

## **Evaluation of Four Rice Varieties on New Peat Soil Rice Field in South Kalimantan Province Indonesia**

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### **Abstract**

*This study aimed to test four rice varieties in newly opened peatlands in South Kalimantan Province, Indonesia. The experiment was carried out on newly opened peat fields owned by farmers in 3 (three) villages, namely Karya Makmur Village, Cintapuri District, Banjar Regency, Jejangkit Muara Village, Jejangkit District, Barito Kuala Regency and Ketapang Village, Bajuin District, Tanah Laut Regency, South Kalimantan Province, from November 2020 until February 2021. The experiment was carried out using a Completely Randomized Design with 5 replications. The experimental treatment was planting 4 local rice varieties, namely Pandak Habang, Siam Unus, Siam Kapuas and Pandak varieties. The results showed that the highest plant height was Siam unus variety with the height of 91.32 cm and the lowest was Pandak variety, with the height of 52.22 cm. Likewise for the maximum number of tillers, it was also seen that the Siam unus variety was superior to other varieties with 26 stems and the lowest was the Siam Kapuas variety, which was 16.5 stems. The highest efficiency was Siam Unus variety with a value of 41.21% and the lowest was the Siam Kapuas variety with a value of 14.75%. The high value of Siam Unus variety is due to the fact that this variety is still the favorite among South Kalimantan farmers with a higher price among the people with small rice grains, clean white color, good taste, and good smell.*

**Key Words:** *Local Rice Variety, New Peat Soil, Efficiency*

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### **I. Introduction**

The change in the function of paddy fields to non-rice fields is one of the causes of the reduced rice field area in Indonesia. This situation continues in line with population growth, industrial activities, transportation and natural disasters, so it is necessary to empower marginal lands that are not yet optimally productive.

One of the lands that has not been optimally utilized is the peatland (Utama et al., 2009). Utilization of peatlands has received great attention, especially for the cultivation of plantation crops (Djafar, 2002). In addition, peatlands also have great potential for cultivating food crops. Indonesia has peatlands of not less than 19 million ha. To meet food needs in 2050, a cumulative expansion of 6.08 million ha of paddy area and 11.75 ha of dry land is required, in addition to the use of abandoned land. Currently abandoned land is 30.67 million ha and 8.28 million ha of which are suitable for rice fields (BPS, 2020). Utilization of abandoned land needs to be accompanied by the development of varieties that have high adaptability to suboptimal land. In supporting food security, the variety assembly gives hope of producing superior varieties with new high yielding and adaptive varieties on problematic lands such as tidal swamps. Assembling of varieties, either through plant crosses or mutations based on local varieties is expected to obtain superior varieties that have higher yield potential, are adaptive to tidal swamps, and are preferred by farmers and consumers. The selection of parents both for crossing and mutation is the first step in assembling new superior varieties. Selection of parents must be based on the superiority of one or more characters to be developed. Plant breeding using mutation techniques is suitable if the genetic source is not available in the germplasm used for hybridization or selection (Fehr 1989). Thus, mutation is the first step in the formation of a basic population. The purpose of mutation is to generate genetic diversity of plant populations

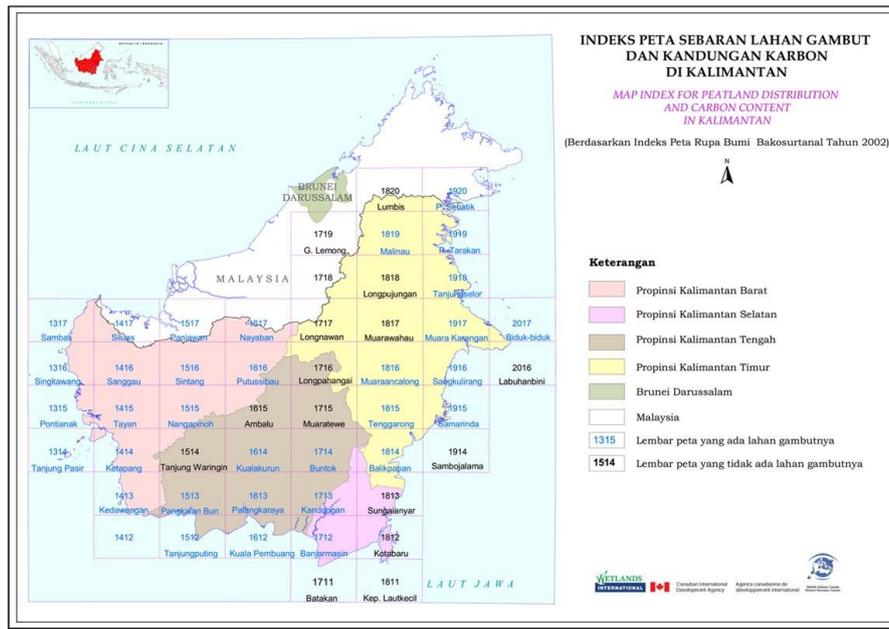


Figure 1. Peatland Distribution Map Index in Kalimantan, Indonesia

From Figure 1, it can be seen that in general the land in Kalimantan is known to be less fertile than in Java; in terms of land availability in South Kalimantan it is wider and can be used for extensification. In Indonesia there are about 20.15 million ha of tidal land (Maamun and Sabran, 1998). According to Sulaiman and Imberan (1996), the area of tidal rice fields in South Kalimantan is 143,738 ha, most of which are planted with local varieties of rice once a year (132,438 ha) (BPS, 2020). One-time rice cropping pattern is also applied by local rice farmers in the Rimau Island swamp, Musi Banyuasin Regency, South Sumatra, because the age of the plants from seedling to harvest is 6-7 months with a yield of 1-2 t of GKG / ha (Wirosoedarmo and Apriadi, 2008). One-time cropping is also caused by land and climate constraints (Suciantini et al. 2008).

South Kalimantan Province recognizes several local rice varieties, which are part of the diversity of local rice varieties in South Kalimantan. The diversity of local rice varieties is still the choice of farmers/cultivators for planting, which do not depend on agricultural input in planting, so it can be said as organic rice. This local rice variety should get the attention of all stakeholders, because it is starting to be lost or not recognized anymore. The diversity of local rice varieties in South Kalimantan Province and in other places or regions constitutes a wealth of biological resources, as germplasm, must be protected so that it does not become extinct.

One of the disadvantages of local rice is its long life and low yield. Siam Unus, Pandak, Bayar Palas, Lemo Kwatik, and Lakatan Gadur have respective ages of 291, 305, 305, 272, and 295 HSS (Khairullah et al. 2006). In newly opened areas, local rice yields averaged 1.0 t/ha, while in areas that have long been managed around 2.5 t/ha (Noorsyamsi et al. 1984).

Based on the knowledge of the community, which they still plant and/or remember their names, they can mention several local rice varieties, namely the Pandak Habang, Siam Unus, Siam Kapuas and Pandak varieties.

Siam Unus then becomes very popular in the community of South Kalimantan, replacing the popularity of Siam Karangdukuh, because of its small-slender form of grain, transparent rice, very white rice color with good taste, especially when it is consumed in warm conditions, and the highest selling price. Segregation of the Siam Unus varieties gave rise to the varieties of Smooth Siam Unus, Yellow Siam Unus, and White Siam Unus, all of which referred to the nature of the shape and color of the grain. Smooth Siam Unus is furthermore popular among farmers and consumers (Khairullah, 2007).

The knowledge of the people of South Kalimantan Province about local rice varieties is based on rice type, size, shape, color, function, quality, processing method, and compatibility with the planter (*daraman*). The people of South Kalimantan Province tend to still pay attention to harmony or suitability (*daraman*) to determine their attitudes, behaviors, and actions in farming and determine the choice of rice varieties for planting.

The dimension of compatibility of the people of South Kalimantan Province is the result of trials (trial and error) carried out by each cultivator, to find certain rice varieties that are compatible or suitable for them. Rice varieties that are compatible with or suitable for cultivators are believed to provide the expected yields, more yields and very few disturbances. To find compatible rice varieties, cultivators do this by planting several

times of several local rice varieties, which can be up to several growing seasons. This has led cultivators to prefer local rice varieties that are compatible with themselves, not based on economic prices and rice quality. Siam rice is a local rice variety that has the most expensive selling price and the best quality, with a good aroma, but not all cultivators grow this variety because of their belief in the concept of compatible. Farmers still choose rice based on the compatible concept, not based on the selling price of rice. In South Kalimantan Province, cultivators plant various local rice varieties according to the concept of compatible, which of course will continue to maintain the diversity of local rice varieties.

## II. Research Method

The experiment was carried out on newly opened peat fields owned by farmers in 3 (three) villages, namely Karya makmur Village, Cintapuri District, Banjar Regency, Jejangkit Muara Village, jejangkit District, Barito Kuala Regency and Ketapang Village, Bajuin District, Tanah Laut Regency, South Kalimantan Province from November 2020 to February 2021. The experiment was carried out using a completely randomized design with 5 replications. The experimental treatment was the planting of 4 local rice varieties, namely Pandak Habang, Siam Unus, Siam Kapuas and Pandak varieties.

## III. Results And Discussion

Cultivation was carried out twice, starting with clearing the land from weeds. The first cultivation was to turn the soil over, while the second process was to smooth the soil and level it. The cleared land was then mapped with each plot measuring 2 x 3 m. Seed nursery was carried out 25 days before planting. It was carried out separately for each rice variety. Before sowing the seeds, the four rice varieties were soaked and the seeds that float were removed. Submerged seeds are continued to soak for 24 hours. The seeds that had been soaked for 24 hours were then sown in the seed plots according to the variety. Planting was done when the seeds were 25 days old by planting 3 seedlings of 1 clump with a spacing of 25 x 25 cm. At the time of planting, the rice fields were not inundated and left until they were 2 mst.

Fertilizers that were given were Urea, SP36 and KCl with each fertilizer had a dosage of 150, 125 and 125 kg ha<sup>-1</sup> which was carried out in a distributed manner. Urea was given twice at planting and at the age of 4 mst, while SP36 and KCl were given at the same time at planting. Maintenance activities include inundation and weeding. Inundation was carried out when the plants were 2 mst as high as 10 cm from the soil surface. Weeding was done twice, first when the plants were 3 mst and the second at 5 mst by pulling out the growing weeds and burning them.

Observation parameters were carried out on growth and yield. Growth parameters include plant height, amount of chlorophyll, and maximum number of tillers. Generative parameters consist of the number of productive tillers, harvesting age, panicle length, number of panicle grains, number of panicle-filled grains, number of panicle-1 empty grains, weight of 1000 seeds and the measured yield parameter was grain weight plot converted to hectare production.

So far, the initial planting of rice was often determined by using rainfall data that applied the Oldeman method (Rimbinguwu and Syahbuddin, 2007). The beginning of rice planting was determined when the rainfall in that month had reached 200 mm. On this basis, the initial determination of planting could change. Climatic anomalies slowed down the planting time of rice in the first planting season (October-December) and in the second planting season (April-June).

**Table 1.** Plant Height (cm) and Maximum Number of Tillers of 4 Peat Rice Varieties

No	Variety	Plant Height (cm)	Number of chlorophyll	The maximum number of tillers (Tiller)
1.	Pandak Habang	86.25	31.00	21.00
2.	Siam Unus	91.32	36.50	26.00
3.	Siam Kapuas	65.47	33.50	16.50
4.	Pandak	52.22	23,50	18,00
	KK (%)	19,50	13,00	16,75

Explanation: Column number followed by the same lowercase letter does not differ according to DMRT 5%

Source: Primary Data Processing, 2021.

Based on Table 1, it could be seen that the highest plant height was Siam Unus variety with 91.32 cm and the lowest was Pandak variety with 52.22 cm. Likewise for the maximum number of tillers, it was also seen that the Siam Unus variety was superior to other varieties with 26 tillers and the lowest was Siam Kapuas variety, namely 16.5 stems.

The cultivation techniques used by farmers in the study area were relatively the same, as was generally the cultivation on tidal fields, although there were variations between farmers. The seeds came from self-

propagation or from relatives / neighbors of a village or village nearby. Seeds could also come from relatively far away, if they had just started planting in the village concerned and were usually in small quantities. Soil processing was carried out by *tajak-puntal-balik-hambur* (at the same time utilizing organic matter derived from weeds). The nursery system used is *taradak-ampak-lacak*. The spacing was 25 cm x 25 cm, 25 cm x 30 cm or 30 cm x 30 cm. Most farmers also used inorganic fertilizers with several variations in dosage and type.

### Plant Growth

The height of rice plants showed clear differences among varieties, namely Pandak Habang, Siam Unus, Siam Kapuas and Pandak varieties. The same thing was with the amount of chlorophyll and the maximum number of tillers, which showed the number of chlorophyll and the maximum number of tillers of Siam Unus variety was more than the other three varieties.

The results of peatland soil analysis can be seen in Table 2.

**Table 2.** Results of Analysis of Peat Soil in South Kalimantan Province

No	Assignment Type	The Depth of 0-20cm
1.	Type of Peat	Sapric
2.	pH H <sub>2</sub> O	3.95
3.	C-Organic (%)	19.85
4.	N-Total (%)	6.74
5.	P-Bray (ppm)	1100

Source: Primary Data Processing, 2021.

Based on Table 2, it could be seen that the type of peat at a depth of 0-20 cm was a sapric type with a degree of acidity (pH) of 3.95 with C-Organic of 19.85% and N-Total of 6.74% and P-Bray of 1100 ppm. From table 2, the acidity level of the peat soil in the study area needed a variety that was truly tolerant to the condition of the peat soil.

Kinship analysis was performed by cluster analysis with the SPSS program using 15 characters after the main component analysis. These characters were the number of panicles, length of panicle, weight of grain/panicle, weight of grain/clump, number of seeds/panicle, weight of 1,000 grains, grain length, grain width, percentage of empty grain, result of *ubinan* (unit of land measurement), number of tillers, leaf length, leaf width, length of leaf tongue, and plant height. The method used in clustering was the agglomerative method, which meant that two accessions that were most similar would be grouped together, and then would be clustered again with other accessions that were most similar. And so on until it formed a large group of all accessions. The selection of the five best varieties was carried out based on the Exponential Rank Method (MPE) using seven criteria, namely plant height, number of panicles, length of panicles, weight of grains/panicles, number of grains/panicles, and weight of 1,000 grains.

Siam Unus rice was rice that thrives in peat and tidal areas in South Kalimantan. The growth and progress of this rice in Kapuas district was because it was tolerant to marginal soils containing Pyrit (soil poison, Fe Al). The age of Siam rice after planting was 120 days, so it was a type of rice that had a long life. There were 20 tillers in a fertile development area, and this decreases with the level of local soil fertility. The obstacle to the development of this rice type was the absence of efforts to purify the variety, so it was feared that there would be a decline in its genetic characteristics, long productive life, and low productivity (an average of 2.3 tons per ha). Siam Unus rice was processed with environmentally friendly principles because from the nursery to post-harvest handling, it hardly used chemicals, especially pesticides, so it was safe for consumption.

The plant height of the four rice varieties based on the description showed that the plant height had not reached its maximum growth. Plant height was still below the description as a result of pressure of low peat soils fertility as shown in Table 2.

The results of the analysis in Table 2 were not different from the results of chemical analysis, which showed that the acidity of the peatland in this area was 3.75-4.05, the total N content was high at a thickness of 0-40 cm, the availability of P was low-medium, the content of Ca, Mg and K was very low, micro-nutrient content, especially Cu and Zn.

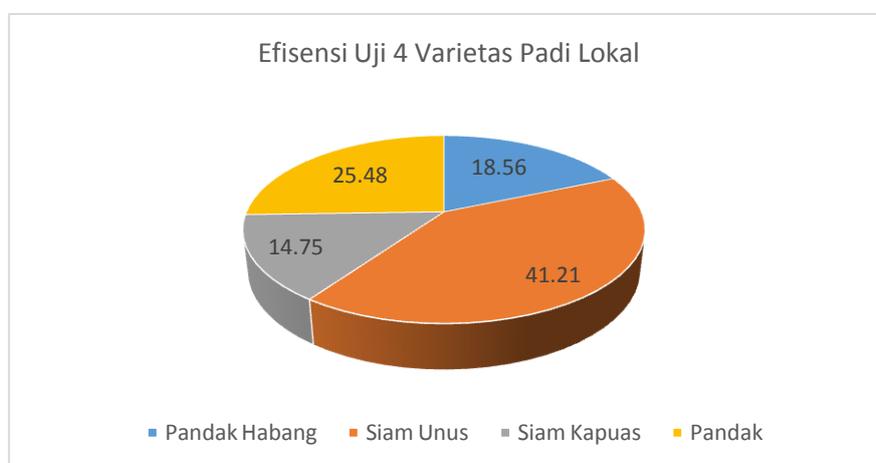
As for identifying the number of productive tiller, harvesting age, panicle length, number of grains per panicle, number of pithy grains per panicle, number of empty grains per panicle, weight of 1000 seeds and weight of plot-1 grain of four rice varieties in peatlands can be seen in Table 3 below.

**Table 3.** The number of productive tiller (JAP), harvesting age, panicle length (PM), number of grains per panicle (JGP), number of pithy grains per panicle (JGBP), number of empty grains per panicle (JGHP), weight of 1000 seeds (B1000B) and weight of plot-1 grain (BGP) of four rice varieties in peatlands.

No	Variety	JAP (Tiller)	PM (cm)	JGP (grain)	JGBP (grain)	JGHP (grain)	B1000B (gram)	BGP (Kg)	Efficiency (%)
1.	Pandak Habang	8.55	23.00	91	71	20	16	1.2	18.56
2.	Siam Unus	12.50	27.50	95	78	26	24	1.8	41.21
3.	Siam Kapuas	9.45	21.25	84	64	19	12	1.2	14.75
4.	Pandak	11.30	19.25	88	56	17	13	1.4	25.48
	KK (%)	12.75	17.50	16	19	12	10	17.0	100.00

**Explanation :** Column number followed by the same lowercase letter does not differ according to DMRT 5%; JAP = number of productive tiller, PM = panicle length, JGP = number of grains per panicle, JGBP = number of pithy grains per panicle, JGHP = number of empty grains per panicle, B1000B = weight of 1000 seeds dan weight of plot-1 grain

Based on Table 3, it could be seen that for the number of productive tillers of Siam Unus variety had the highest number of tillers compared to Pandak Habang, Siam Kapuas and Pandak varieties as well as the JGBP where Siam Unus had 76 seeds which was also the highest compared to the other 3 varieties grown on peatlands.



**Figure 2.** Test Efficiency of 4 Local Rice varieties

From Figure 2, it could be seen that the highest efficiency was the Siam Unus variety with a value of 41.21% and the lowest was Siam Kapuas variety with a value of 14.75%. The high value of Siam Unus variety was due to the fact that this variety was still the favorite among South Kalimantan farmers with a higher price among the people with small rice grains, clean white color, good taste, and good smell.

### Traditional Tools in Local Variety Rice Cultivation.

Some of the traditional tools used by traditional farmers in cultivating local varieties of tidal rice were tajak, tutujah, ani-ani, and gumba. The picture of this traditional tool was shown in Figure 5. Tajak was a traditional tool used for minimum tillage. Its use was like 'playing golf', where the leg was lifted up and then lowered against the surface of the land and cut the weeds (water chestnut, hay and other weeds that grew). The depth of the soil surface exposed to the sharp surface of the plowing tool was about 0.5 to one cm, so this was called minimum tillage. This was very advantageous to do especially on acid sulfate soils that had pyrite at shallow depths. This was because if the pyrite was exposed due to a rather deep tillage, it would cause soil acidity and increased iron levels in the soil solution. Tutujah was a traditional tool for planting rice seeds derived from trace seeds.

The usage was by dividing the seeds into two to three stems and then they were planted by inserting the tip of the tutujah seven to 10 cm deep and then inserting the root base of the trace seeds. In this way the fingers did not hurt in planting rice seeds, because they had been assisted by a tutujah tool to perforate the soil. The soil surface that was cultivated with the plow was still hard, so it needed a tutujah tool to facilitate the planting. Ani-ani was a traditional tool used to harvest ripe rice panicles. The use of this tool took a long time and required a lot of labor. However, with this tool the farmer could select the panicles that were really ripe.

#### IV. Conclusion

Based on the experiment and discussion above it is concluded that the growth and yield of local rice in Siam Unus variety are better than Pandak Habang, Siam Kapuas and Pandak varieties. The growth and yield of local Siam Unus and Pandak rice are better than Pandak Habang and Siam Kapuas on peat soils in South Kalimantan Province.

#### V. Suggestion

For farmers, especially those who are cultivating lowland rice on peatlands, it is recommended to plant a more superior Siam Unus variety in terms of cultivation, management and high selling prices so that farmers can improve their welfare.

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