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Tidal rice farming in South Kalimantan: tradition, advantages, and challenges

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Since the 19th century, South Kalimantan was projected by the Dutch colonial government to become a rice farming area. The land used as rice fields at that time was tidal land, which indigenous farmers planted with various types of local rice that were adaptive and had abundant yields. This study aims to explore community knowledge of tidal rice farming in the modern era, document the local rice farming system, and discover the advantages and challenges of rice farming on tidal land. The study was conducted in Patih Muhur Lama and Jejangkit Muara Villages, South Kalimantan, which have historically been tidal lands. Where local rice farming activities already persist. The used methods to collect data were a survey and semi-structured investigation with farmers, traditional Banjar community figures, and field extension workers. Manuscripts and ancient documents were also analyzed descriptively-qualitatively to strengthen the field study results. The results revealed that community knowledge of rice farming on tidal land was still well-maintained. However, there was a change in the annual rice cropping pattern from once a year to twice a year. Furthermore, local and superior rice cropping patterns were implemented in Jejangkit Muara Village, while the integrated farming pattern of rice and oranges was applied in Patih Muhur Village. This change in rice planting patterns has proven to increase the productivity and income of rice farmers. Additionally, *tajak*-a traditional tillage tool-is rarely used and has been replaced by hand tractors, which can overcome the lack of manpower. Likewise, *handil* and *saka*-traditional water management systems-are often found not functioning properly. Moreover, three basic aspects must be considered carefully in rice farming on tidal land: the characteristics of the land, the variety of rice planted, and the expected yield.

Keywords: Banjar people, Land-use change, Rice farming, Tidal land, Traditional knowledge

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Kalimantan is the second largest island in Indonesia, with a mostly flat topography. The lowland area is located in the west to the south, dominated by landscapes formed by fluvial and organic processes. The fluvial landscape in this section is heavily influenced by the flow of large rivers, such as the Kapuas, Kahayan, Barito, and other smaller rivers. Organic processes create landscapes in the form of peat plains. The formation process is influenced by low topography with basins filled with remnants of vegetation[1]. Fluvial and organic processes, as well as river tides, play a role in the formation of river deltas. The material in the tidal currents consists of gravel, clay, silt, and sand. We may find organic materials in the basin and anticlinal structures that form peat landscapes. These materials are carried away in the water flow and settle along natural embankments. This material deposit makes the estuary area very fertile so that it can be used for tidal cultivation with local rice plant species[2].

Tidal land is part of a coastal plain or riverbank where waterlogging occurs due to periodic fluctuations in sea level tides caused by the gravitational forces of the moon and sun towards the water on Earth. Flooding occurs along the coastal plains and on the banks of river mouths during high tide. The tidal level rises when the rainy season starts (usually in October), peaks in January or February, then decreases in March or April and remains stagnant until June. The water level decreases when the dry season comes[3].

Meanwhile, technology development in tidal lands aims to support effective, efficient, productive, and sustainable agricultural activities, from land preparation to planting, fertilizing, pest control, and harvesting. The development and application of

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technology also aim to increase production to meet the needs of the local rice market in the Banjar community or the people of South Kalimantan in general. In addition, encouraging the creation of technology, in overcoming agricultural constraints and problems of agriculture in tidal areas, such as those applied in water management[4]. It also causes location differentiation related to the selection of rice varieties or even the types of production plants. Understanding and applying traditional technology in agricultural systems also consider environmentally friendly agricultural practices[5-8]. In other words, the people of South Kalimantan have a local wisdom system regarding tidal farming. This wisdom is related to agricultural and irrigation systems[9]. This illustration shows that local rice cultivation efforts in tidal lands are related to ecological condition and the methods applied.

The illustration above shows that local rice cultivation efforts in tidal land are related to ecological conditions and the methods applied. This understanding must be supported by knowledge of agricultural history and traditional technologies from the past to the present. Discussion on the history of agriculture in the research locations can help understand recent agricultural events or activities and, at the same time, may become a provision for conducting further analysis.

The increase in population has accelerated the increasingly massive rate of land change, especially in suburban areas. Moreover, socio-economic activities (*i.e.*, trading, coal mining, and oil palm plantations) are also quite high in South Kalimantan. The pace of the economy becomes unstoppable. This situation can trigger a change in people's lifestyles that were once traditional to become more global and modern. The current market-driven has changed the agricultural commodities of most people in South Kalimantan from those who originally planted rice to those planting coconuts, mangoes, and now oranges. Changes in land use and agricultural commodities-exacerbated by changes in seasons that tend to be wet allegedly due to global climate change-are slowly felt to be able to change people's behavior, which is feared will erode local agricultural patterns even in tidal areas. Of the several possible cultural erosions that are considered to occur in the future, this study aims to reveal traditional technologies in local rice cultivation practiced by the Banjar people of South Kalimantan in farming rice on tidal land and explore the advantages and challenges of tidal farming in the present and future.

Method

Study area

This study was conducted in Patih Muhur Lama and Jejangkit Muara Villages in Barito Kuala Regency, South Kalimantan Province (Fig. 1). The location determination was carried out deliberately

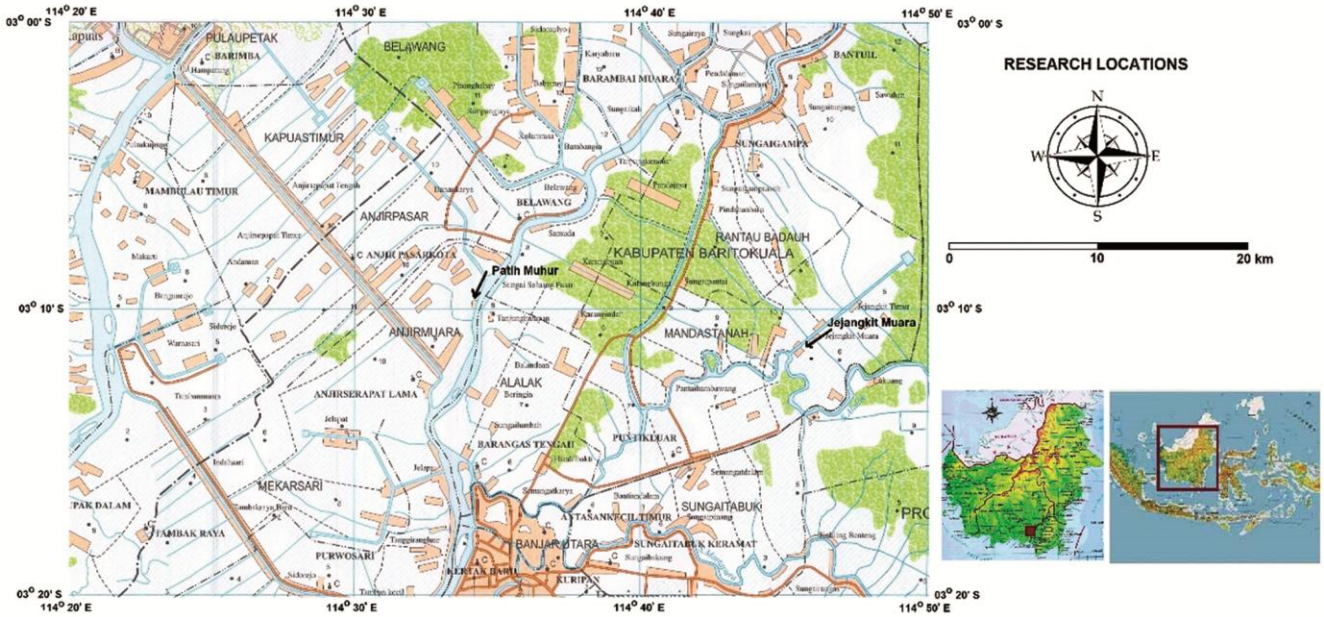

Fig. 1 — Research locations (Sources: The National Mapping Agency of Indonesia, 2017)

with three aspects, namely: The first, the existence of archaeological findings information in Patih Muhur Lama Village and Jejangkit Muara, which showed that the research location was an old settlement in Muara Barito[10-12]. In addition, it also found archaeological features that can still be observed in the form of *handil* and *saka*, which are integrated into tidal agricultural irrigation systems (Fig. 2). The second, aspect is knowledge of agricultural technology, in which the people living in those two villages have experience using traditional agricultural technology. The third, the two villages have different environments that can give an idea of farmers' adaptation to tidal land, where Patih Muhur Lama village is tidal land type C and D (type C does not flood at low tide but the groundwater depth is less than 50 cm, and type D does not flood at low tide and the groundwater depth is more than 50 cm)[13]. Meanwhile, Jejangkit Muara Village is dominated by overflow types A and B (type A is land covered by both large and small tides, and type B land is covered during large tides).

Data collection and analysis

The methods employed to collect data were a survey and semi-structured investigation with farmers during (indicated the year), traditional Banjar community figures, and field extension workers during October 2022. Before each investigation interview, prior informed consent was verbally requested. The collected data included the origin of agriculture at the study site (*i.e.,* Patih Muhur Lama and Jejangkit Muara with 14.5 and 750 hectares of tidal agriculture land, respectively, out of 191,740 hectares in South Kalimantan[14-16]), technology applied including traditional and modern tidal farming methods, such as the use of rice varieties, equipment or mechanization used. In addition to primary data collected directly in the field, we also conducted literature studies to strengthen the results of field studies. The obtained data were analyzed with a qualitative-descriptive approach.

Fig. 2 — *Handil* and *saka* in traditional irrigation systems on swamp land, which developed into secondary and tertiary channel

Results and Discussion

The origin of rice farming in South Kalimantan

The history of tidal farming in South Kalimantan can be traced back to the 17th century when the Banjar people consumed not much rice but tubers and sago[17]. In the 17th century, the Sultanate of Banjar began to trade rice cultivated near the Meratus hills, although in insignificant quantities. Furthermore, according to Daudi[18], Banjar's ulama, Arsyad Al-Banjari, with his relatives and students in 1734-1759 AD, developed agriculture in Sungai Tuan Village. It was carried out to fulfill food needs for those studying religion from Arsyad Al-Banjari, whose place of education was in Dalam Pagar. Furthermore, Knappen[17] revealed that the Dutch colonial government gradually issued a rice planting policy for all residents around Banjarmasin and persuaded the local people to create agricultural lands by developing wet rice farming techniques, especially the use of *tajak* (a traditional agricultural tool for pulling grass and loosening the soil) or *cangkul* (a hoe). The Dutch colonial government and the Sultan of Banjar also introduced wet rice varieties from Java to be planted in Martapura, South Kalimantan.

At that time, rice plants increased sharply, as reported by CG Goldman in his book, as mentioned by Knappen[17]. Then, there was an expansion of rice fields from the area of Muara Barito to the coast of the Java Sea. Even tidal rice farming penetrated the lower reaches of Barito. The increase in tidal farming in the 19th century was triggered by new settlers due to the conducive security situation in the Barito region. Another policy that the Dutch colonial government carried out was the arrangement of concentrated villages on the banks of the river, which also stimulated the growth of agricultural land in the tidal zone.

In the early days of Indonesia's independence, the expansion of rice fields continued, including through a project called the "Polderplan Kalimantan: A Plan for Improvement and Expansion of Rice Fields in South Kalimantan." The project covered an area of 840,000 hectares, encompassing three main watersheds: the Barito, Kapuas, and Kahayan Rivers.

In addition, the design project for tidal rice fields in Jelapat, west of Banjarmasin, was continued in 1971. This agricultural development project was then integrated with the transmigration project, which began in 1953 until 1982[19].

Agricultural technology for cultivating local rice

Tidal farming technology maintains traditional methods in various forms in South Sumatra[14], South Kalimantan[15], and Kolepom Island in Papua[16]. Traditional knowledge in agricultural systems based on local wisdom is known as ethno-agronomy. It is certainly different from other regions in which almost every stage of activity-from land preparation to harvesting-is dominated by modern technology[5,20].

However, the technology of tidal farming in South Kalimantan is not completely traditional, as shown by the use of modern technology in several areas. For example, the Patih Muhur Lama Village community is a farming community that maintains traditional methods, wherein agricultural practices are carried out minimally using modern technology. Meanwhile, the people in Jejangkit Muara Village have used modern technology, as observed by the presence of tractors for land processing and harvesting machines (combined harvesters).

Differences in environmental conditions in the two places cause the application of different agricultural technologies. Alluvial sedimentation at the mouth of the Muhur River has formed fertile agricultural land. Furthermore, Patih Muhur Lama Village's agricultural land has low acidity, making farmers not need liming the land. However, tidal currents from both the Barito and Muhur Rivers often submerge settlements and rice fields. Farmers in Patih Muhur Lama Village also use *handil* as a drainage channel. The *handil* seems ineffective because the water discharge is too high. Farmers' efforts to address this problem are to make *surjan* by elevating their agricultural land. This finding is different from the condition of farmers in Jejangkit Muara Village. The high acidity of organosol soils forces farmers to spread lime. This is carried out to reduce the acidity of the peat soil. The irrigation system in Jejangkit Muara Village is constructed very complexly by making primary, secondary, and tertiary canals. We may find a *tabat* or water gates in some canals that regulate the water volume and wash pyrite.

The farming technology for cultivating local rice applied in tidal farming activities in the two villages includes water management (*anjir*, *handil*, *saka*, and *tabat*), land management (*tajak*, tractor, *tukungan*, *surjan*, and *baluran*), planting and maintenance (*tugal*, *asak*, worm channels, spreading lime, and fertilizing), harvesting (*ani-ani*, and *mengirik*), and post-harvesting (*kindai*).

Water management

Water management technology is applied by utilizing the tradition of making and placing artificial rivers (*i.e., handil* and *saka*) in rice fields connected to natural rivers or other types of artificial rivers (*i.e.*, *anjir*), and placing *tabat* in certain parts of the artificial rivers. The artificial river network is intended to drain water during high tide to the very edge of the rice fields and channel excess tide water back into the natural river. Meanwhile, *tabat* is usually made in an area quite far from a natural river and will be closed when it starts to recede to hold back water if it is really needed and will be opened again when needed water is sufficient. Apart from being intended to manage water needs, the river network also functions to wash or drain pyrite, which arises as a result of processing by turning over deep soil using a tractor from the surface of the paddy fields to natural rivers. The disposal of pyrite will accelerate the readiness of the land for planting. In addition to providing lime, the farmers make worm channels to drain the pyrite from the fields to the sewer (*handil*) and then go to the natural river.

The *handil* and *saka* canals in Patih Muhur Lama Village and its surroundings were connected directly by the Barito River and Sarapat *anjir*. Meanwhile, in Jejangkit Muara Village and its surroundings, it was previously connected to Marabahan *anjir* (Talaran *anjir*). Talaran *anjir* is no longer functioning properly, while Sarapat *anjir* is still normal. The area of Barito Kuala Regency has indeed become a rice barn that has received attention since 19th century. The construction of Sarapat *anjir* took place from 1879 to 1932, which connected the Kapuas and Barito Rivers[21,22], while the construction of Marabahan (Talaran) *anjir* was carried out after Indonesia's independence[23]. The Dutch colonial government built the Serapat *anjir* not only for irrigating rice fields but also for facilitating monitoring of its territory, managing ship traffic or water transportation, and supporting household needs[24]. Irrigation with the *handil* and *saka* systems was continued by the post-independence Indonesian government by building a fork irrigation system consisting of primary canals (*anjir*), secondary canals (*handil*), and tertiary canals (*saka*)[25].

Land processing

In general, the traditional rice farming system of the Banjar people begins with land preparation. Farmers apply a *tajak-puntal-hambur* system. *Tajak* is a long machete in the shape of the letter "L". *Tajak*, or *manajak*, is a designation for harvesting leftover grass or straw from the previous season's rice harvest. *Puntal* or *memuntal* is a local term for collecting wild grass or straw that has been cut down and then forming a pile like a ball with a diameter of 30-50 cm, leaving it to soak in the rice fields for up to two weeks to speed up weathering and make the process more even. After 15-21 days, the pile is turned upside down. After the weeds and straw have been decomposed, the grass is chopped or cut into small pieces and then spread over the surface of the rice fields as organic fertilizer. Turning over weeds and grass collected from slashes can accelerate the decomposition process carried out by aerobic bacteria. Meanwhile, *mahambur* or *hambur* is the final stage of work in preparing land in the *tajak-puntal-hambur* system. It is conducted by spreading organic matter that has matured evenly over the entire surface of the soil[9].

Tidal agricultural land processing technology includes rice planting areas and their diversification (fruit and vegetable plants). The rice planting area is paddy fields, while the land preparation uses *tajak*, hand tractor, or both (Fig. 3). Using *tajak* as a land processing method is usually determined by the lands, which are types A and B. For this reason, the most appropriate tool is *tajak* so as not to cause pyrite to come out. Another reason is cost. Because the land is not too large, it is still possible to do it manually. Land preparation using *tajak* is only for clearing the grass and turning over the surface soil so that the pyrite is not lifted. Some farmers in tidal lands also cultivate their lands with hand tractors because their land is large. Thus, it needs to be supported by the farmers' readiness to incur additional costs, including spreading lime to reduce soil acidity or increase soil pH.

Fig. 3 — Use of *tajak*, a soil processing tool in tidal land which can remove weeds from rice fields

Land preparation for crop diversification is conducted by piling up the soil in paddy fields. It is usually more than one layer, and has certain intervals. The land ready for planting is called *tukungan*, which is about 1×1.5 m with a height of 70 cm. Generally, fruit trees are planted in *tukungan*, such as oranges (*Citrus* spp.). As agricultural activities continue, the pile of soil on the *tukungan* is extended so that it will eventually be connected to the *tukungan* next to it, which is called *surjan*. The size of the *surjan* is generally 2-4 m wide with a height of 70-100 cm and extends to follow the length of the rice fields. Farmers-who maximize their land for setting cropping patterns by maintaining rice plants as their main commodity-tend to make the wide spacing between *surjans* so that the lower part of the land (called *tabukan*) can be used for rice plants, while the parts of *surjan* or *guludan* can be utilized for cultivating oranges or rambutan (*Nephelium lappaceum* L.). In spaces between the fruit trees in *surjan*, vegetables are usually planted, such as kale (*Ipomoea aquatica* Forssk.), mustard greens, chili (*Capsicum* spp.), and katuk leaves (*Sauropus androgynus* (L.) Merr.) to meet farmers' needs and be sold on the market. On lands with a very low fertility rate, *surjan* is generally made denser. In addition, the lower part of the land (*tabukan*) is not utilized at all. Furthermore, the surface soil is moved to the *surjan* section so that farming activities in the *surjan* are optimized, generally only for fruit and vegetable crops.

Planting and maintaining

In planting and maintaining activities for local rice, preparing seeds for tidal farming starts with choosing a nursery or *tugal*, usually in a high and dry area, for example, near a house or on the side of a road. Before undergoing the process of *tugal*, the seeds are first soaked overnight and dripped. They then go through the process of *tugal* by placing about half a handful of rice seeds (10-20 grains) into a hole made with *tugal*. The tool is wood with a length of about 1 meter with a blunt surface and an indentation for holding in the middle of the wood (Fig. 4). The preparation of seeds in this way is called *menugal* (the tool is called *tugal*), usually carried out in October-November. When the seeds have grown and are 30-40 days old, they will be scattered in the *tugalan* area so that they grow to be many. This activity is called *malambak*. After the

seeds are 30 days old from dispersal or 60-70 days after *tugal*, they are moved near the rice fields (called *malacak*) until the water recedes a little or for 30 days. After that, around March-April, when the water begins to recede, the seeds are ready to be planted in the rice fields using a tool called *asak* (Fig. 5). Among traditional farmers, some carry out rice planting activities with a mutual assistance system called *bahandipan* (Fig. 6).

Previously, traditional farmers paid little attention to the spacing of rice plants. Currently, they have a new insight for setting spacing distances of 20-30 cm, called *jajar legowo*. This spacing gives more rice tillers and sufficient density, so the rice does not collapse easily. With this cropping pattern, the results obtained can be more. In traditional agriculture, rice planting is carried out with the provision of compost resulting from decomposing grass. After planting, traditional farmers usually do not carry out much maintenance. Only recently, there have been treatment activities with fertilization and pest control.

Fig. 4 — Make a seeding hole to prepare seeds with a blunt-tipped piece of wood called *menugal*

Fig. 5 — Farmers planting rice using *asak*

Advantages and disadvantages of tidal farming

In the annual rice cultivation system, tidal land is dominated by a once-a-year rice cultivation system by planting local rice with a longer age and growth phase than superior rice. However, in Patih Muhur Lama Village, rice cultivation is found in various cropping patterns, such as once a year with a local rice planting pattern and twice a year with a local-superior rice pattern and a superior-superior rice pattern, which is carried out in tidal land types A and B. Almost all farmers who conduct the twice-a-year cropping pattern by planting superior rice get government assistance through programs to increase production and food security. In the twice-a-year cropping pattern with local-superior rice, farmers use almost all local rice yields ranging from 1.0 to 2.0 tons/ha for family consumption. Meanwhile, the yields from superior rice varieties are generally sold as unhulled rice because buyers are coming to the farmers. In the research locations, the productivity level of superior rice is around 3.5-4.5 tons/ha and higher than that of local rice, which is only 1.0-2.5 tons/ha. One of the disadvantages of local rice is its longevity and low yield. *Siam Unus*, *Pandak*, *Bayar Palas*, *Lemo Kwatik*, and *Lakatan Gadur* have ages of 291, 305, 305, 272, and 295 DAS (days after sowing), respectively[26] (Fig. 7). In newly opened areas, local rice yields an average of 1.0 tons/ha. Meanwhile, in areas managed for a long time, it is around 2.5 tons/ha[27].

The advantages and disadvantages of agricultural activities on tidal land are related to three aspects,

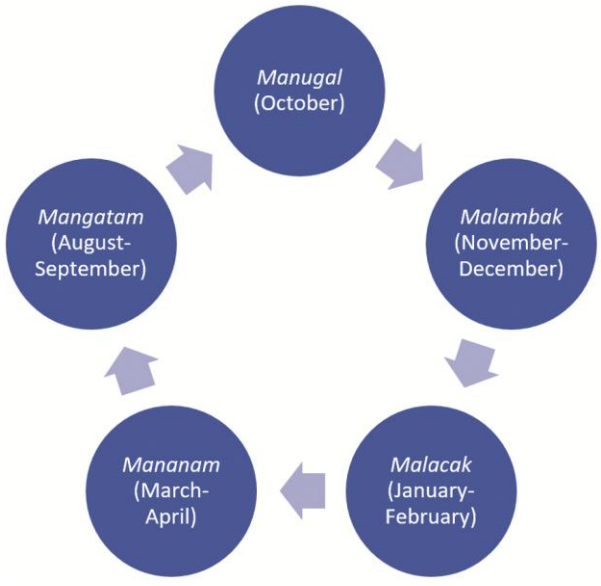

Fig. 6 — Steps of rice production from planting-to-harvest in tidal lands

Fig. 7 — Several local rice varieties of the *Siam* group

namely land characteristics, varieties planted, and yields. Predicted gains and losses from land characteristics, including land type, impact the choice of rice varieties. As is known that tidal land has four types of water overflow which are strongly influenced by sea level, namely type A overflow is land covered by large and small tides, type B is closed land at high tide, type C does not flood at low tide but the depth of groundwater is less than 50 cm, and type D does not flood at low tide and the groundwater depth is more than 50 cm[13]. In tidal land types A and B, the local varieties that are mostly planted are specific for paddy fields, such as *Siam Mutiara*, *Siam Cantik*, and *Karang Dukuh*. Meanwhile, in types C and D, the local rice varieties planted are very specific for upland or local rice types that are resistant to drier environments. The reason for local rice to be planted on land types A and B is that these lands experience long periods of waterlogging. To date, the types of rice resistant to inundation for a long duration are local varieties. Farmers who cultivate in tidal land types A and B will have a greater chance of successful harvest because sufficient water is available. In addition, farmers can choose cropping patterns either once a year or twice a year with long-lived local rice and short-lived superior rice. Meanwhile, farmers in land types C and D can choose local or superior varieties that are more drought tolerant due to limited water availability. In types C and D, land use and characteristics are also very suitable for perennial crops, making many farmers use them for fruit trees. Thus, farmers in these two types of land can harvest twice a year.

Apart from that, the disadvantage of agricultural activities in tidal land is related to intensification and productivity. Intensification is not easy to do because the conditions of the land are very acidic and high in Fe, so newly cleared land must be neutralized through a good washing system, and often done for a long time[26,28]. Tidal land-especially in types A and B-experiences long-standing water. This condition is only suitable for local rice varieties. On the other hand, local varieties of rice are long-lived. Therefore, it is possible only to harvest once a year if the harvest is successful. Under such conditions, intensification is difficult to do. Meanwhile, there is an opportunity for intensification of land types C and D so that the farmers can harvest twice a year. The drawback of land types C and D-as well as tidal land in general-is the level of soil fertility which is not too high. In order to increase soil fertility, more costs are needed for fertilization. Thus, to maximize yields, agricultural activities in tidal lands have greater financial consequences. With these facts, when implementing good care and fertilization, there is a chance to match the yields of dry land agriculture (non-tidal). However, this effort has high-cost consequences, making it economically unable to provide results commensurate with dry land farming. Therefore, the most logical thing seems to carry out traditional agricultural activities as they have been tested in tidal areas. Furthermore, to increase yields, modern technology must be supported in certain parts[6,29-31].

It turns out that it is not the only problem tidal land farmers face. In the last two years (2020-2022), farmers have also faced the problem of climate change[32]. One of the real impacts of climate change is the long rainy season. As a result, rice fields in tidal areas are submerged in water longer than usual. In fact, if there is still deep water where it grows for local rice varieties, the rice will continue to enlarge its stems, even though it is time to bear fruit in terms of age. Due to these conditions, in the last two years, tidal land farmers in South Kalimantan generally have been unable to harvest with maximum yields. It seems that farmers have not anticipated climate change, making them not have many options to do as solutions. One of our respondents even said, “The stars are still there. The stars have not changed, but nature has.” The moon’s gravity-which influences the tides-is a marker for local people when they are about to start farming. This condition changes along with environmental changes that are currently happening.

Based on the characteristics of tidal land which has a low pH (2.7-4.6), nutrient-poor, and high iron (Fe) content, farmers innovate in traditional local rice farming practices, such as (1) constructing a water

management system in the form of *handil* and *saka* which are very specific as irrigation systems in tidal land to support rice farming, (2) employing environmentally friendly land management methods and tools like *tajak* and *asah* to eradicate weeds and increase soil organic matter and facilitate the planting process, and (3) providing various local varieties of rice like *Siam Cantik*, *Karang Dukuh*, and *Siam Saba* which farmers believe can grow well in tidal land. The local rice varieties tend to be more tolerant of various stresses that occur in tidal fields, such as low pH, poisoning and poor nutrients, so the risk is smaller than planting superior rice. Local rice also tends to respond less to excess inorganic fertilization, so that local farming is more environmentally friendly and more economical and resistant to pests and plant diseases.

The results of this study also elaborated that the rain that occurred almost throughout the year impacted high plant damage, and wide rice varieties died or failed to plant. However, some local rice varieties survived in these conditions, such as *Siam Madu* and *Siam Cantik*. All of them showed that rice farming practices carried out by farmers could overcome various obstacles to farming in tidal land, although Jenning *et al*. have revealed that low pH, nutrient-poor, and high Fe content in tidal land can inhibit growth, reduce productivity, and cause plant death[33].

Facts on the fields indicated a tendency for local rice cultivation patterns on tidal land and the technology accompanying it to face formidable challenges in future developments. These challenges can be in the form of pest attacks, crop failures, and the possible loss of local rice varieties as well as their cultivation technology[34]. Farmers feel that since they used chemical fertilizers and pesticides, the growth of pests has increased in the following period and also led to new types of pests, resulting in decreased crop yields.

The people of Patih Muhur Lama received IR superior rice assistance from the government in 2017. IR superior rice was promoted to be harvested twice a year compared to local rice, which was only once a year. However, the yields were only good in the first year. In the following years, it began to decline. Therefore, in the third year, it could be said that the harvest failed. In the end, the farmers returned to planting local rice varieties. However, until 2022, local rice yields did not show good yields after planting superior rice. In other words, it could be considered that the harvest also failed.

In addition, the threat of loss of local varieties and technology in tidal farming is also a concern because of the assumption that farming on tidal land is less profitable. When this does happen, it will replace local rice with more promising fruit crops. This replacement will result in the loss of local rice varieties as well as their agricultural technology.

The values of local wisdom that are still well-maintained in agricultural practices on tidal lands showed that local farmers were directly involved in developing environmentally friendly rice farming practices and preserving wide local rice varieties. The diversity of rice germplasm-specific to swamp land-has been preserved by farmers in tidal land. This effort must be supported both through the protection and preservation of local rice varieties[35,36] as well as the development of local varieties widely and massively, bearing in mind that local varieties have very high genetic value and are of great benefit in agricultural systems through the creation and assembling of new varieties with various advantages.

Conclusions

The use of technology in rice farming towards modern agriculture in tidal lands has not changed much in the ways of farming rice in Patih Muhur Lama and Jejangkit Muara Villages. For generations, farmers have mastered traditional agricultural technology using local seeds, and simple and environmentally friendly cultivation practices. There is a response related to changes in adopting new technology, namely in terms of the use of mechanization, especially land processing equipment. In this case, traditional farmers are well aware that traditional land preparation takes a very long time, so it is not a problem for them to clear the land by mechanization. Some of the benefits of traditional farming that farmers maintain in tidal lands are the high socio-cultural value for the Banjar people, who really like the taste of good rice and *pera* (hard texture). The selected local rice varieties tend to be more tolerant of various stresses that occur in tidal fields, such as low pH, poisoning and poor nutrients, so the risk is smaller than planting superior rice. Local rice also tends to respond less to excess inorganic fertilization, so that local farming is more environmentally friendly and more economical and resistant to pests and plant diseases. Likewise, the selling price of local rice is higher than superior rice, so that this traditional business continues to be maintained.

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Conflict of Interest

There is no conflict of interest.

Author Contributions

All authors contributed to conceptualization; formal analysis; funding acquisition; resources; Writing original draft; editing and review of the manuscript and also approved the manuscript for final publication.

Informed Consent

Informed consent was obtained from all the knowledge holder share the data including photographs as and when required.

Data Availability

The data are exclusively retained by the authors.

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