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Farming Practices Among Hill Paddy Smallholders in Sg. Asap, Belaga, Sarawak

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Abstract

Hill paddy cultivation is popular among the native people living in the eastern part of Malaysia, The Island of Borneo. A preliminary study focused on the background and farming practice of the hill paddy among smallholders in Sg. Asap, Belaga Sarawak (East Malaysia) is an initiative to enhance hill paddy cultivation and pursue self-sufficiency in overall rice production. A total of 30 respondent samples were collected from February to March 2023, and the samples collected were interpreted using descriptive analysis. The findings show that *Kerawing*, *Alek*, and *Pulut* were the most popular hill paddy varieties. Approximately 86.7 percent of the farmers cultivated hill paddy at least more than a hectare. The most common agricultural inputs used were herbicides and the least used fungicide. 73.4 percent of farmers harvested at least 1 tonne of hill paddy per hectare. Only 53.3 percent of the farmers chose to commercialise their yield. Besides, the study shows that the younger generation's involvement is depleting, with zero study participants below 35. Sixty percent of the farmers claimed that generational practices are the reason behind their interest in hill paddy cultivation. With commercialisation and self-sufficiency as the target of the governing party, hill paddy cultivation has to be upscale and improved in terms of farm area, management practices, involvement training, and participation of the younger generation.

Keywords: Sarawak hill paddy, production, cultivation practices

1. Introduction

Paddy plants are commonly known as *Oryza. sp* or rice plants are highly adaptable to various temperatures. The plants grow on all continents except for Antarctica. It is known to be the world's highest-yielding cereal grain, feeding 3 billion people worldwide daily.

The world's rice production for the year 2022 is at 513.9 million tonnes (FAS, 2023). Ninety-five percent of the total rice production happens in the continent of Asia, where 2 billion rice eaters are situated out of the 3 billion (Bhattacharjee, Singhal, & Kulkarni, 2002). The Oryza sativa is the scientific name for the Asian rice which evolved from Oryza rufipogon through domestication and is believed to have started in China (Fornasiero, Wing, & Ronald, 2022; Kovach, Sweeney, & McCouch, 2007). The top five world rice producers and consumers are China, India, Bangladesh, Indonesia, and Vietnam, all Asian countries. The rice produced in this continent is consumed within 10 miles of its paddy field (Kushwaha, 2016), which proves that rice and paddy fields play an integral part in Asia's culture and tradition.

There are various kinds of rice can be found all over the world. They are differentiated according to their cultivation system and adaptability to the environment. The rice can be classified based on altitude (upland or lowland) and water source (irrigated or rainfed) (Rao, Wani, Ramesha, & Ladha, 2017). Of the total world rice produced, the irrigated lowland paddy contributes 75 percent, whereas Asia contributes 56 percent (GRiSP, 2013). While the rainfed lowland paddy contributes 19 percent, the rainfed upland contributes 4 percent, and the irrigated upland contributes 2 percent (GRiSP, 2013).

Sound almost insignificant, with only 13 percent of cultivated area worldwide (Kazuki Saito, Asai, Zhao, Laborte, & Grenier, 2018) contributing 4 percent of the total world production, the upland rainfed rice called hill paddy has its uniqueness and significance. It is commonly cultivated by farmers from the poorest areas in Asia, Africa, and Central America (IRRI, 1975). Even though the hill paddy has been claimed to have low productivity (Fairhurst & Dobermann, 2002; Kazuki Saito et al., 2017; van Oort et al., 2015), it has significantly contributed to the food security and, further beyond it, to rural communities (Khazanah Research Institute, 2022). The cultivated hill paddy are heirlooms preserved and guarded by their genome through generations. These heirlooms hill paddies are unique cultivars mainly found among rural indigenous communities, where swidden agriculture is still practiced. Many of these heirlooms' hill rice varieties are seldom purchased in the open market, even though they fetch higher prices than other rice (Akite, Okello, Kasharu, & Mugonola, 2022).

Hill Paddy in Malaysia

Despite being its main staple, Malaysia's reliance on imported rice is still 40 to 35 percent, which is significantly high (Department of Statistics Malaysia, 2021). Malaysia's government has initiated plans to increase the self-sufficiency level of rice production to ease the reliance on imports. One of its initiatives is to enhance the cultivation of hill paddy among smallholders (Khazanah Research Institute, 2022).

Malaysia is one country that has nurtured the traditional cultivation of hill paddy. Hill paddy cultivation is popular among the native people living in the eastern part of Malaysia, The Island of Borneo. More than just a food crop, hill paddy is an inheritance passed down from generations in Sarawak's Dayak culture and tradition. For generations, the seeds have been collected selectively and guarded carefully. While passing down from one generation to another, the seeds are improved through evolution and proper selection according to the needs and preferences, resulting in a more vigorous plant with a better yield over time.

The Sarawak hill paddy has numerous varieties, each unique in morphology, taste, smell, and texture (The Borneo Post, 2023). It has been estimated that Sarawak has about 500 varieties of hill paddy, which are still under the identification and classification process (Khazanah Research Institute, 2022). Despite the low productivity, the uniqueness of hill paddy has opened doors for demand for it, paving the way for a potential market to emerge (Bernama, 2019). The current hill paddy production rate in Sarawak for 2021 is 28,325 tonnes, the lowest in 15 years (Department of Agriculture Sarawak, 2022). Further, the rate of hill paddy production is currently insufficient for marketing, as many farmers cultivate hill paddy as subsistence (The Borneo Post, 2023).

Hill Paddy Cultivation Practice in Sarawak

Every location in Sarawak has its rice specialty (The Borneo Post, 2023). According to the tradition of Sarawak hill paddy farmers, seeds are regarded as treasures and generational inheritances that have been passed down (Khazanah Research Institute, 2022). The seeds have changed and developed through evolution and selection by farmers through generations. Farmers choose seeds based on consuming preferences and crop sustainability (The Borneo Post, 2023).

According to Li, Feng, Jiang, Liao, and Zhang (2014), indigenous hill paddy farmers in Sarawak frequently practice swidden agriculture. The location for the new cultivation cycle will be identified while the seed selection process is underway. The region is chosen based on its accessibility through discovery. Typically, the location picked is on Native Customary Land near their settlements. Native Customary Rights (NCR) lands are communal areas with no legal title that belong to Sarawak's indigenous people and are governed by customary law (Bulan & Locklear, 2008).

Swidden hill paddy farming requires significant labour, requiring families and communities to form reciprocal cooperation to supply labour and speed up the process, intensifying the process for the next step. The laborious manual land clearing begins at the end of July after the harvest festivals in June. The standard equipment machetes, hoes, chainsaws, and sickles are used for slashing. In the slashing process, trees fall, and buffer barriers between the cultivation area and the cultivation site are created in preparation for the burning process.

The burning process commences once slashing is done. Fire is commonly used for clearing by indigenous people with careful handling skills to prevent a spark in a forest fire (Nigh & Diemont, 2013). Debris from the burning process is accumulated for future rounds of burning. The burning process clears and significantly provides natural fertiliser for paddy planting

(Kurata, 2013).

The planting process begins after the land is fully cleared. Selected paddy seeds are sown directly into the rich, recently burned forest soil. It is a tradition that the women follow behind the men, drop the seeds into the holes they've made in the ground, and then close them with their feet as the men plow the ground with wooden poles shaped like spears.

Farmers spend time weeding and creating scarecrows to keep an eye on their crops after planting. The hill paddy is frequently left to grow unattended after it sprouts and develops stems. Most traditional farmers use neither fertilisers nor provide any preharvest crop care during the entire planting to the harvesting process. The hill paddy entirely relies on the ecosystem to provide it with all the necessities for survival and growth until the harvesting season begins in January and ends in March.

However, this traditional method has been of the subsistence farming culture. To break the cycle of subsistence and increase sustainability, farmers and government organisations are attempting to spend more on fertilisers, pesticides, weedicides, and training when budgets are available (Bernama, 2019). This initiative is to achieve productivity-driven goals and shape the minds of the indigenous community through human development.

Holding on and striving to achieve the Malaysian goal of increasing self-sufficiency through enhancing hill paddy cultivation, the initiative commences from knowing the background and farming practices of the people involved in the cultivation. Assistance can be supplied accurately only by understanding needs (Hollan, 2008). This study focuses on the background and farming practice of the hill paddy smallholder community as an initiative to enhance hill paddy cultivation and pursue self-sufficiency in overall rice production.

2. Literature Review

The average production of hill paddy per hectare in Sarawak is 0.8 tonnes (Department of Agriculture Sarawak, 2022). It is relatively lower compared to the average wet paddy production in Sarawak, which is 3.5 tonnes per hectare (Department of Agriculture Sarawak, 2022). Hoki (1977), in a study, stated that the hill paddy cultivation in Sarawak is decreasing, which Echoh, Nor, Gapor, and Masron (2017) proved right through their study. Hoki (1977) also stated that productivity in terms of yield and labour is lower by at least three times compared to wet paddy. Overall, the study concluded that hill paddy and wet paddy cultivation practices were similar in Sarawak as both are manually cultivated and processed. The study suggested that the government should introduce modern farming methods to increase rice production self-sufficiency.

The recent rice shortage has led India and 18 other countries to restrict rice exports to cater to their domestic needs. This move, especially by India, has cut the global supply a fifth (AP News, 2023). Malaysia, which has relied on imported rice for at least one-third of its supply, has faced a price hike of 36 percent (Chan, 2023). The hike has caused increased consumer demand for local rice, which is cheaper than imported rice (Bernama, 2023; Chan, 2023).

India and Indonesia are the two leading countries in Asia and worldwide that have cultivated

hill paddy extensively, with more than a million hectares. China, Brazil, Nigeria, Guinea-Bissan, Cote d'Ivoire, and French Guiana are also countries that have cultivated between half to one million hectares of hill paddy (Kazuki Saito et al., 2018). These countries have placed research and modernisation of hill paddy as the vital focus to achieve production capacity.

Budiono and Adinurani (2017) conducted a study in Lamongan, Indonesia, to study the factors influencing hill paddy production. The study found that using herbicide and urea fertiliser was optimum for production. The current average production yield in Indonesia is 4.66 tonnes per hectare. Another study by Hindarwati, Minarsih, Praptana, Supriyo, and Romdon (2023) in Boyolali Regency, Indonesia, found that low nutrient availability is an obstacle to increasing hill rice productivity. The team of researchers stated that the combination of biofertiliser and inorganic fertiliser gave a comparative advantage of 48 percent with the conventional fertilisation method in hill rice production.

Saito et al. (2023), who conducted a study on the status quo and challenges faced by hill paddy farmers in Sub-Sahara Africa, found that the paddy, which accounts for 70 percent of the total rice harvested area, had a low yield with an average of 2 tonnes per hectare. The scenario was due to the strong effect of climate extremes, which causes water stress, soil-related constraints, and sub-optimal resource management. Smallholders were found to practice poor crop management by utilising sub-optimal fertiliser, herbicides, and types of machinery. Water conservation technologies, labour-saving technologies, site-specific nutrient management practices, and decision-support models were introduced to alleviate the constraints. Saito et al. (2023) stated that, even through these introductions of new methods, hill paddy research efforts must continue to enhance resilience to climate change and increase the productivity and sustainability of hill rice production.

Langangmeilu et al. (2023) conducted a study in India hill paddy stated that the average yield per hectare is 1 tonne. The low hill rice yield was linked to a lack of high-yielding varieties. The study adds that small-scale farmers' poor crop management practices and climate change worsened hill paddy production. Another study in Kenya by Pope, Opile, Ngode, and Chepkoech (2023) stated a similar review as Langangmeilu et al. (2023) that climate change has caused a reduction in the productivity of hill paddy. Pope et al. (2023) stated that drought-tolerant hill paddy varieties are essential to increase hill rice production.

Fageria (2001), in his study in Brazil, stated that the average yield per hectare of hill paddy is less than 2 tonnes. The study found that the limitation in output was due to water stress, disease, insect infestation, and weeds. To improve the situation, Fageria suggested basic principles of nutrient management, disease, insect and weed control, maintenance of organic matter, etc. These basic principles are applicable under similar agroecosystems.

Even though the basic principles can be adapted under similar agroecosystems, the practicability differs depending on the local specific constraints, technological adoption, and socio-economic standards (Fageria, 2001). Echoh et al. (2017) expressed the local specific constraints in Tatau, Sarawak, as inadequate land, drainage and irrigation issues, transport facilities, agriculture aid distribution, and competition in cultivation with other lucrative industrial crops.

Khanal and Regmi (2018) found that financial constraints could significantly influence the production efficiency of hill paddy farmers. The availability of financial solvency and liquidity positively influenced production efficiency. Farmers who earned off-farm incomes proved more efficient than those with financial solvency.

A study by Strauss, Barbosa, Teixeira, Thomas, and Junior (1991) on hill paddy farmers in Central-West Brazil found that farmers' education level positively impacted the diffusion process in technology adoption. Yet, the study concluded that the investment of human capital in terms of extension agents' did not compensate for the farmers' adoption to improve cultivation practices. The study by Budiono and Adinurani (2017) also found that age defines the ability to rationalise decision-making and physical capability in labour. At the same time, education influences creativity, skill, and knowledge in farming.

Singh, Bhatt, & Kiran (2020) conducted a study in India that parallelly supports the findings of Strauss et al. (1991) and Budiono and Adinurani (2017) by stating that education, training, experience, and age are highly probable to influence production rate, enabling the farmer to produce a greater quantity of output from the same amount of input.

Oladeebo and Fajuyigbe (2007) conducted a study in Osun State, Nigeria, to evaluate the technical efficiency of men and women hill paddy farmers. The study showed that women farmers were more efficient than men farmers. The result also indicated that farmers' age and education years positively influence the technical efficiency level.

Wu, Ding, Pandey, and Tao (2010) evaluated the impact of technology adoption on the well-being of hill paddy farmers in Yunan, China. The study showed that the improvement of hill paddy rice technology has a robust positive impact on the well-being of farmers, as measured using income levels and the incidence of poverty. A similar study on the adoption of technology for hill paddy was conducted by Khuvung and Mishra (2023) in the state of Nagaland. The study showed that the extent of adoption score was at a 60 percent moderate level.

3. Method

Out of 12 divisions in Sarawak, hill paddy cultivation is most intense in the division of Kapit. For the year 2021, the division of Kapit recorded the highest production rate among all divisions, which is 10,693 tonnes, 38 percent of the total production in Sarawak (Department of Agriculture Sarawak, 2022). Kapit is the largest and most steadily producing division for hill paddy, at least for the past five years compared to others.

The Kapit division is divided into four districts: Bukit Mabong, Belaga, Song, and Kapit. The distribution of contribution to hill paddy differs between each district. The Kapit district contributes the most, with 4,122 tonnes, followed by Belaga with 2,977 tonnes, Bukit Mabong with 2,367 tonnes, and Song with 1,277 tonnes (Department of Agriculture Sarawak, 2022).

This study focuses on the district of Belaga, which is the second place in the production of hill paddy in the entire state of Sarawak after the district of Kapit. Belaga's unique and

exciting background and history drew the researchers' interest to this place to conduct the study. Sungai Asap in Belaga (Figure 1: Location map) is the resettlement area of the people of Bakun. The government implemented the resettlement in 1994 due to building a hydroelectric dam, currently known as the Bakun Dam (Ahsan, Hamdan, & Haji, 2016). The dam's construction has caused controversial issues regarding native rights on land and livelihood, as their land for cultivation was stripped away with little compensation (Ahsan et al., 2016; Cooke, Nordensvard, Saat, Urban, & Siciliano, 2017). The limited land compensation has taken a toll on their livelihood: their dependence on food and earnings. Many have argued that land compensation is unsustainable and inadequate for producing hill paddy and other crops (Ahsan et al., 2016; Cooke et al., 2017).

A survey was conducted to study the hill paddy smallholder population of Sungai Asap. An interviewer-administered questionnaire was designed based on a simple production equation based on the possible agricultural inputs factors and farming practices of hill paddy cultivation. The survey was conducted using non-probability convenient sampling. From the survey, 30 respondent samples were collected from February to March 2023. The results of the samples collected are interpreted using descriptive analysis.

4. Results and Discussion

Table 1 shows the demographic feature of the studied Sungai Asap hill paddy farmers population. The result shows that 46.7 percent of the surveyed population were male while 53.3 percent were female. From the studied population, it can be seen that all farmers were more than 36 years of age, with the majority ranging from 46 to 65. Only 5 percent of the farmers were more than 66 years of age. This result shows that the younger generation's involvement is depleting from the practice. Echoh, Nor, Gapor, & Masron (2017) raise the same concern by stating migration to cities to seek new opportunities with higher income is the reason for the lack of involvement. The younger generation's lack of involvement could result in losing culture and its essence. Furthermore, it could result in losing inherited heirloom varieties of hill paddy, which has vast market potential. Awareness must be raised to sustain hill rice's legacy and unique diversity in Sarawak.

Table 1. Demographic Features of the Studied Population of Hill Paddy Farmers

Demographic	Characteristics	Frequency	Percentage
Gender	Male	14	46.7
	Female	16	53.3
Age	18 to 25	0	0
	26 to 35	0	0
	36 to 45	3	10
	46 to 55	10	33.3
	56 to 65	12	40
	66 to 75	4	13.3

	76 and above	1	3.3
Nativity	Bumiputra	30	100
	Non-Bumiputra	0	0
Ethnicity	Kenyah	30	100
	Other	0	0
Education	No Education	3	10
	Primary	16	53.3
	PMR	5	16.7
	SPM	6	20
	STPM	0	0
	Others	0	0
Household Size	1 to 5 person	12	40.0
	6 to 10 person	12	40.0
	11 to 15 person	4	13.3
	16 person and above	2	6.7
Years of Experience	2 to 5 (Entry Level)	1	3.3
	6 to 10 (Intermediate Level)	1	3.3
	11 to 15 (Mid-Level)	0	0
	16 and above (Senior Level)	28	93.3
Monthly Gross Income	RM0 to RM500	18	60.0
	RM501 to RM1000	5	16.7
	RM1001 to RM 1500	6	20
	RM1501 to RM2000	0	0
	RM 2000 and above	1	3.3

Forty percent of the hill paddy farmers selected had a household size of 6 to 10 people. 33.3 percent of the farmers had at least a household size of 1 to 5 people, while 20 percent had more than ten people.

The farmers selected were 100 percent *Bumiputra*, a special citizenship status given to the natives of Malaysia. They were all of the *Kenyah* tribe, a minority of the 27 ethnicities from the *Orang Ulu* group of Sarawak. The word '*Orang Ulu*' means people of the interior area. The interior places in Sarawak have exceptional beauty and are pristine, yet it also has challenges, such as access to education. Of the population surveyed, 10 percent do not have any educational background, while 53.3 percent, more than half of the population surveyed,

only had primary education. Only 36.7 percent of the selected population received secondary education, and only 20 percent completed the Malaysian Certificate of Education (SPM).

Regarding the experience of planting paddy, 93.3 percent of the population have at least 16 years or more of experience. This indicates that most of the respondents selected have a senior level of experience in cultivating hill paddy. The remaining 6.6 percent had entry-level and intermediate-level of experience.

From the population selected, 60.0 percent of the farmers earned a gross income of a maximum of RM500 per month. Meanwhile, 16.7 percent earned between RM501 to RM1000 per month. Only 7 percent earned more than RM1000 per month.

The hill paddy farmers were divided into two groups in terms of mode of cultivation-part-time and full-time. Part-time cultivation is defined as cultivating hill paddy as a side income, while full-time is defined as cultivating hill paddy as the sole income. Table 2 shows the mode of cultivation of the surveyed population of hill paddy farmers. Seventy percent of the people selected cultivated paddy solely. In contrast, 30 percent practised it part-time. The part-timers cultivated vegetables and other industrial crops such as oil palm.

Table 2. Mode of cultivation of hill paddy farmers

Mode of Cultivation	Frequency	Percentage
Part-time	9	30
Full-time	21	70
Total	**30**	**100**

Table 3 shows the participation of the hill paddy farmers in agricultural training. 53.3 percent of farmers selected for the study had never participated in any training on agricultural practices for knowledge development. 36.6 percent of the farmers claimed to have attended once, while only 10 percent have attended twice or more. Training participation is necessary for knowledge and skill development among hill paddy farmers. Hence, participation should be encouraged to develop skills and knowledge to help decision-making and farm management, which is much needed in boosting production.

Table 3. Training Participation of hill paddy Farmers

Training Participation	Frequency	Percentage
Never	16	53.3
Once	11	36.7

Twice or more	3	10
Total	30	100

Table 4. Reasons for Cultivating Hill Paddy

Reasons for Cultivation	Frequency	Percentage
High return	3	10
Generates income throughout the year	4	13.3
Incentives availability	2	6.6
Generational practice	18	60
For household food security	7	23.3

Table 4 shows why the selected paddy farmers chose to cultivate hill paddy. They were allowed to choose more than one reason for growing. The reason with the highest score was generational practice. Sixty percent agreed that planting paddy was part of their culture passed down from generation to generation and is an integral part of their life. The second highest reason was food security for their household, where their family could enjoy sufficient rice. 13.3 percent claimed that hill paddy generates income throughout the year, with only 10 percent claiming it gives high financial returns. Only 6.6 percent of farmers were cultivating due to incentives for governmental sectors.

Table 5 shows the size of land cultivated by hill paddy farmers. 53.3 percent of the hill paddy farmers cultivated 1.1 to 1.5 hectares of hill paddy. 13.3 percent of the farmers cultivated less than 1.1 hectares, with 3.3 percent cultivated less than half a hectare. 26.6 percent of farmers cultivated 1.6 to 2.5 hectares of hill paddy. Only 6.6 percent of the farmers studied cultivated more than 2.6 hectares of hill paddy.

Table 5. Size of Land Cultivated by Hill Paddy Farmers

Hectare	Frequency	Percentage
Less than 0.5	1	3.3
0.6 to 1.0	3	10
1.1 to 1.5	16	53.3
1.6 to 2.0	5	16.7
2.1 to 2.5	3	10

More than 2.6	2	6.7
Total	30	100

There are various types of hill paddy varieties found in Sg. Asap. Table 6 shows the 15 varieties found cultivated by the studied population. Each farmer was found to be cultivating at least three of the varieties. The most popular hill paddy variety was *Kerawing*, *Alek*, and *Pulut*. All three types were grown by 43.3 percent of the population. The *Sepakau*, *Abeng*, and *Isau* varieties were planted by 20 percent of the population. The *Hitam*, *Saleng*, *Kunyit*, and *Unan* varieties were produced by 10 percent of the population. The Merah variety was planted by 6.6 percent of the population, while *Kabeng*, *Longuan*, *Sekapan*, and *Ubek* were cultivated by 3.3 percent. The type of variety the farmers choose depends on their taste, texture, flavour, and smell preference.

Table 6. Variety Cultivated by Hill Paddy Farmers

Variety	Frequency	Percentage
Kerawing	13	43.3
Alek	13	43.3
Pulut	13	43.3
Sepakau	6	20
Abeng	6	20
Isau	6	20
Hitam	3	10
Merah	2	6.6
Saleng	3	10
Kabeng	1	3.3
Longunan	1	3.3
Sekapan	1	3.3
Ubek	1	3.3
Kunyit	3	10
Unan	3	10

Table 7 shows the farming practices applied by the farmers. Only 33.3 percent of the farmers studied fertilised their paddy, while the remaining farmers rely on the natural elements available in the soil to sustain their paddy throughout the season. Meanwhile, 20 percent of the farmers sprayed insecticide to control insect infestation, and the other 80 percent of the farmers did not control any infestation of insects.

Herbicide application is the most common farming practice compared to any other practice.

Eliminating weeds helps prevent competition for nutrients between the weeds and paddy. Lack of weed control will result in a decrease in the yield of the crop (Colbach et al., 2020). 53.3 percent of the farmers sprayed herbicide to control weeds and sustain paddy yield. Another 46.7 percent of farmers control the weeds through manual weeding or not at all.

Fungal infection is common in hill paddy fields (Chanu, Chhetry, & Sharma, 2010). Fungicide spraying is not common among hill paddy farmers in Sg. Asap. Only 6.6 percent of the studied population practices fungicide application.

Table 7. Farming Practices

Practices	Frequency	Percentage
Fertilising	10	33.3
Insecticide	6	20
Herbicide	16	53.3
Fungicide	2	6.6

Yield is the ultimate result of proper management of the farm. Table 8 shows the yield harvested by the farmers. 53.4 percent of the paddy farmers harvested between 1 to 2 tonnes of paddy for a hectare of land. Only 20 percent of the farmers harvested more than 2 tonnes of paddy per hectare, with 10 percent harvesting more than 3 tonnes per hectare. More than a quarter of the farmers, or precisely 26.6 percent, harvested a tonne or lesser paddy per hectare. The quantity harvested by these farmers is relatively low compared to those who harvested 2 tonnes or more.

Table 8. Yield Per Hectare

Yield	Frequency	Percentage
Below 500kg	5	16.6
501kg-1000kg	3	10
1001kg-1500kg	8	26.7
1501kg-2000kg	8	26.7
2001kg-2500kg	3	10
2501kg-3000kg	0	0

More than 3000kg	3	10
Total	30	100

Table 9: Commercialisation of Yield by Hill Paddy Farmers

Commercialisation of Yield	Frequency	Percentage
No	14	40.6
Yes	16	53.3
Total	30	100

Even though hill rice (milled hill paddy) fetches high prices, the product is hardly found in open markets (Taridala et al., 2019). The commercialisation of yield by the studied paddy farmers is shown in Table 9. 53.3 percent of the farmers commercialise their yield, mainly in small market areas. In contrast, another 40.6 percent of the farmers do not sell their yield, as it is solely cultivated and reserved for their family's consumption.

With the recent price plunge, the demand has driven the urgency for research and development on local hill paddy varieties, where Sarawak recently opened a new 10,000-hectare hill paddy fields to cultivate hybrid high-yielding varieties (Reporters, 2023; The Borneo Post, 2023). The new 10,000-hectare large-scale paddy field is expected to cater to 80 percent of Sarawak's rice demand (Reporters, 2023). Sarawak is zoning and gazetting lands to cultivate hill paddy with targets to make Sarawak the rice bowl of Malaysia and further generate income through export by 2030 (Ali, 2023; Reporters, 2023).

5. Conclusion

The hill paddy is seen as a potential geographical index commodity for commercialisation. The uniqueness of hill rice has potential market value, which could benefit rural communities, especially hill paddy farmers. With commercialisation and self-sufficiency as the target of the governing party, hill paddy cultivation has to be upscale and improved in terms of farm area, management practices, involvement training, and participation of the younger generation.

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Authors contributions

All the authors are equally contributing to this research and article preparation.

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Competing interests

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Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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Copyrights

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