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Growth, Productivity and Land Equivalent Ratio of Soybean-Corn Intercropping on the Different Potassium and Husk Ash Dose under Saturated Soil Culture on Tidal Swamp

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Abstract

Saturated soil culture (SSC) is a cultivation technology that gives continuous irrigation and maintains water depth constantly and makes soil layer in saturated condition. This technology is appropriate to prevent pyrite oxidation on tidal swamp and has been proved to increase the soybean productivity on tidal swamp.Intercropping soybean-corn on the saturated soil culture technology will increase input efficiency and farmer income in the cultivation system. The experiment was conducted at Mulyasari Village, Tanjung Lago Sub District, Banyuasin District, South Sumatera Province (11 feet above sea level, 2°38'42.35" South Latitude, and 104°45'5.92" East Longitude), from May to September.

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The experiment used a randomize complete block design with 2 factors, three replications. The first factor is potassium dose, consisted of : 0, 30, 60, and 90 kg K_2O ha^{-1}. The second factor is husk ash, consisted of : without husk ash , and 1 ton ha^{-1} husk ash. The calculation of land equivalent ratio (LER) was made with comparing intercropping to the monoculture of soybean and corn with treatment potassium : 0 , 30 , 60, and 90 kg K_2O ha^{-1}, on without husk ash and plus husk ash .The result showed that the higher productivity of soybean and corn were obtained on 90 kg K_2O ha^{-1} with application husk ash. In this fertilizer combination on the intercropping, the productivity of corn and soybean were 7.41 ton $ha^{-1}$and 1.93 ton ha^{-1}, but on the monoculture the productivity of corn and soybean were 8.77 ton ha^{-1} and 3.54 ton ha^{-1}. The land equivalent ratio of intercropping was obtained > 1, with range 1.37-1.49. This means that intercropping system increased land efficiency.

Keywords: Soybean-corn; land equivalent ratio; pyrite oxidation; potassium fertilizer.

1. Introduction

Indonesia has about 23.1 millions ha tidal swamp area, scattered in Sumatra, Kalimantan, Papua and Sulawesi. As much as 5.6- 9.9 millions ha are potentially for agricultural areas development, such as South Sumatra which has about 0.3 millions ha potential area for agriculture [1] . According reference [2] that the issues of tidal area are height of soil acidity (low pH), soil fertility lowness, mineral content of aluminum (Al), deposition of pyrite (FeS2), height of acid sulphate that can be poison for plants, depth and maturity problems of organic material and water fluctuations tides. In other words, the tidal area has a low soil fertility [3]. With a proper management through the application of appropriate science and technology, tidal swamp has great prospects to be developed into productive agricultural land, especially in order to achieve food self-sufficiency, with saturated soil culture technology. Saturated soil culture technology can reduce toxic compounds and reduce soil acidity, and keep some certain water level so the layer of plant roots remain in water-saturated conditions [4] .

Tidal swamp is very potential on some agricultural commodities. Corn is the second important commodity after rice in tidal swamp which cultivated on C type overflow land with a shallow drainage system. Its productivity is still low, 2.21 tons ha^{-1} [5]. Productivity of soybean on tidal swamp is only about 0.8 tons ha-1 in conventional cultivation of soybean production in fields containing of pyrite [6]. According reference [4] the test result of soybean varieties on saturated water cultivation in tidal area showed that the varieties that give the highest yield is Tanggamus, which can achieve as much as 4.51 tons of dry seeds ha-1. According reference [7]. That saturated soil culture increased nitrogenase activity 9 fold than conventional culture, and improved of soybean growth, and increased of soybean productivity than conventional culture. Management of tidal swamp until now have generally remained as monoculture with the risk of crop failure due to plant pests, climate change and dynamics of prices. There are some ways to improve efficiency of land as alternative pathway for sustainable agriculture at once, they are intercropping planting pattern, use of light, water and nutrients, weeds control, pests and diseases [8]. Fertilizer is an important factor of cultivation on tidal swamp, in addition to water-saturated culture techniques. Potassium is absorbed in large amounts by plants so that when potassium in the soil and irrigation water is inadequate, it will affect the plant conditions. Potassium enhances plant resistance to certain diseases and improve root system, potassium tends to block the effects of fall crops and against the ill effects caused by nitrogen overload. According reference [9]. Mulyono (2014), that a lot of rice husk ash contains potassium nutrients needed by plants, as well as on specific doses husk ash can reduce P and K fertilizer as well as replacing ameliorant lime [10].

2. Materials and Methods

The experiment was conducted on tidal swamps land at B over flow type in Mulyasari Village, Tanjung lago Sub District, Banyuasin District, South Sumatra Province from April to August.

The experiment was arranged in a randomize complete block design with 2 factors, three replications. This first factor is potassium dose, consisted of : 0 , 30 , 60 , and 90 kg K_2O ha^{-1}. The second factor is husk ash, consisted of : without husk ash, and 1 ton husk ash ha^{-1}. The calculation of land equivalent ratio (LER) was made with comparing intercropping to the monoculture of soybean and corn with treatment lime : 0 , 30 , 60 , and 90 kg K_2O ha^{-1} on without husk ash and husk ash.

The LER was calculated with equation :

$$LER = \frac{\text{Soybean yield in intercropping}}{\text{Soybean yield in monoculture}} + \frac{\text{Corn yield in intercropping}}{\text{Corn yield in monoculture}}$$

In the intercropping, corn was planted with double row distance 240 cm x 40 cm x 20 cm, 1 seed per hole , and soybean was planted with single row distance 25 cm x 20 cm, 2 seeds per hole in the among planting of double row corn (Figure 1). In the monoculture, corn was planted with single row distance 100 cm x 20 cm, 1 seed per hole, and soybean was planted with single row distance 25 cm x 20 cm, 2 seeds per hole. In this experiment used Pioneer 27 variety for corn and Tanggamus for soybean.

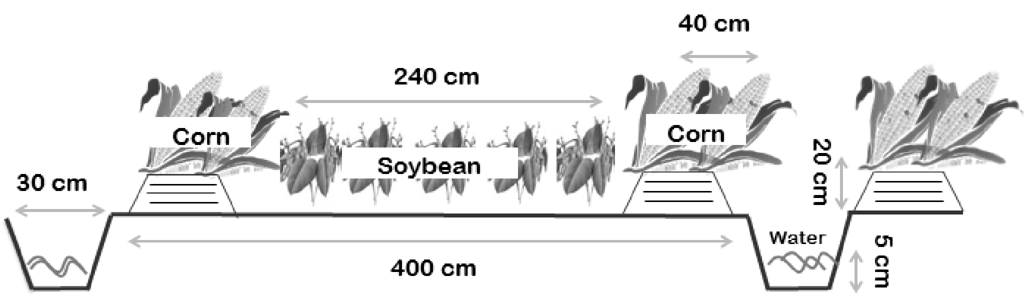

Figure 1: intercropping soybean-corn under saturated soil culture on tidal swamp

Each plot was made with size 4 m x 5 m, and it was surrounded by trench (with size width 30 cm and depth 25 cm). Water was given 20 cm under soil surface at planting time and kept until the maturity stage and made plots in wet condition.

Plots was applied with 2 ton dolomite ha^{-1} and husk ash and potassium depend on the treatment, and 300 kg

SP36/ha at one week before planting. At planting date, seeds of soybean was inoculated with *Rhizobium sp* and treated with insecticide with active agent Carbosulphan 25.53 %.

The bed height of corn was made with 20 cm upper soil surface to avoid of temporary flooding. Seeds of corn was inoculated with Redomil. Corn was applied with 150 kg Urea ha^{-1} at planting date and 30 days after planting. Corn and soybean were sprayed with 10 g Urea L^{-1} water at 2, 3, 4, 5 weeks after planting with spray volume 400 L^{-1} water ha^{-1}.

The observed variable of soybean are ; plant height and leaf number at 2, 4, 6, 8, and 10 weeks after planting (WAP); 50 % flowering time; nodule dry weight, root dry weight, stalk dry weight, leaf dry weight at 8 WAP; number of branch, filled pod, empty pod per plant, seed dry weight per plot and 100-seed dry weight at harvest time. The observed variable of corn are ; plant height and number of leaf at 2,4, 6, 8, and 10 WAP; 50 % silking time, 50 % tasseling time; root dry weight, stalk dry weight, and leaf dry weight at 12 WAP; number of cob per plant, seed dry weight per cob, and 100-seed dry weight at harvest time. The soil sample will be taken before planting, and analyzed at Bogor Laboratory

3. Result and Discussion

3.1. Planting General Discussions

Banyuasin region is an area that affected by the tide so that most of the land is used in food agriculture wetlands, especially tidal rice fields [11]. These trial field have a height of 3.35 m above sea level, precisely, 2°38'42.35 "South latitude and 104°45'5.92" East Longitude. The type of soil in the trial field are tidal area with type B overflow [12]. The results of the soil analysis before being given the treatment showed that the soil is acidic with a pH of 4.66. Fe content in the soil was 90.61 ppm and included to the very high category. The average air humidity during the study was 82.2%. The average temperature was in the range of 27.8-28.3 ° C. The rainfall in the study area in April to June ranged from 114-225 mm / month and decreased in July to 50 mm. Rainfall was then increased to 194 mm in August. As for optimal growth, both soybeans and corn at a minimum of the average rainfall is at least 100 mm / month [13].

Field circumstances deemed sufficiently qualified to grow soybeans and corn with saturated water cultivation, although there are fluctuations in rainfall is quite risky due to natural phenomena which can not be predicted well. Cultivation of water saturated indicated there is the phenomenon of plants in the field in the form of acclimatization of plants. Acclimatization is characterized by yellowing of the leaves of soybean, while corn leaves yellowing not happen, because the corn crop is likely to have stress resistance under conditions of land is not fertile research. According reference [10, 14] this is because the N content in plant tissue and the leaves fall, so do fertilizer N application through the leaves. Acclimatization process occurs at the start of the plant growth at 2 to 4 weeks after planting, maximum at 6 WAP plants with both the normal and the maximum height parameters as well as the performance of its leaves.

The pests organism in this study are pests, weeds and plant diseases. Pests that attack in soybean is a grasshopper (*Valanga nigricornis*), ladybugs suction tip (*Aphlocnemis Phasiana*), army worm (Spodoptera litura), and green lady bugs (Nezara viridula). Pest that attacks on corn is the stem borer (Ostrinia furnacalis). While the pest that attack on both field is rat (*Rattus argentiventer*). Pest control is done by spraying insecticides and rodenticides spread around plots cropping for pest rodents. The dominant weeds that grow in the fields of research are Cyperus iria and Ludwigia octovalis, with weed control is done manually by plucking weeds. As well as for diseases that attack plants, downy mildew, is only found in corn.

3.2. Soybean Growth and Production

Application of potassium fertilizer affected on the plant height and leaves number at 6, 8, 10 weeks after planting (WAP). Potassium fertilizer increased of plant height and leaves number per plant. At 10 WAP, the highest plant and leaves number was obtained on 90 kg K_2O ha^{-1}. While the husk ash affected only on the plant height at 10 WAP and leaves number at 4 WAP. At 10 WAP, application of husk ash increased plant height of soybean, but its leaves number was the same (Table 1). The interaction between potassium fertilizer and husk ash dose affected on the plant height at 10 WAP and the leaves number at 4 and 10 weeks after planting.

Table 1: Plant height and leaves number of soybean on the different potassium and husk ash dose

Plant Age (WAP)	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
	Plant Height (cm)				Plant Height (cm)	
2	15.20a	15.26a	15.17a	15.04a	15.27a	15.06a
4	33.22a	33.33a	34.17a	35.00a	34.37a	33.48a
6	53.03c	58.00b	59.17b	65.64a	59.75a	58.17a
8	54.19d	60.36c	63.78b	68.86a	61.94a	61.65a
10	55.39d	62.03c	67.94b	72.55a	63.86b	65.10a
	Leaves number				Leaves Number	
2	2.42a	2.36a	2.44a	2.55a	2.43a	2.46a
4	6.45ab	6.56b	6.40ab	6.98a	6.84a	6.35b
6	15.92b	16.30b	16.53b	18.14a	16.72a	16.72a
8	19.75c	19.94c	21.08b	22.00a	20.72a	20.67a
10	19.75b	20.20b	21.44a	22.19a	21.08a	20.71a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.. WAP = Weeks After Planting

Application of potassium fertilizer did not affect on the root dry weight, and affected on the stem, leaves and total biomass dry weight. The highest of stem, leaves and total biomass dry weight was obtained on 90 kg K_2O ha^{-1}.. Application of husk ash only affected on stem and total biomass dry weight. Potassium fertilizer increased stem and total biomass dry weight (Table 2). According (Welly, 2013).stated that nutrient uptake in the saturated soil culture is greater than conventional cultivation, so soybean and corn in the intercropping under saturated soil culture response to the application of potassium and husk ash. .

Table 2: Root, stem, and leaves dry weight of soybean on the different potassium and husk ash dose

Dry Weight	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
	G				G	
Root	0.95a	0.98a	1.11a	1.20a	0.98a	1.13a
Stem	9.51c	9.80bc	10.23b	11.52a	10.01b	10.52a
Leaves	6.97ab	6.29b	7.00ab	7.65a	6.73a	7.22a
Total of dry biomass	17.44c	17.08c	18.36b	20.38a	17.74b	18.88a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.

Potassium fertilizer affected on the nutrient content and nutrient uptake. Application of potassium increased nutrient content, and affected on the increasing of nutrient uptake. The highest nutrient content and nutrient uptake was obtained on 90 kg K_2O ha^{-1}, but it was not different with 60 kg K_2O ha^{-1}. But application of husk ash only increased nutrient content. According reference [15] that the soil fertility condition in tidal swamp were indicated by high pyrite, low pH, medium P availability, low K availability, and high Al .

Table 3: Analysis of potassium leaves nutrient of soybean on the different potassium and husk ash dose at 7 WAP

Observation Variables	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
Nutrients uptakes (g)	0.25c	0.42bc	0.63ab	0.78a	0.40a	0.64a
Nutrient Content (%)	0.37b	0.51b	0.61ab	0.86a	0.32b	0.86a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%. WAP = Weeks After Planting

Data of 50 % flowering time of soybean were not significantly different among all treatments, whether it's on potassium and husk ash dose treatment. Flowering age is appeared at least on 50% of flowers appearance, that in the range of 6-7 WAP or in the range of 38-39 DAP (Days After Planting).. Whereas the branch number and fill pod number were affected by addition of potassium but both of the variable were not affected by husk ash. The highest of branch number and fill pod number were obtained on 90 kg K_2O ha^{-1} (Table 4).

Data in Table 5 presented that, addition of potassium gave effect to the 100 seeds dry weight of soybean, because the dose 0 kg ha^{-1} as control is significant different when compared to other doses, either 30, 60 or 90 kg ha^{-1} potassium fertilizer. However on the seed dry weight per plot and productivity variables, all treatment doses either potassium or husk ash were not significantly different. The average seed weight per plot that converted into productivity has the highest yield at a dose of potassium 90 kg ha^{-1}, which is 1.85 tons ha^{-1}, and the lowest dose of potassium 0 kg ha^{-1} as amount as 1.60 ton ha^{-1}.

Table 4: Flowering time, branch number, and fill pod number of soybean on the different potassium and husk ash dose

Observation Variables	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
Flowering Time (day)	39.00a	39.16a	38.50a	39.33a	38.91a	3 39.08a
Branch Number	4.77c	5.16b	5.24ab	5.44a	5.19a	5.12a
Fill Pod Number	61.82c	64.02b	64.44b	66.13a	63.56a	64.64a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.

Table 5: Seed dry weight per plot, productivity, and 100 seed dry weight of soybean on the different potassium and husk ash dose

Observation Variables	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
100 seeds dry weight (g)	10.34b	10.96a	11.12a	11.29a	10.81a	11.05a
Seed dry weight/plot (g/8 m^2)	1282.33a	1403.33a	1410.00a	1480.00a	1374.25a	1413.58a
Productivity (kg ha^{-1})	1602.90a	1754.20a	1762.50a	1850.00a	1717.81a	1766.98a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.

3.3. Corn Growth and Production

Potassium fertilizer affected on the plant height and leaves number per plant of corn at 6, 8, and 10 WAP. At 10 WAP, the highest plant and leaves number were obtained on 90 kg K_2O ha^{-1}. Application husk ash did not affect on the plant height and leaves number per ;plant of corn from 2 WAP until 10 WAP (Table 6). According references [16] that the nutrient K plays a role in maintaining the turgor pressure in the cell to facilitate metabolic processes and cell elongation continuity. Potassium fertilizer and husk ash affected on the root, stem, and leaves, and total biomass dry weight. Potassium and husk ash increased of root, stem, leaves, total biomass dry weight. The highest root, stem, and total biomass dry weight were obtained on 90 kg K_2O ha^{-1}, and they were not different with 60 kg K_2O ha^{-1}. The highest leaves dry weight was obtained on 90 kg K_2O ha^{-1}, and it was not different with 30 kg K_2O ha^{-1}. Application husk ash increased of root, stem, and total biomass dry weight, but it was not different on the leaves variable. According reference [9] that husk ash contains any nutrients potassium needed by the plant, as well as on specific doses husk ash can replace fertilizer potassium [10]. Dry weight data is presented in Table 7.

Table 6: Plant height and leaves number of corn on the different potassium and husk ash dose

Plant Age (WAP)	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
	Plant Height (cm)				Plant Height (cm)	
2	44.16a	42.37a	41.30a	44.58a	43.07a	43.14a
4	69.66a	75.08ab	75.12ab	81.62a	75.97a	74.77a
6	158.54b	166.45b	183.91a	194.12a	178.04a	173.47a
8	187.20c	192.62c	202.04b	218.95a	201.37a	199.04a
10	192.16c	196.58c	205.37b	224.33a	204.64a	204.58a
	Leaves Number				Leaves Number	
2	4.33a	4.20a	4.41a	4.29a	4.27a	4.35a
4	5.62a	5.91a	5.66a	5.95a	5.87a	5.70a
6	7.33c	7.45c	9.00b	10.29a	8.64a	8.39a
8	9.95c	10.58c	12.04b	13.33a	11.56a	11.39a
10	11.04c	11.95bc	12.87ab	13.66a	12.41a	12.35a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%. WAP = Weeks After Planting

Table 7: Root, stem, and leaves dry weight of corn on the different potassium and husk ash dose

Dry Weight	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
	g				g	
Root	7.56b	7.58b	8.22ab	8.86a	7.53b	8.58a
Stem	23.45b	21.91b	26.43a	26.10a	23.16b	25.79a
Leaves	21.01b	22.06ab	21.53ab	22.82a	21.81a	21.90a
Total Biomass	52.02b	51.56b	56.19a	57.80a	52.50b	56.28a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.

Table 8 shows that the nutrients uptake of corn was not significantly different between two treatment of potassium fertilizer, they are between 0 and 30 kg ha^{-1}, and between 60 and 90 kg ha^{-1}, but significantly different between (0 and 30 kg ha^{-1}) and (60 and 90 kg ha^{-1}). Likewise with husk ash data showed significantly different between without and with husk ash treatment . While the analysis of nutrient content, pointing out that all the treatments were not significantly different statistically.The comparison between nutrient uptakes in the intercropping cultivation and monoculture, it is known that corn is dominantly compete with soybean, so that its nutrient uptakes is higher than monoculture cultivation of soybean. According references [17]. it is caused by the characteristic of monocots such as corn that requires K component more than dicotyledonous plants, like soybean .

Table 8: Table 3 Analysis of potassium leaves nutrient of corn on the different potassium and husk ash dose at 7 WAP

Observation Variables	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
Nutrients uptakes (g)	0.46b	0.51b	1.23a	1.08a	0.61b	1.04a
Nutrient Content (%)	1.47a	1.59a	1.64a	1.78a	1.86a	0.86a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.. WAP = Weeks After Planting

Data of 50% flowering time averagely appear in the range of 42-44 DAP for tasseling and 57-60 DAP for silking. The data in Table 9 were not significantly different statistically, among all treatments either potassium or husk ash.

Table 9: Flowering time, cob number per plant, and seed dry weight per cob of corn on the different potassium and husk ash dose

Observation Variables	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
Tasseling Time (Days)	42.83a	42.00a	44.00a	43.00a	43.08a	42.83a
Silking Time (Days)	60.33a	58.50a	59.00a	57.67a	58.83a	58.91a
Cob Number/plant	1.25a	1.50a	1.58a	2.00a	1.47a	1.68a
Seed Dry Weight / cob	259.49a	249.19a	284.28a	279.55a	265.96a	268.80a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.

According to Table 10, treatment of potassium and husk ash affected on the 100 seed dry weight, seed dry weight per plot, and productivity, with top results in the treatment of potassium 90 kg ha^{-1} and husk ash 1000 kg ha^{-1}.

According references [18] potassium plays an important role in photosynthesis in which more than 50% of the total of these elements in the leaves are concentrated in the chloroplast. Addition of potassium will increase the rate of photosynthesis so that the sugar components will increase. sugar from photosynthesis will also be transported to the roots, so that the roots will more actively absorb other nutrients.

Table 10: Seed dry weight per plot, productivity, and 100 seed dry weight of corn on the different potassium and husk ash dose

Observation Variables	Potassium Fertilizer (Kg K_2O ha^{-1})				Husk Ash (Kg ha^{-1})	
	0	30	60	90	0	1000
100 seeds dry weight (g)	39.94c	40.30bc	40.53ab	40.89a	40.31a	40.52a
Seed dry weight/plot (g/8 m^2)	4967.10c	5244.20bc	5545.40ab	5793.30a	5149.10b	5625.90a
Productivity (kg ha^{-1})	6208.90c	6569.60bc	6931.80ab	7241.60a	6436.40b	7039.50a

Note: numbers followed by the same letter at the same row are not significantly different with Duncan Multiple Range Test α = 5%.

3.4. Land Equivalent Ratio

Table 11 shows that the land equivalent ratio (LER) > 1. Reference [19] Ezward (2010) stated that if LER > 1 means that intercropping more profitable than monoculture. If it is compared those two methods, between intercropping and monoculture, has known that monoculture productivity is higher in one commmodity than intercropping, because of competition in terms of water and light allegedly. Reference [20] Austin (2013) stated that there is competition in terms of water in legumes planted inline with corn. Competition in getting water is a major obstacle. But with under SSC methods the obstacles can relatively overcome because characteristic of the methods itself where availability of water is relatively always available with the help of pump technology and high intensity of solar radiation that reach 1040 watt m^{-2} [14]. Range values of LER are 1.37 to 1.49, which means that the efficiency level of land use is high and can be interpreted at the highest point effectively reached 49%. Soybean and corn growth in the intercropping under saturated soil culture can be seen in Figure 2.

Table 11: Productivity of Monoculture and Intercropping Soybean-Corn and Land Equivalent Ratio (LER)

Potassium (kg K_2O ha^{-1})	Husk Ash (ton ha^{-1})	Monoculture of soybean (ton ha^{-1})	Intercropping of soybean (ton ha^{-1})	Monoculture of corn(ton ha^{-1})	Intercropping of corn (ton ha^{-1})	Land Equivalent Ratio (LER)
0	0	2.73	1.60	7.53	5.39	1.40
30	0	3.00	1.76	7.48	6.33	1.40
60	0	2.70	1.73	8.13	6.39	1.46
90	0	3.24	1.77	8.30	6.31	1.37
0	1	2.42	1.60	7.80	6.39	1.49
30	1	2.90	1.74	8.20	6.38	1.43
60	1	3.02	1.79	8.49	7.41	1.43
90	1	3.54	1.93	8.77	7.41	1.40

Figure 2: Soybean and corn growth in the intercropping at 5 weeks after planting under saturated soil culture on tidal swamp

4. Conclusion

Potassium nutrient uptake of soybean and corn were affected by the application of potassium fertilizer.. Husk ash can replace the potassium fertilizer for few percent. The results showed that the highest productivity of corn and soybeans was obtained at 90 kg K_2O ha^{-1} with the provision of husk ash. At this fertilizer combination , productivity of intercropping reached 7.41 ton ha^{-1} of corn and 1.93 tons ha^{-1} of soybean, but the productivity of monoculture reached 8.77 tons ha^{-1} of corn and 3.54 tons ha^{-1} of soybean. Land equivalent ratio in the intercropping soybean-corn was obtained > 1, with a range of LER 1.37 to 1.49, which means that intercropping systems increased of the land efficiency.

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