Local Rice Cultivars Grown on Tidal Swampland near Coastal Area in South Kalimantan

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ABSTRACT

Local Rice Cultivars Grown On Tidal Swampland Near Coastal Area in South Kalimantan (E. Purnomo, M.L. Setiawan, N. Yuliani, E. Atmaja, M. Wahyuni, A.R. Saidy, and M. Osaki): Local farmers in South Kalimantan (Banjarese farmers) use to grow local rice cultivars. The local rice growing areas are varied with distance from the coastal line. Consequently, the degree of salinity also varied. To overcome the salinity problem, farmers do their last transplanting earlier than the farmers in the inland area and grow the local rice cultivars that they believe tolerant to salinity. In this study, we investigate the local rice cultivars grown by the farmers in the coastal areas. Sixty paddocks were selected in Pulantan, Aluh-Aluh, Simpang Warga and Bunipah Villages, Aluh-Aluh District, Banjar Regency, South Kalimantan. The rice yield of each paddock was estimated by sampling 3 x 5 hills in 3 replicates. The soil was collected within the 3 x 5 hills area and analysed their electric conductivity (EC) and pH. We found that there were four families of local rice cultivars grown, namely, Palas, Bayar, Pandak and Siam families. Among all local rice cultivars grown, it was revealed that Pandak Putih and Siam Unus produced the highest yields. However, according to the farmers, Palas and Bayar families are the common rice tolerant to salinity. The good price of Siam family and good yield of Pandak family at other paddocks might become the considerant of growing such rice families in the study site.

Keywords: Banjarese, local rice, multiple transplanting, tidal swamplands

INTRODUCTION

Study on salt tolerant rice has been intensively carried out by many researchers (Heenan *et al*., 1988; Shannon et al., 1998; Zeng and Shannon, 2000). According to Black *et al.,* (1995) the effect of salt occurs at seedling or grain filling stage. The salt effects include reduce water availability and toxicity. Increased concentration of salt in soil solution results in a lower water potential. Therefore, energy is required to overcome the attraction water molecules have for solute. Such condition not only may affect the growth of rice seedling but also the grain filling process. The most common toxicity in salty soil is caused by excess sodium and/or chloride. Plants suffering from sodium toxicity tend to be stunted, droughted appearance and have a low yield.

The acid sulphate soils in South Kalimantan is recommended for growing rice. Most of local farmers in South Kalimantan (later called as Banjarese farmer) grow local rice cultivars. Some of acid sulphate soil can be found in the coastal area. The main problem of growing rice in this area is the intrusion of saline water.

We noticed that the Banjarese farmers have their own strategies in elucidating salinity problem in growing rice. These are escape mechanism and selecting so called tolerance rice for saline condition. The Banjarese farmers in this area carried the last transplanting in January and harvest in July, each year. The earlier planting aims to avoid saline water entering their paddock during the grain filling period. The grain filling period occurring in May-June, however, the saline water starts entering the paddock in July.

The second strategy is the use of salt tolerant rice cultivars. Indonesian known salt tolerant rice is Pobbeli (Fairhurst *et al*., 2007), however, no farmers grows this rice. Banjarese farmers in the coastal area have their own local rice. There was no study has been carried out to clarify the level of

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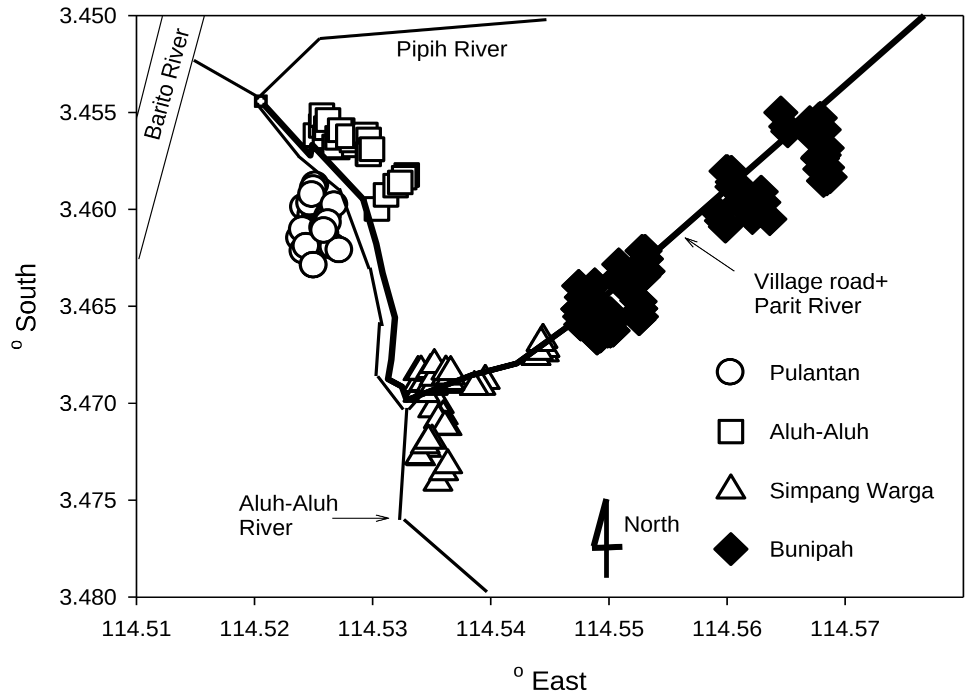

Figure 1. Situation map of the study area and the sampling points. Scale: 1"= 30 m.

tolerance of the local rice to salt. The aims of the present work are to identify local cultivars grown in the coastal and describe the soil condition where the rice grown.

MATERIAL AND METHODS

Site. The study was taken place in Aluh-Aluh District, South Kalimantan Province. Four villages were selected, namely, Pulantan, Aluh-Aluh, Simpang Warga and Bunipah. The distribution of paddock selected paddock in each village can be seen in Figure 1.

Local rice cultivation practices. The Banjarese farmers in the coastal area used a multiple transplanting system for growing the rice. The multiple transplanting system consisted of seedling (early October), first transplanting (mid December), second transplanting (early February) and last transplanting (early April).

Experimental procedures. The experimental procedures included yield sampling and soil analysis. The rice yield was obtained by selecting three sites in each paddock. In each site, 3 x 5 hills were cut 1 cm above the ground and determined grain yield.

Soil sample was collected from the middle of where the plant samples were collected. The soil samples obtained were analysed their EC and pH *in situ*.

RESULTS AND DISCUSSION

Study site. The EC readings of each paddock are presented in Figure 2. Base on criteria proposed by Dobermann and Fairhurst (2000), it was observed that 78% out of 60 paddocks had EC reading of >4 dS m^{-1}. These paddock comprised 10 paddock with EC of >10 dS m^{-1}, 20 paddocks with EC of 6-10 dS $m^{-1}$and 17 paddock with EC of 4-6 10 dS m^{-1}. For susceptible rice cultivars, such EC levels cause decrease in rice yield for 50%, 20-50% or 10-15%, respectively. Only 13 paddocks had EC readings of <2 dS m^{-1}, which is according to Bohn *et al*. (1979) and Dobermann and Fairhurst (2000) such EC reading will not affect rice yield.

We found that there was effect distance from Barito River on the reading of EC of the paddock.

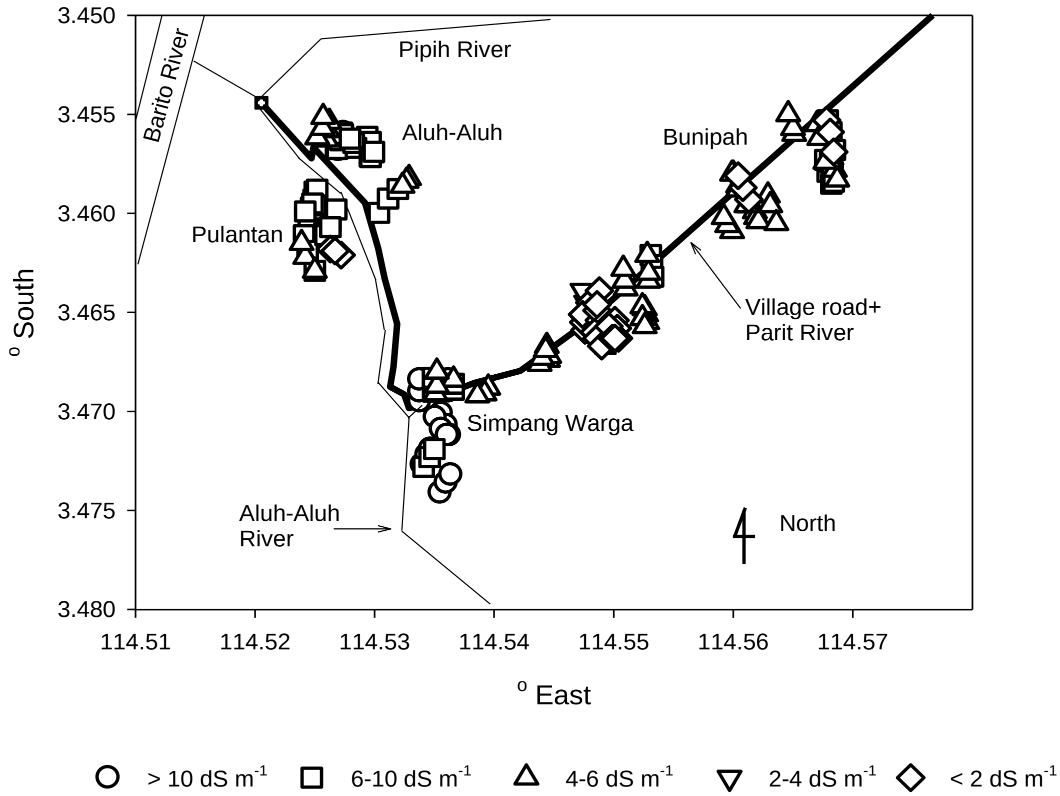

Figure 2. The distribution of EC readings in each paddock selected.

As the paddock away from the Barito River the EC reading was lower. But, there was an exception. There were paddocks that had low EC readings near the Barito River or high EC readings far from the river. Base on field observation, the low or the high EC reading usually associated with the good or poor drainage condition, respectively. The good drainage means that the salty water entering the paddock during high tide can move back to the river. In contrast, some paddocks laid lower than the river resulted in salty water being trapped in the paddock.

The distribution of soil pH in each paddock is demonstrated in Figure 3. The soil pH ranged 4.2 to 6.6. The low pH soils were usually found in paddocks which had good drainage system. In this area oxygen supply was enough for oxidation of pyritic materials to proceed. The oxidation of pyritic materials results in soil acidification (Dent, 1986). On the other hand, high pH soils were usually found in the waterlog condition where reduce reaction of iron (Fe^{2+}) and or manganese (Mn^{2+}) might have been occurred. Such reaction consumes H^+ which led to the increase of pH (Conyers *et al*., 1995; Purnomo and Osaki, 2006).

Rice yield. Rice in the study area ranged 0.7 to 1.9 t ha^{-1} (Figure 4). This rice yield is considered low. Hasegawa et al. (2002) observed that there were some local rice cultivars yielded 3-5 ton ha^{-1}. The low yield of the present study can be due to some reasons. First, the farmers might have selected inappropriate local rice variety and secondly, it was observed that there was no rainfall in May and June (Figure 5).

For the same period in 2001, Purnomo and Osaki (2006) observed that the amount rainfall was 127 mm and the yield for Siam Unus was 3 t ha^{-1}. It seems that the rainfall in May and June is very important for grain filling. Therefore, rainfall in this period is critical factor for local rice variety to get good yield. From our study about local rice in this area, (1) there was no relationship between local rice yield and soil properties variation (Purnomo *et al*., 2004), (2) a very large rooting system of local rice cultivar resulted in easy access to nutrient

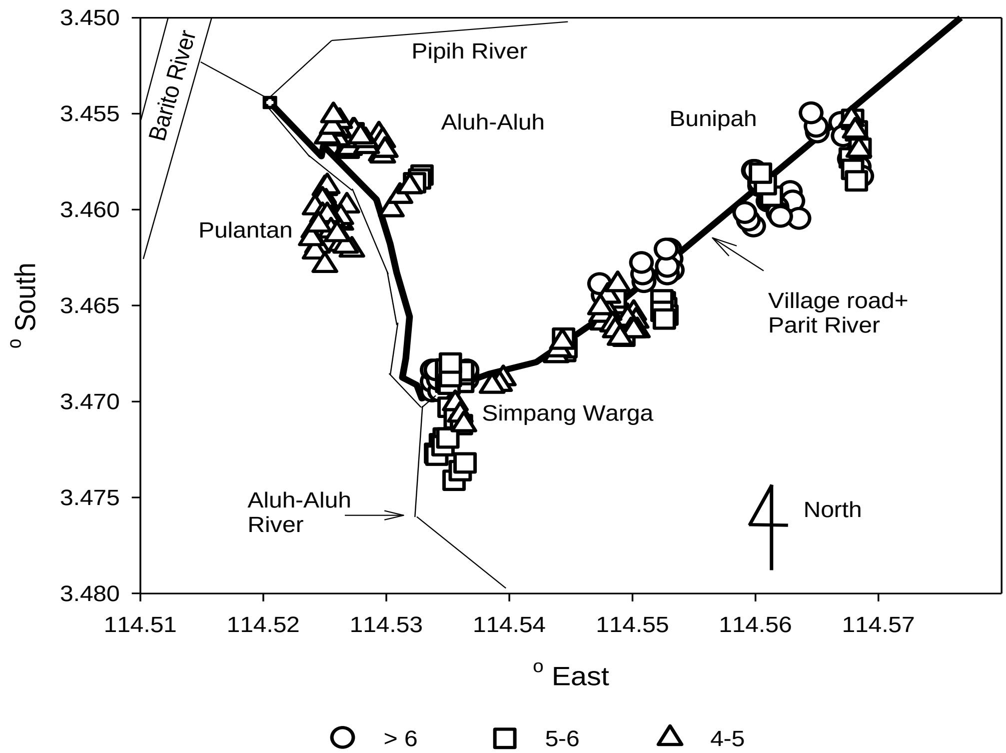

Figure 3. The pH reading of each paddock.

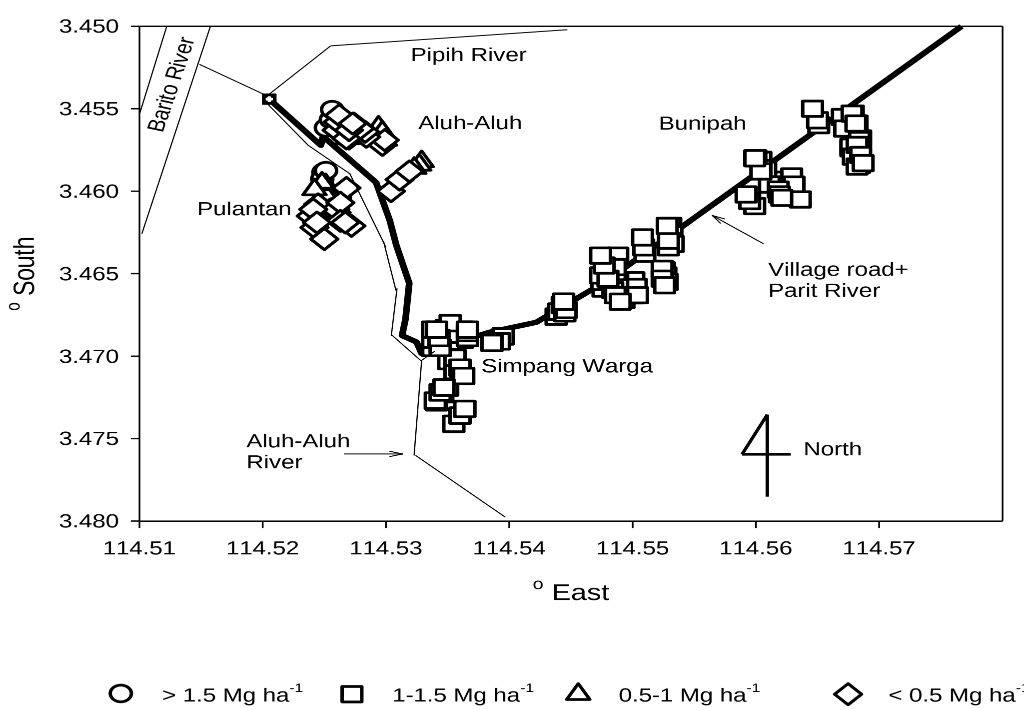

Figure 4. Yields of local rice varieties in the study site.

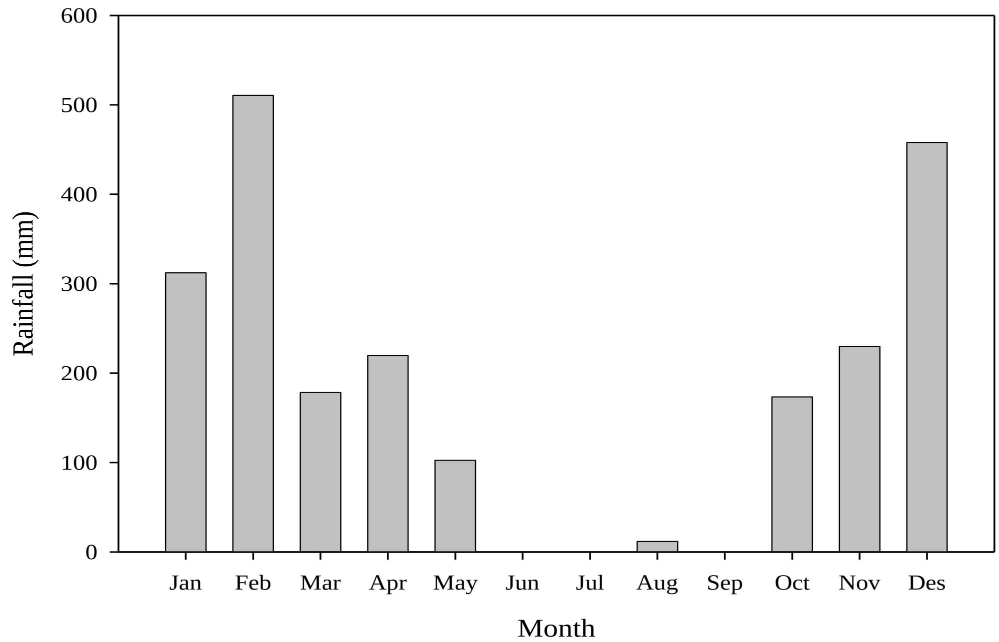

Figure 5. The amount of rainfall during the year 2003 growing season

(Hasegawa *et al*., 2004) and (3) nutrient supply for local rice cultivar is heavily relied on beneficial microorganism anchored on the rhizosphere namely N fixing bacteria (Hashidoko et al., 2006; Purnomo et al., 2006), P solubilising bacteria (Hairani et al., 2005; Purnomo et al., 2005) and K solubilising bacteria and mycorrhiza (Purnomo et al., 2007)

Table 1. Local rice varieties grown by the farmers in the study area.

No.	Local name of local rice varieties grown in the study area				
1.	Bayar Kuning	Palas	Pandak	Siam Pandak	Adil
2.	Bayar Kuning	Palas	Pandak	Siam Puntal	Adil
3.	Bayar Kuning	Palas	Pandak	Siam Puntal	Emas Putih
4.	Bayar Pahit	Palas	Pandak Kembang	Siam Putih	Isip
5.	Bayar Pahit	Palas	Pandak Putih	Siam PX	
6.	Bayar Pahit	Palas	Pandak Putih	Siam Sebelas	
7.	Bayar Papuyu	Palas	Pandak Putih	Siam Suruk	
8.	Bayar Papuyu	Palas	Pandak Putih	Siam Tanggung	
9.		Palas	Pandak Putih	Siam Tanggung	
10.		Palas	Pandak Putih	Siam Tanggung	
11.		Palas	Pandak Putih	Siam Tanggung	
12.		Palas Putih	Pandak Putih	Siam Tanggung	
13.			Pandak Putih	Siam Tanggung	
14.			Pandak Putih	Siam Tanggung	
15.			Pandak Putih	Siam Unus	
16.			Pandak Putih	Siam Unus	
17.			Pandak Putih	Siam Unus	
18.			Pandak Putih	Unus Kuning	
% of total	13%	20%	30%	30%	7%

Table 2. Local rice varieties considered to be salt tolerant found in the field.

Village	Site ordinate		Rice variety	EC (dS m-1)	Yield (Mg ha-1)
	ºS	ºE			
Pulantan	3.46	114.53	Pandak Putih	8.61 ± 2.18	1.55 ± 0.18
Aluh-Aluh	3.46	114.53	Siam Unus	4.90 ± 1.94	1.96 ± 0.17
Simpang Warga	3.47	114.53	Siam Unus	8.06 ± 3.41	1.65 ± 0.07
Bunipah	3.47	114.55	Unus Kuning	6.90 ± 0.25	1.54 ± 0.51

Rice cultivars grown. We observed that there were four mains local rice cultivars grown in the study area (Table 1). These were Bayar, Palas, Pandak and Siam cultivars. According to the farmers in the study area the Bayar and Palas are the local rice cultivars that are commonly grown in saline condition. However, our study showed different result. The decision of selecting local rice cultivars to grow depends on last year price and yield. This indicates that the preference of rice cultivars grown in the study area was not based on their tolerant to salt. Furthermore, based on yield, Pandak Putih and Siam Unus were the most tolerant rice cultivars found in our study (Table 2). According to the farmers, these two rice cultivars are considered as moderate tolerant to salinity.

CONCLUSIONS

It can be concluded that, there were four families of local rice cultivars grown, namely, Palas, Bayar, Pandak and Siam families. Among all local rice cultivars grown, it was revealed that Pandak Putih and Siam Unus produced the highest yields. However, according to the farmers, Palas and Bayar families are the common rice tolerant to salinity. Last year good price and yield of Siam and Pandak families at might become the consideration of growing such rice families in the study site. Based on yield, Siam Unus and Pandak Putih were most tolerant rice cultivars.

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