# Management of Rice Straw Waste from Sang Yod Rice Production by Farmers Adhering to Good Agricultural Practice (GAP) Standards in Phatthalung Province

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**Abstract**

This research was to study 1) personal characteristics and socio-economic factors, 2) knowledge on utilization of rice straw waste, 3) needs for rice straw waste management, and 4) problems and suggestions of farmers on rice straw waste management. The sample was 180 farmers growing GAP rice. Data was collected by using questionnaires. The statistical techniques used were frequency, percentage, mean, standard deviation, and Chi-square test. The results revealed that most Sang Yod rice farmers were female, with an average age of 62.78 years. The majority were married and had a primary educational level. The average rice cultivation area was 4.92 rai, with an average cultivation experience of 10.73 years. The average number of workers was 3 people. The average income was 11,711.39 Baht/year and had exposed news through various media and activities. Farmers' knowledge in managing rice straw waste was at a moderate level, with an average of 1.59. The management of rice straw waste involved plowing and using it as animal feed, with the percentage of 37.78 and 37.22. The need for rice straw waste management was found at a moderate level, with an average of 2.26. Hypothesis testing found that marital status and experience had a statistically significant relationship with the management of rice straw waste at the level of 0.05. Additionally, exposure to news by Sang Yod rice farmers was significantly related to the rice straw waste management at the 0.01 level. Problems and suggestions were found to be a lack of support from government agencies in managing rice straw waste.

**Keywords**: Sang Yod rice, management of rice straw waste, GAP

## Introduction

Guidelines for economic development, according to the BCG Model, emphasize economic growth in three dimensions: the bioeconomy, the circular economy, and the green economy (National Science and Technology Development Agency, 2020). This emphasis is particularly relevant for Thailand due to biological diversity and abundant resources. However, continuous economic development has led to the rapid depletion of available resources, causing deterioration, and generating various wastes and pollution. Adaptation is necessary to address the challenges posed by this situation. The BCG economic model emerges as a new economic approach with the potential to foster robust and sustainable

relationships between the economy and resources. This model is achieved by incorporating knowledge and innovation to facilitate development from upstream to downstream. The focus is on using resources efficiently and economically, along with reusing resources for maximum benefit. Moreover, this economic model can contribute to upgrading the agricultural sector from the previous resource-intensive model with low output to a more efficient form of agriculture. This innovative approach minimizes labor while achieving high production levels, leveraging knowledge and scientific technology to enhance production efficiency, reduce production waste, and promote the reuse of waste. Consequently, this leads to the conservation, restoration, and increased value of resources, along with a reduction in environmental pollution (Sreewongchai, 2023)

Phatthalung Province is characterized by lowland terrain, and the majority of its residents are engaged in agriculture. Key economic crops include rice and rubber. Notably, the region is known for cultivating traditional local rice varieties, particularly "Sang Yod Phatthalung Rice," recognized as a Geographical Indication (GI) with special characteristics and high nutritional value (Saeton, 2007). This rice is well-suited for advanced production and processing techniques, adding economic value to agricultural products that define Phatthalung province's identity. Aligned with the Thai rice strategy for the years 2020 to 2024, Sang Yod rice is acknowledged for its distinctive features and is positioned as a raw material for functional food in specific market groups. This expanding and significant market emphasizes the need to enhance production efficiency by concentrating on reducing production costs (The Government Public Relations Department, 2020). In line with this strategic plan, Phatthalung province has the potential to elevate the value of Sang Yod rice production with Good agricultural practices (GAP) by incorporating technology and innovation in both production and processing. This approach includes environmentally friendly resource management, aiming for zero waste agriculture in every production process, ultimately increasing the overall product value. The transformation of agricultural waste materials into high-value products, coupled with the strategic use of knowledge and technology, positions Phatthalung province to leverage these strengths to attract consumers and entrepreneurs in the future.

Therefore, the researcher is interested in studying the management of rice straw waste from Sang Yod rice production in Phatthalung province, renowned for its significant rice production. This study is particularly focused on exploring practices that lead to production efficiency, reduced resource utilization, and the incorporation of renewable resources. Additionally, it aims to minimize waste release from production and make use of leftover materials from each production process. The objective is to align with the country's economic development guidelines, specifically by the BCG economic model. This initiative aims to guide farmers cultivating Sang Yod rice, contributing to the further addition of value to their agricultural practices.

## Materials and Methods

### Population and Sample

The research focuses on a total of 324 farmers cultivating Sang Yod rice in Phatthalung province who have attained GAP standards (Phatthalung Rice Research Center, 2022) and are

interested in improving the quality of rice. The sample size was determined using the multi-stage random sampling method, resulting in a sample size of 180 individuals by using Yamane (1973). There were 55 in Muang district, 72 in Khuan Khanun district, 32 in Pak Phayun district, 3 in Tamot district, and 18 in Khao Chaison district. (Table 1)

**Table 1** Population and sample size classified by district - Farmers growing Sang Yod rice with GAP standard in Phatthalung province

| District | Population (cases) | Sample size (persons) |
|---|---|---|
| Mueang | 99 | 55 |
| Kuan Khanun | 129 | 72 |
| Pak Phayun | 57 | 32 |
| Tamot | 5 | 3 |
| Khao Chaison | 34 | 18 |
| **Total** | **324** | **180** |

**Research Tools**

This research employed a questionnaire as a data collection tool. The questionnaire encompassed five content areas: 1) basic personal information, economy and society, 2) knowledge on utilizing rice straw scraps, 3) management of rice straw waste, 4) needs for managing rice straw waste, and 5) problems and suggestions regarding the management of rice straw from Sang Yod rice production. The validity of the questionnaire underwent a validation process involving 3 experts. Furthermore, the questionnaire was pre-tested with 30 Sang Yod rice growers who shared similar characteristics with the sample group. Subsequently, the data were analyzed to determine the confidence value using the KR-20 formula, following the Kuder-Richardson model. The Kuder-Richardson reliability coefficient for knowledge about rice straw waste management was calculated and found to be 0.72. Additionally, the reliability of the questionnaire for assessing the needs of Sang Yod rice farmers in managing rice straw waste, measured using Cronbach's alpha, was determined to be 0.94.

Interpreting knowledge on rice straw management among Sang Yod rice farmers.

Interactive measurements are employed to define the level of knowledge among Sang Yod rice farmers. The interpretation is as follows:

Scores between 0.00 - 6.66 mean that Sang Yod rice farmers demonstrate a low level of knowledge of straw waste management.

Scores between 6.67 - 13.32 mean Sang Yod rice farmers have a moderate-level knowledge of straw waste management.

Scores between 13.33 - 20.00 mean Sang Yod rice farmers have a high level of knowledge of straw waste management.

Interpreting the needs for rice straw management among Sang Yod rice farmers.

The assessment of needs for rice straw management among Sang Yod rice farmers is divided into three levels:

Scores between 1.00 - 1.66 mean Sang Yod rice farmers indicate a low level of rice straw management.

Scores between 1.67 - 2.33 mean Sang Yod rice farmers indicate a moderate rice straw management need.

Scores between 2.34 - 3.00 mean Sang Yod rice farmers indicate a high level of rice straw management.

**Data Analysis**

The collected data underwent a comprehensive analysis using descriptive statistics to elucidate information within the sample group. This included an exploration of basic personal factors, economic and social indicators, knowledge of rice straw management, and the needs of Sang Yod rice farmers regarding rice straw management, as well as insights into issues, problems, and suggestions from the questionnaires. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were employed to provide a detailed overview of the data. In addition to descriptive analysis, inferential statistics were applied to test hypotheses and identify relationships among variables. The variables under consideration encompassed basic personal data, economic and social information, knowledge of rice straw management, and the need for rice straw management among Sang Yod rice farmers. Furthermore, Chi-square statistics were utilized to assess the statistical significance of relationships, with a focus on the 0.01 and 0.05 significance levels. This comprehensive approach aimed to derive meaningful insights into the factors influencing rice straw waste management among Sang Yod rice farmers.

**Results and Discussion**

**1. Personal characteristics and socio–economic factors**

The majority of Sang Yod rice farmers in this study were women, constituting 60.56 percent of the surveyed population with an average age of 62.78 years. These farmers reflect a seasoned cohort. Marital bonds were strong, as approximately 76.67 percent of them were married. The prevailing educational level was primarily at the primary education stage. Sang yod rice farming households had an average of 3.60 members who contributed to the daily dynamics. An encouraging trend was noted in land ownership, with a substantial 83.33 percent of Sang Yod rice farmers proudly owning the land they cultivate. Sang yod rice cultivated across an average area of 4.92 rai, represents a testament to the farmers' experience, averaging at 10.73 years. The labor force comprised an average of three individuals, embodying the collaborative spirit in rice farming. Active participation in farming groups was a commonality among Sang Yod rice farmers. Their hard work yields an average income of 11,711.39 Baht. The sowing method was applied by 55.56 percent of farmers, and the prevalent use of rice harvesters underscores the adoption of modern agricultural practices. This corresponds to Chanthavong *et al*. (2018), a study on the Factors Affecting Farmers' Adoption of Rice Production Technology under the Good Agricultural Practices System at Champhone district, Savannakhet Province, Lao People's Democratic Republic found that most farmers were married. Moreover, this study similarly found that a significant proportion of farmers were married, as revealed by the study's findings. The importance of family units was supporting the agricultural sector, particularly

considering the labor work in agriculture as their main occupation.

**2. Knowledge of the utilization of rice straw waste**

Analysis of farmers' knowledge levels in the utilization of rice straw scraps found that farmers had a high level of knowledge in using rice straw scraps, scoring between 13.33 - 20.00, with 41.10 percent, and a moderate knowledge level (score between 6.67 - 13.32) with 58.90 percent. The highest score was 18.00 points. The lowest score was 9.00 points. Overall knowledge of Sang Yod rice farmers was at a moderate level. Most farmers knew about managing rice straw waste, the benefits of rice straw, including knowing the negative effects of managing rice straw by burning. Therefore, promoting knowledge on rice straw management was important to provide farmers with correct and diverse approaches to rice straw management, which leads to a new product and adds value to rice straw for maximum benefit. (Table 2)

**Table 2** Knowledge level on the utilization of rice straw by Sang Yod rice farmers

| Knowledge on the utilization of rice straw | Percent | Level of knowledge |
|---|---|---|
| (6.67 - 13.32 score) | 58.90 | Moderate |
| (13.33 - 20.00 score) | 41.10 | High |
| Mean = 13.63 S.D. = 0.49 Minimum = 9.00 Maximum = 18.00 | | |

**3. Management of rice straw waste for Sang Yod rice farmers**

The post-harvest rice straw management practices of Sang Yod rice farmers had several patterns emerge. Most farmers were managed by plowing with 37.78 percent to add nutrients to the soil. However, the majority, 51.67 percent do not use technology in their rice straw management as farmers used more for fodder and plowing, with only 33.22 percent employing agricultural machinery like hay balers, and 15.00 percent using biotechnology such as microorganisms. Moreover, the utility of rice straw was about 67.78 percent of farmers do not use while 32.22 percent compress straw into bales for utilization. Most farmers with 62.80 percent, do not transport for selling rice straw. Most farmers do not use technology to communicate with rice straw buyers, and the majority, 66.10 percent, communicated through traditional methods like telephones with 33.90 percent. This varied approach to rice straw management underscores a blend of traditional and technology-informed practices among Sang Yod rice farmers. The diversity of rice straw management approaches underscores the integration of traditional practices and technology embraced by Sang Yod rice farmers with access to various media and technology, becomes imperative for farmers to adapt and apply these methods in their respective areas for enhanced appropriateness and efficiency (Table 3).

Table 3 Management of rice straw waste for Sang Yod rice farmers

| Management of rice straw waste | Percent |
|---|---|
| Plowing | 37.78 |
| Fodder and plowing | 51.62 |
| Employing agricultural machinery | 33.22 |
| Using biotechnology | 15.00 |
| Do not use rice straw | 67.78 |
| Utilization of rice straw | 32.22 |
| Not transport for selling rice straw | 62.80 |
| Do not use technology to communicate | 66.10 |
| Communicated through traditional methods | 33.90 |

**4. Needs for rice straw waste management**

Overall needs for rice straw waste management of Sang Yod rice farmers was found to be at a moderate level with an average score of 2.26 when considering the needs of Sang Yod rice farmers for the rice straw management that farmers need plowing and covering with an average score of 2.70, followed by making mulch with average score of 2.66, promotion, support, and assistance from related agencies with average score of 2.60. Using rice straw for various purposes, with an average score of 2.50, managing waste to become zero with an average score of 2.40, and making compost, with an average score of 2.36. A moderate level of needs was animal feed with an average score of 2.32, followed by planting materials with an average score of 1.86, and making use of rice straw in various aspects with an average score of 1.67. The rice straw management that farmers need least was energy production, with an average score of 1.64, and burning with an average score of 1.43. (Table 3) This is because most farmers were aware of the consequences if rice straw was managed by the burning method, causing air pollution and loss of nutrients in the soil. Farmers, therefore required sustainable and environmentally friendly with rice straw management which correlation with Kongjan *et al.* (2021), who studied stubble and rice straw management by farmers in a project to promote the cessation of burning in agricultural areas of Ayutthaya province found that most farmers were aware of the impact of stubble and rice straw burning at a high level. All farmers acknowledged that burning stubble and rice straw causes danger to themselves and others and including the environment.

Table 4 Needs of rice straw waste management from Sang Yod rice production

| Management of rice straw scraps | $\bar{X}$ | S.D. | Level of needs |
|---|---|---|---|
| Burning | 1.43 | 0.71 | Low |
| Plowing | 2.70 | 0.47 | High |
| Mulching | 2.66 | 0.53 | High |
| Bio-compost | 2.36 | 0.84 | High |
| Fuel energy production | 1.64 | 0.78 | Low |
| Animal feed | 2.31 | 0.78 | Moderate |
| Material Planting | 1.85 | 0.87 | Moderate |
| Utilizing technology for the effective management of rice straw | 2.50 | 0.65 | High |
| Zero waste management | 2.40 | 0.71 | High |
| Promotion, support, and assistance from various agencies | 2.60 | 0.68 | High |
| Utilization of rice straw | 1.67 | 0.70 | Moderate |
| **Total** | **2.26** | **0.58** | **Moderate** |

**Relationship between personal characteristics and socio - socio-economic factors and knowledge about rice straw waste management and rice straw waste management of Sang Yod rice farmers**

The results revealed a significant relationship between marital status and experience with rice straw waste management among farmers, reaching a statistical significance level of 0.05 and 0.01 (Table 3). The prevalence of married status in the area suggests a conducive environment for efficient rice straw waste management, fostered by mutual assistance in both labor and decision-making processes. The experience of most farmers in cultivating Sang Yod rice contributes to their expertise in the entire rice production process, from upstream to downstream activities which correlation with Pinya *et al.* (2019), examining the participation of farmers in an agricultural promotion system project in Wiang Pa Pao District, Chiang Rai Province, noted a similar association with marital status. This demonstrates the historical significance of prioritizing family-building to foster stability and mutual support. Natteechao *et al.* (2018), in their investigation of the decision to produce organic Sang Yod rice in Phatthalung Province, found that farmers with 7-10 years of experience were predominant. Moreover, the study establishes a noteworthy connection between exposure to news and rice straw waste management, with a statistical significance level of 0.01. Collectively, corroborates with the findings of Chaiwut *et al.* (2021), who studied the impact of support from a large-scale agricultural extension system project on farmers in Saengcha district, Ang Thong province. The majority of large-scale plot farmers in that study received news through personal media facilitated by government or private officials, highlighting the importance of regular knowledge promotion activities. Recently, the technological advanced era has provided farmers had easy access to information through television, radio, and telephones, allowing them to stay informed and apply acquired knowledge effectively.

Table 5 Relationship between personal characteristics and socio-economic factors, and knowledge about rice straw waste management and rice straw waste management of Sang Yod rice farmers

| Factor | Management needs rice straw scraps | | |
|---|---|---|---|
| | $X^2$ | p-value | Significance |
| Status | 8.998* | 0.011 | Sig. |
| Experience | 7.321* | 0.026 | Sig. |
| Media exposure | 16.384** | 0.003 | Sig. |

Remake: * Significance level at 0.05, ** Significance level at 0.01

**5. Problem and suggestions of farmers on rice straw waste management**

The problem encountered was that farmers lack agricultural machinery to manage rice straw waste. Knowledge and new methods for managing rice straw waste, because there was still no sector to take care of or help in this area. Most farmers were ready to receive support in both knowledge and methods. However, farmers know that burning rice straw is detrimental to both their health and the environment. Therefore, farmers were very interested in managing rice straw waste effectively. Minimize negative effects on themself and the environment. The suggestion from most farmers was support and assistance from government agencies in managing rice straw waste, such as agricultural machinery. Knowledge and methods for managing rice straw waste in new ways to increase the value of rice straw which includes the use of rice straw to further develop for creating maximum value.

## Conclusion

According to research findings, several factors are associated with the management of rice straw waste among Sang Yod rice farmers. Firstly, marital status plays a crucial role as farmers assist each other in both labor and decision-making regarding management. Secondly, experience is another significant factor, with most farmers having cultivated Sang Yod rice for a considerable period, resulting in expertise in the entire rice production process. Lastly, exposure to news was important as farmers mainly rely on media sources like agricultural extension officers, who visit them directly to discuss and share ideas. Farmers' knowledge of managing rice straw waste was at a moderate level because they had some understanding of basic techniques for straw management. However, there was room for improvement in adopting more advanced and sustainable methods of straw management, such as composting or using it for bioenergy production. Therefore, while there was a foundational understanding, there was still potential for further education and support to enhance farmers' ability to effectively manage rice straw waste. Farmers mainly managed rice straw waste by plowing it and using it as animal feed. Their need for rice straw waste management was moderate. This was because most farmers had small livestock operations and aim to minimize the use of chemical fertilizers to nourish the soil. Consequently, farmers rely on traditional methods such as plowing and using rice straw as animal feed. They avoid burning methods because they were aware of the negative effects of burning rice straw.

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