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Soybeans (*Glycine max* (L.) Merill) Variety Tolerance Under Young Oil Palm Shadding

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Abstract.

The research purpose was to select the soybeans variety that tolerance at the young oil palm shading. The research conducted at oil palm smallholder at 2 years aged at Sungai Mandau sub district siak regency, using Randomized Block Design with 10 high yielding soybeans varieties wereArgomulyo, Anjasmoro, Dering 1, Dena 1, Burangrang, Grobogan, Dena, Gema, Kaba, dan Devonwith 5 times replication. The result showed that he highest plant height was shown by the Argomulyo variety (61.52 cm), and the lowest plant height is the Anjasmoro variety (38.72 cm). The highest number of primary branches was shown by Grobokan and Gema varieties, while Argomulyo, Dering 1 and Burangrang varieties showed the least number of primary branches, but these three varieties were not significantly different from Anjasmoro, Dena 1, Denas, and Kaba. Therewere a wide diversity among varieties in the number of podsproducing. Gema is the variety that gives the highest number of pods compared to other varieties, followed by the Devonian variety, and Denas, on the other hand Kaba gives the least number of pods, followed by Grobokan and Dena 1 varieties, the number of other variety pods is between the two groups. Anjasmoro, Dering 1, and Gema showed the highest productivity compared to other varieties, but not significantly different with Argomulyo, Dena 1, Grobokan, Denas and Devon.

Keyword: peat soil, oil palm, shading

1. Introduction

The position of soybeans as a food crop ranks third after rice and corn. Based on 2014 fixed figures, Riau soybean production was 2,145 tons of dry beans or decreased by 187 tons (down 8.02 percent) compared to the previous year. This decline in production occurred due to a decrease in harvested area by 514 hectares or down 25.32 percent. (BPS, 2015).

Riau has the largest oil palm plantation area in Indonesia, reaching 23% of the national oil palm plantation area, covering 1,781,900 ha. 17.60% of the area is immature plantations (Ditjenbun, 2014). No less than 20% of the area of immature oil palm plantations is on peatlands. Until now the space between immature oil palm trees is left without useful cover crops, weeds become easy to grow, this has resulted in additional costs in its management.

Technically, the space between immature oil palm plants can be utilized for the cultivation of food crops that will add value to the land. Soybean is one of the suitable food crops used as intercropping in oil palm plants not yet produced, this refers to the inter-crop integration system workshop between oil palm plantations which confirms that soybeans are one of the recommended food crop commodities,

the results of overlapping farming analysis Kelapa sawit soybean juice produces B / C ratio of 1.29 (Wardiana and Mahmud, 2003).

The obstacle faced when cultivating soybean plants as intercropping is the low intensity of light received as a consequence of the closure of the canopy of oil palm plants. One form of plant response to low light is the morphological changes in the stem due to the shade effect so that the stem is etiolated (Yunita et al, 2008). According to Muhuria (2006), an increase in leaf area is another mechanism of adaptation of plants to low light intensity which allows an increase in the catchment area, also causing the leaves to become thinner because the palisade cells consist of only one or two layers.

Tests on 17 soybean genotypes planted under rubber trees aged 1, 2, and 3 years showed the ability of soybean genotypes to adapt to the conditions of lack of light, soybean productivity under conditions of rubber plants aged 1, 2 and three years in a row 0, 8%, 1.5% and 1-13% lower than in open conditions (Jufri, 2006). Other studies have also shown results that show the ability of soybean varieties to tolerate low light intensity. The decrease in low light intensity affects the density of the stomata and the density of the leaf trichome as well as the growth and yield of soybean plants. 50% shade treatment increases surface trichome density of soybean leaves but decreases total leaf area, number of primary branches, top surface stomata density, number of pods per plant, number of pods contained per plant and weight of 100 seeds (Pertiwi et al, 2012). Darma et al. (2012) stated the results of their research that the provision of 50% shade in the Petek variety showed tolerance tolerant to shade through increased chlorophyll a, chlorophyll b, decreased chlorophyll ratio higher, and weight 100 seeds higher than that of Jayawijaya varieties.

Susanto and Sundari (2011) suggested the results of their research on the effect of shade on 4 soybean varieties, the results showed that the Wilis variety had the highest number of filled pods compared to Argomulyo, Anjasmoro, and Grobogan and were considered to be very tolerant in the shade of 50%.

2. Methods

The study was carried out in Muara Kelantan Village, Sungai Mandau District, Siak Regency in 2017. The location was shallow peatland (80-100 cm) planted with 2-year-old oil palm. Using a Randomized Group design, with a single factor of 10 levels consisting of new superior varieties of soybeans: Argomulyo, Anjasmoro, Dering 1, Dena 1, Burangrang, Grobogan, Denas, Gema, Kaba, and Devon, repeated 5 times. So there are 50 research units. The area of one experimental unit is 19m x 4m according to the size of the available interposed land. Implementation of research activities include: 1. Clearing the experimental land, beginning with the spraying of a systemic herbicide to remove weeds in the field, continued with the removal of the remnants of disturbing plants .; 2. Soil processing, carried out if the soil is perfect, the soil is covered with a depth of 20 cm, after one week followed by crushing the soil using rotary; 3. Amelioration, in general peat soils in Riau react acidly, so it is necessary to provide ameliorant to increase soil pH. the granting of 2 tons / ha of agricultural lime is done in conjunction with the second tillage; 4. Planting, carried out 1 week after tillage II. The number of seeds is 2 seeds per planting hole, before the soybean seed was given rhizobium inoculant. The spacing in the plot is 40 cm x 20 cm while the distance between plots is 1 m .; 5. Fertilization, done by giving 50 kg Urea /ha, 100 kg TSP/ ha and 100 kg KCl/ ha at planting time; 6. Replanting, done by replacing dead plants with other seeds, replanting is done a week after planting; 7.

Weeding, done by removing all the weeds that grow in the trial unit, is done by taking into account the condition of weeds in the test plot; 8. Pest and disease control, carried out by following the Integrated Pest / disease control pattern; 9. Harvest, carried out after the leaves of the plant turn yellow and begin to fall out. Harvesting is done by cutting the base of the stems of plants; 10. Drying is done by drying the sun's tarpaulin, so the seeds that come out of the pods do not fall to the ground.

Variables observed in the study included vegetative and generative growth variables and yield components. The variables are as follows: 1) Plant height: plant height is measured from the ground level to the highest growing point in cm. measurements taken before harvest, taken from 5 sample plants per treatment plot; 2) Number of primary branches: i.e. counting all branches that were formed and producing pods, carried out before harvesting were taken from 5 sample plants per treatment plot; 3) Number of pods per plant by counting the number of filled pods and number of empty pods per plant taken from 5 sample plants per treatment plot; 4) Number of seeds per Productivity pod, obtained by converting seed weight per plot into tons / ha. Growth data, yield components, and yields of plants were analyzed for variance at a 95% confidence level, if there were real differences, they were further tested using the DMRT Test using STAR software.

3. Result

Plant Height

The results of observations of the plant height of 10 varieties tested in the first planting season in 2017 are shown in Table 1. Based on table 1, the highest plant height was shown by Argomulyo varieties as high as 61.52 cm followed by Grobokan varieties 51.29 cm. On the other hand the varieties that showed the lowest plant height were Anjasmoro varieties 38.72 cm followed by Burangrang 38.24 cm, the lowest plant height was not significantly different from some of the other tested varieties, such as Dering 1, Dena 1, Denas, Kaba and Devon. Variation between varieties in displaying plant height is thought to be the plant's response to the received light intensity. As it is understood that soybean plants planted between oil palm plantations have not produced yet. The condition of soybean cropping between oil palm causes the intensity of light received is not as much as in open land. One form of adaptation to obtain adequate lighting, soybean plants do elongation segments so that the figure becomes taller and can receive better light

Table 1. Plant height, amount of primary branches / plants and amount of soybean pods under the shade of immature oil palm

Varieties	Plant height (cm)		Amount of primary branches		Amount of soybean pods/plant	
Argomulyo	61.52	A	1.88	b	75.94	ef
Anjasmoro	38.72	D	2.32	ab	94.36	d
Dering 1	40.54	Cd	2.04	b	91.26	de
Dena 1	47.92	Bc d	2.96	ab	55.90	g
Burangrang	38.24	D	1.88	b	90.00	de
Grobokan	51.92	B	3.36	a	71.00	fg
Denas	44.00	Bc d	2.28	ab	110.46	c
Kaba	48.52	Bc	3.00	ab	28.06	h

		d				
Gema	50.16	Bc	3.40	a	186.34	a
Devon	45.72	Bc d	3.12	ab	154.80	b

Note: Numbers in the same column followed by lowercase letters are not significantly different according to the DMRT test at a 95% confidence level

Amount of Primary Branches

The number of primary branches of 10 varieties tested ranged from 1.88 to 3.4 fruits per plant, this condition actually did not show the optimal condition of each variety in demonstrating the primary branch (Table 1). The optimum primary branching condition has not yet been achieved which is thought to be related to the low light intensity received, so that the plants try to raise the height of the plants rather than multiplying the number of primary branches.

Amount of Pods/ Plant

There is considerable diversity among varieties in producing the number of pods per plant (Table 1). Gema is the variety that gives the highest number of pods compared to other varieties, the second most produced by the Devon variety followed by Denas, on the other hand Kaba gives the least number of pods, followed by Grobokan and Dena 1 varieties, the number of other variety pods is between the two groups.

Variations shown by varieties in producing the number of pods in addition to being determined by genetic diversity between varieties, allegedly also as an effect of the soybean growing environment. Between varieties there is diversity in adapting to the intensity of light received. In this study, the Gema variety shows better adaptability in responding to low light, this variety still provides the highest number of pods compared to other varieties. Kaba is a variety that is not good enough to respond to low light intensity, as seen from the performance of the smallest number of pods produced compared to other varieties.

Table 2. Performance of number of seeds / pods and soybean productivity under the shade of oil palm that has not produced yet

Varieties	Amount of seed/pod		Productivity (tons/ha)	
Argomulyo	2.54	a	1.63	ab
Anjasmoro	2.90	a	2.03	a
Dering 1	2.50	ab	2.04	a
Dena 1	3.00	a	1.68	ab
Burangrang	2.70	a	1.41	b
Grobokan	2.80	a	1.69	ab
Denas	2.50	ab	1.65	ab
Kaba	2.00	b	0.83	c
Gema	2.60	a	2.11	a
Devon	2.64	a	1.61	ab

Note: Numbers in the same column followed by lowercase letters are not significantly different according to the DMRT test at a 95% confidence level

Amount of Seeds/pod

The performance of the number of seeds per pod of 10 tested varieties is shown in table 2. In general the number of seeds per pod of soybean plants ranged from 1 to 3 seeds. The results of the data analysis showed that 9 test varieties had the number of seeds per pod not significantly different, from the table it was seen that only Kaba displayed the number of seeds per pod lower than other varieties, except for the Dering 1 and Denas varieties. The number of seeds per pod shows that almost all varieties display the same number of seeds. This condition shows that the number of seeds per pod is more controlled by genetic factors than the environment, so that even though the conditions of light intensity are lacking, plants still display the number of seeds per pod no different.

Productivity

The productivity performance of 10 soybean varieties tested as shown in table 2 shows variations in the ability of varieties to produce seeds. Anjasmoro, 1st ring, and Gema showed the highest productivity compared to other varieties, but statistically it was still not significantly different from the Argomulyo, Dena 1, Grobokan, Denas and Devon varieties. This result was different from research conducted by other researchers who stated that soybean genotypes were indicated very tolerant of the shaded environment characterized by higher plants than in conditions without shade but plants do not collapse (Susanto and Titik, 2011). This condition can be seen from Gema and Anjasmoro, although they have a lower plant figure compared to Argomulyo but can produce higher production with other varieties. Kaba variety in this study shows the lowest yield compared

Gema varieties show high productivity with other varieties compared to Kaba. This is thought to be related to the ability of these varieties to adapt to their environment. This can be seen from the consistency of these varieties in the performance of other variables such as the number of pods/plant and the number of seeds/ pod.

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