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Research paper

Performance of Two Rice Varieties at Vegetatif Stage in Two Flooding Types on Tidal Swampland

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Tidal swampland has potential to be developed as agricultural land area, but it has constraint in term of low productivity. The use of adaptive rice variety on tidal swampland is one of method to overcome low productivity problem. The objective of this research was to determine performance of hybrid and inbred rice varieties at vegetative stage and to obtain adaptive rice varieties on two flooding types of tidal swampland. This research was conducted at two locations of tidal swampland, i.e. B flooding type located at -2^{0}38'59, 132"S 104^{0}44'28,449"E and C flooding type located at -2^{0}38'58,81"S 104^{0}44'26,745"E in Muara Sugih Village, Tanjung Lago Subdistrict, Banyuasin District, South Sumatra, Indonesia. The design used in this research was Randomized Block Design with six replications. Variety treatment (V) was consisted of V1: Inpari 30 and V2: Hipa 5 Ceva. The results showed that rice hybrid variety (Hipa 5 Ceva) and rice inbred variety (Inpari 30) had the same vegetative stage growth pattern. Hipa 5 Ceva rice variety was adaptive to be developed at two flooding types on tidal swampland area.

Keywords: B flooding type, C flooding type, Rice variety, Tidal swampland.

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INTRODUCTION

Utilization of suboptimal land such as tidal swampland with objective to increase food crop production and as national food barn is strived for continuously. One of effort is through the use of adaptive rice variety on several land flooding types at tidal swampland area.

Tidal swampland is swamp or wet land which is affected by sea water tidal phenomenon (Gribaldi, 2020). Indonesia has tidal swampland covering area with magnitude of 20.1 million hectares, but only 9.53 million hectares had potential to be developed as agricultural land (Sinaga, 2015). Tidal swampland based on land flooding types was consisted of 4 flooding types. A and B flooding types area only receive flooding during high tide, whereas A flooding type receives flooding during high tide as well as low tide. C and D flooding types were area which are not receive tidal seawater. C flooding type area receives tidal infiltration with soil watertable depth less than 50 cm, whereas D flooding type receives tidal infiltration with soil watertable depth higher than 50 cm(Noor, 2004 *in* Gribaldi, 2020). Farmers at tidal swampland area of South Sumatra usually conduct rice cultivation on C and D flooding types land.

Problem of rice cultivation in tidal swampland are low soil fertility as well as water flooding at several areas within tidal swampland area. Land is flooded by water in depth up to one meter above soil surface during rainy season and soil

watertable is more than 50 cm below soil surface during dry season (Dakhyar et al., 2012). The use of adaptive rice varieties is expected to be capable to overcome this problem.

Rice varieties that have potential to be developed at tidal swampland are hybrid and inbred varieties. According to Susilawati et al. (2012), hybrid rice variety has better growth than other superior rice variety, but the price of this seeds variety is more expensive and famers should buy new seeds for every planting season. On the other hand, inbred rice variety is cheaper because farmers can provide this seeds by themselves, resistant to pest and disease as well as environmentally friendly.

The study results by Gribaldi et al. (2020) showed that tiller numbers of hybrid rice varieties of Hipa 5 Ceva was relatively similar to inbred variety of Inpari 43, but its tiller numbers was different compared to other inbred varieties such asInpari 30, Inpara 3 and Inpari 33.

The low production of rice in tidal swampland and the use of hybrid rice varieties thought to be superior to inbred varieties are still very limited, so this research needs to be conducted. This study objective was to determine the performance of two rice varieties of hybrid and inbred at vegetative stage and to obtain the adaptive rice varieties on two flooding types area at tidal swampland.

MATERIAL AND METHODS

Plant material and seedling preparation

Rice variety seeds used in this study was inbred rice variety (Inpari 30)and hybrid rice variety (Hipa 5 Ceva) which are commonly used by farmers at tidal swampland area. Before application, these seeds are previously incubated for 3 days (Suwignyo et al., 2012). After germinate, these seeds are seedling on nursery beds having dimension of 2 m x 10 m.

Field experiment

This study was conducted at two locations in tidal swampland area, i.e. B-flooding type located at -$2^0$38’59, 132”S $104^0$44’28,449”E andC-flooding type located at -$2^0$38’58,81”S $104^0$44’26,745”E at Muara Sugih Village, Tanjung Lago Subdistrict, Banyuasin District, South Sumatra, Indonesia.

Experimental design and procedures

The design used in this research was Randomized Block Design with six replications. Variety treatment (V) was consisted of V: Inpari 30 and V2: Hipa 5 Ceva. Land is cleared of grasses and left over crops, grasses and left over crops are sprayed by using Paraquat herbicide, followed by land tillage using hand tractor equipped with disk plow and subsequently is provision of beds plot having dimension of 9 m x 3 m. Seedling having 21 days old was transferred into each treatment unit with dimension of 9 m x 3 m which was previously added with manure at dose of 10 ton.ha^{-1}. Seedling was planted in an upright position with planting distance of 25 cm x 25 cm using 2 seedlings per hole and depth of 2 cm according to method of Gribaldi et al.(2016). N fertilizer was given at 1/3 dose during planting and the other 2/3 dose was given at 42 days after planting with dose of 135 kg N.ha^{-1},according to method of Gribaldi et al.(2020). P and K fertilizer were given on all treatments during planting at dose of 60 kg.ha^{-1}, respectively (Setiawan et al., 2012).

Measured Parameters

Observation of agronomic characteristics for rice crop at vegetative stage is consisted of plant height (cm), number of tillers per clump (tiller) and plant dry matter weight per clump (g).

Statistical Analysis

Agronomic characteristics data was analyzed statistically by using *Analysis of Variance* (ANOVA) followed by Tukey (HSD) test at significant level (α) of 5%. All data calculation was done by using SPSS 22.0 program and data was presented in form of tables and figures.

RESULT AND DISCUSSION

Soil Chemical Characteristics before Treatment

Analysis results of soil chemical properties before treatment at two experimental plots, i.e. B and C flooding types showed relatively similar soil condition which characterized by very low soil fertility, soil pH in the range of acid to very acid (pH 4.56 and 4.41), and bases content in the range very low to low such as Ca, Mg and K-dd which indicate low nutrients availability at experimental plots. Soil fertility improvement was done through addition of ameliorant in form of manure at dose of 10 ton.ha^{-1}as well addition of N, P and K fertilizers to overcome lack of nutrients availability and to increase rice crop yield.

Table 1.Results of soil analysis at two flooding types in tidal swampland area

Analysis	Results			
	C flooding type	Criteria*	B flooding type	Criteria*
N total (%)	0.20	Very low	0.43	Very low
pH	4.56	Acid	4.41	Very low
C-Organic (%)	9.33	Very high	8.74	Very high
Available-P (ppm)	32.14	Very high	37.34	Very high
K-dd (me/100g)	0.46	Medium	0.34	Lowh
Na-dd (me/100g)	1.97	Very high	2.15	Very high
Ca-dd (me/100g)	1.25	Very low	1.17	Very low
Mg-dd (me/100g)	1.11	Medium	1.06	Medium
CEC (me/100g)	24.86	High	23.01	High
Al-dd (me/100g)	0.40	Low	1.70	Low
Texture (%)				
-Sand	11.08		6.08	
-Loam	50.03		55.10	
-Clay	38.89		38.82	

Source: Soil Science Laboratory, Faculty of Agriculture, Unila, Lampung. 2020.Criteria*: Soil Research Council, Bogor, 2009.

Plant Height

Plant height for two rice varieties used in this research showed similar growth pattern, either at B flooding type or C flooding type (Figure1). The fastest increment rate of plant height for hybrid variety (Hipa 5 Ceva) and inbred (Inpari 30) was occurred in 14-28 days after planting with magnitude of about 1.9 to 2.1 cm.day^{-1},but it began to decline at 28-42 days after planting with increment rate of about 0.2 to 0.3 cm.day^{-1} (Table 2). This showed that plant growth pattern for these two varieties either on B flooding type or C flooding type represent sigmoid curve. According to Gardner et al. (2008), sigmoid curve is the one which characterized crop growth pattern. Moreover, according to Sabatini et al. (2017), growth pattern of plant height is increasing in relation to increasing of plant age. In addition, according Harjanti et al. (2014), plant height is represent increasing cell division due to increasing of assimilate. Hybrid variety (Hipa 5 Ceva) tend to show higher plant height than inbred variety (Inpari 30) at 48 days after planting either on B flooding type or C flooding type with plant heights of 80.3 cm and 82.6 cm, respectively. This is assumed that Hipa 5 Ceva variety was more adaptive to B flooding type and C flooding type resulting in its better growth.

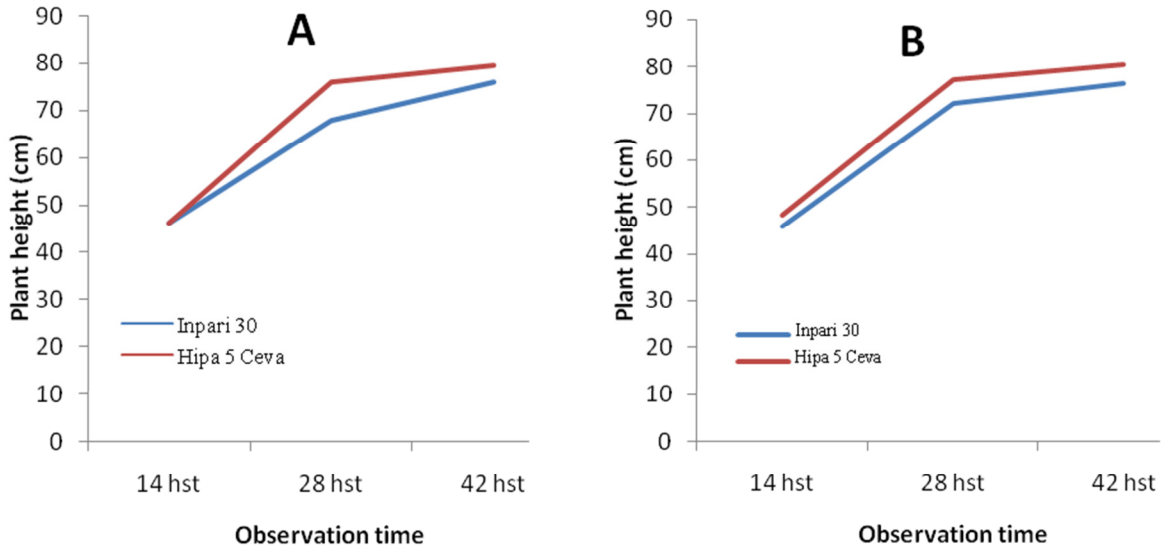

Figure1.Plant height (cm) of two rice variety on B flooding type (A) and C flooding type (B) at tidal swampland.

Table 2.Increment rate of plant height (cm/day) for two rice varieties on two flooding types at swampland area.

Varieties	B flooding type		C flooding type	
	14-28 dap	28-42 dap	14-28 dap	28-42 dap
Inpari 30	1.9	0.3	2.1	0.3
Hipa 5 Ceva	2.0	0.2	2.0	0.3

Note: dap = days after planting.

Number of Tillers

Number of tillers for two rice varieties used in this study showed similar pattern of tillers increment, either on B flooding type or C flooding type. Number of tillers at 28 days after planting for inbred variety (Inpari 30) either on B flooding type or C flooding type showed maximum tiller numbers of 31.4 tillers and 34.7 tillers, respectively. For rice variety of Hipa 5 Ceva, it had less number of tillers increment up to 42 days after planting with magnitude of 32.0 tillers on B flooding type and 37.0 tillers on C flooding type(Table 3). Higher number of tillers for rice variety of Hipa 5 Ceva than inbred variety (Inpari 30) was assumed due its better growth which was represented by higher plant height and plant dry matter weight of this variety (Hipa 5 Ceva). According to Yohana (2013), the development of tiller numbers is started since the first tillers emergence up to maximum tillers establishment. The growth is started slowly followed by fast high increment and subsequently is gradual declining growth until point of stop growing. Moreover, according to Susilawati et al. (2011), higher number of tillers on hybrid rice because it has better vegetative growth. In addition, hybrid rice has higher vigor genetic traits than inbred rice variety (Satoto et al. (2009).

Table 3.Numberof tillers for two rice varieties on two flooding types at swampland area.

Varieties	B flooding type			C flooding type		
	14 dap	28 dap	42 dap	14 dap	28 dap	42 dap
Inpari 30	11.7	31.4	31.4	12.3	34.7	34.7
Hipa 5 Ceva	12.0	31.9	32.0	15.3	36.9	37.0

Note: dap = days after planting.

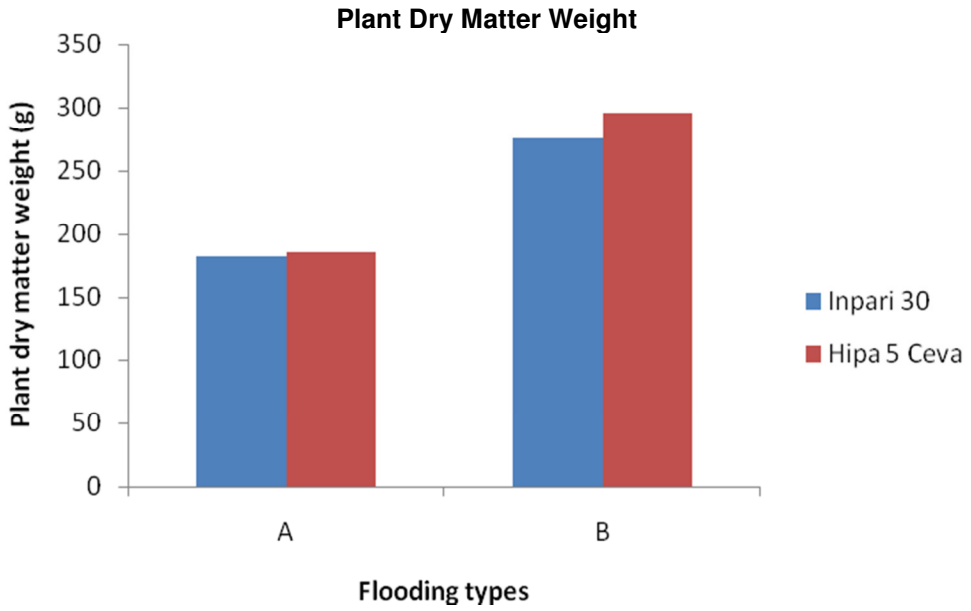

Figure 2. Plant dry matter weight (g) of two rice varieties on B flooding type (A) and C flooding type (B) at tidal swampland area.

Plant dry matter weight for two rice varieties on two flooding types of land can be seen in Figure 2. Hybrid variety (Hipa 5 Ceva) and inbred variety (Inpari 30) showed higher plant dry matter weight on C flooding type land than that of B flooding type land. This was due to the fact that soil pH on C flooding type land was higher than soil pH on B flooding type land (Table 1) so that crop nutrients were readily available on C flooding type land than that of B flooding type land. In addition, Hipa 5 Ceva variety showed higher plant dry matter weight than that of other varieties on both flooding types land at tidal swampland. This was due to the fact that Hipa 5 Ceva variety was more adaptive toward very acid up to acid land condition so that its growth was better than that of Inpari 30 variety. Results of study by Gribaldi et al. (2020) showed that hybrid variety of Hipa 5 Ceva was more adaptive to environmental condition with low soil pH. This is in accordance to opinion from Virmani and Kumar (2004) which stated that hybrid rice had higher adaptation capability to environment with low soil pH.

CONCLUSION

Results of this study showed that rice hybrid variety (Hipa 5 Cepa) and inbred variety (Inpari 30) had similar growth pattern at vegetative stage. Variety of Hipa 5 Ceva is an adaptive variety to be developed at two flooding types land at tidal swampland area.

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