkulu. Both varieties have the best growth and yield response among other varieties. *Anjasmoro* 100 seeds weight and the production are 16.85 g and 2.67 tons ha⁻¹ respectively, while *Wilis* is 14.58 g and 2.58-ton ha⁻¹ respectively. Thus, soybean productivity proves that the target of this study has been exceeded. Both varieties also have approximately the same N, P, and K nutrients which indicate the need for more or less the same fertilizer. The compatibility of these two varieties against rhizobia, arbuscular mycorrhizae fungi, and

phosphate solvent phosphate should be investigated further to increase productivity.

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