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A study on rice field farmer implementation of rice straw composting

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Abstract. Rice straw is an abundant material which can be utilized as an ingredient in organic fertilizer or compost. Especially since various laboratories test also found that rice straw, which tends to be viewed as farm waste, contains beneficial nutrients, which aid in plant growth and in maintaining soil fertility. In actual practice, rice straw often left wasting unused, disposed mostly by burning. Hence it necessitated a survey to learn the percentage of farmers that compost rice straw within an area to be undertaken, especially at regions that have been designated as rice cultivation center. The study was conducted in three districts in Klungkung region, e.g., Banjarangkan, Klungkung, and Dawan. Klungkung region was chosen as a research site due to its inclusion as one of the areas where the national program of rice, corn, and soybean (Pajale) development was being undertaken. The survey for this study was conducted by giving out questionnaires and interviews. The survey was conducted with 89 respondents. The results found in this study revealed that there was no farmer who composted rice straw. It was found that 97.75% of farmers admitted not to compost their rice straw due to their lack of knowledge on the way and means of rice straw composting. In fact, it was found that 74.16% of farmers have no notion that rice straw could be turned into compost. This data was in line with results found from interviewing 12 extension worker officials who fully admitted that they were never done any socializing effort on rice straw compost at all. It was found that 97.75% of farmers admit not to compost their rice straw due to their lack of knowledge on the way and means of rice straw composting.

1. Background

Rice straw is one farm waste that comes out in large amount during harvest. Rice straw is a part of a rice plant that includes stems, leaves, and tillers [1]. Rice straw utilization by composting would provide a means to avoid air pollution that comes from residual burning while also preventing the loss of nutrients in organic materials [2]. Rice straw is a local material that can potentially be turned into organic fertilizer. It is available in abundance during harvest yet has not been fully utilized [3]. The recycling of plant waste by composting is crucial in maintaining soil fertility in tropical regions [4]. Its global production is estimated to be around 650-975 million ton annually. There is around 1-1,5 kg of rice straw from each kilogram of shifted rice produced [5].

Various studies found rice straw to contain nutrients that are needed by soil and plant, which are N, P, K, and C-organic. Rice straw contains around 0.6% N, 1.5% K, 5% Si, 40% C, 0.10% of each P and S



[6]. The utilization of farming waste as compost not only would provide plants with important nutrients but also increased soil fertility and can become a mean to protect the environment with waste management [7]. The utilization of rice straw can become the mean to solve the problem of rice straw disposal and reduce pollution that came from open field burning [8]. Rice straw management can provide farmers and the local community with added economic value and can induce a larger village economy growth by developing industries and give supplemental values to farm environment [9][10].

Composting possesses many benefits such as reducing waste volume, reducing surface and groundwater pollution, reducing transportation cost, reducing air pollution from waste burning, providing better waste management, increasing material recycling and can be performed with low capital and cost [11]. Farmers' awareness and understanding of the role of organic material in farm soil are still low, as shown by the little attention farmers paid to reintroduced farming waste back into the soil. Rice straw is the most often burned or left to be taken by another person as fuel for industrial needs [12]. On a study done in Malaysia, it was found that several factors that influence farmers decision to utilize rice straw. Those are the lack of incentive for the farmer, inefficient technology, inadequate logistics facilities (storage and transportation), farmer's low level of ability and knowledge, and the lack of capital to manage rice straw [13].

The question is how many farmers in Indonesia, especially in Klungkung region, Bali, that compost rice straw. Then what are the principle difficulties that prohibit them from composting rice straw. By discovering those problems, a solution for future rice straw management can be drawn, thus making rice straw to be regarded as a boon instead as a liability.

2. Methods

The study was conducted in three districts in Klungkung region, e.g., Banjarangkan, Klungkung, and Dawan. Klungkung region was chosen as the research site due to its inclusion as one of the areas where the national program of rice, corn, and soybean (Pajale) development was being undertaken. This study was survey research where the data gathering was conducted in a twofold manner of handing out questionnaires and interviews. The survey was conducted from 9 May until 10 August 2017 with 89 respondents. Interviews on 12 randomly selected extension worker officials were also conducted in this research.

The questionnaire used has already gone through validity and reliability testing. Validity and reliability testing were done using Microsoft Excel 2010. Validity testing with significant level or alpha of 0.05 percent found that from 15 questions, there were nine questions that are valid. Those valid questions have t-count between 2.131 to 6.978, while their t-table is 1.796. Reliability testing showed reliability test value of 0.845 or laid above 0.60; thus, the instrument could be deemed as reliable [14].

Data processing for this research was done on Microsoft Excel 2010 software, where collected data were analyzed descriptively. The collected datum is then tabulated and showed in the form of frequency and percentage table.

3. Result and Discussion

3.1. Respondents Characteristics

When looking at the education levels of the farmers it was found that 38.2% of respondents did not finish their elementary education (SD), 29.21% finished their elementary education, 4.50% finished their middle school education (SMP), 23.60% finished their high school education (SMU), and only 4.50% of respondents finished their university education. Sjakir *et al.* [15] on their research at Maros Region, at South Sulawesi, also came up with a result which showed that only 4.7% of farmers had a university

degree. Farmers with high education experience tend to be self-reliant and eager to try out new technology which they deemed would enable them to increase their farming productivity.

The findings from the respondent's professional status showed that only 82.02% of the farmers in Klungkung Region was a full-time farmer. The rest were part-time farm-workers that had other main occupation such as civil service (elementary school teacher, elementary school administration, and an employee at Kominfo Klungkung), entrepreneur, trader, driver, builder, and chicken farmer. A similar result was also found by Sjakir *et al.* [15] on their research in Maros Region, South Sulawesi, where 93.4% of farmers worked full-time as a farmer.

Findings from the size of each farmer's farm field showed that 33.70% of respondents had a farm field of the size of 1-20 are, and 35.96% owned farm field of the size of 21-40 are. There were only 5.62% (five farmers) who owned a farm field with a size over one hectare. According to Shiotsu *et al.* [16], small farmers in Bali owned less than 0.5 ha of a farm field on average. This farm field size composition for farmers in Klungkung does not differ significantly with those found at Maros Region, South Sulawesi, where around 78.6% of farmers owned less than one ha farm field [15].

3.2. Rice Straw Composting Implementation by Farmers

Based on the results from the interviews and surveys conducted on the farmers, it was discovered that there were no farmers who compost their rice straw. The absence of farmer who composts their rice straw was also found by Amamsiri and Wichramasinghe [17] in their research at Sri Lanka and Sidhu *et al.* [18] in their research at Punjab, India. The majority of farmers (97.75%) admitted to never compost their rice straw due to their lack of knowledge on the how-to and means of composting, and only 2.25% admitted to knowing a little about rice straw composting. 96.63% of farmers that did not know that composting would require decomposers and 96.63% of farmers who also did not know that decomposers were responsible for speeding up the composting process. This result is in line with the insight put forward by Supaporn *et al.* [12], that the complex and labor-intensive procedures composting rice straw inhibits farmers from composting rice straw.

It was found that as many as 73.03% of farmers said that rice straw did not need to be composted and only 2.25% that said the contrary. The majority of the farmers held the view that rice straw does not need to be composted since it has been used as mulch. A graphic representation of farmers' opinion on the necessity of composting rice straw is shown in figure 1.

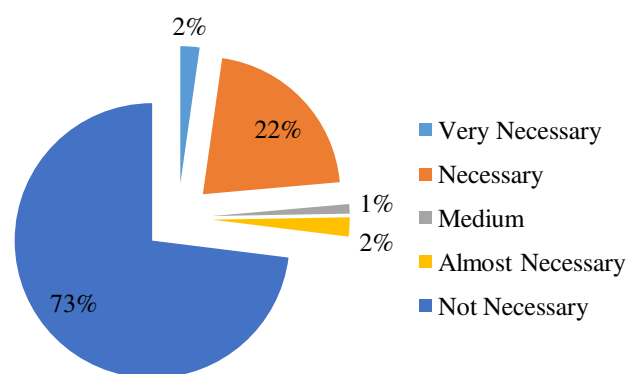


Figure 1. Farmers' opinion on the necessity of composting rice straw

Based on the research's findings, it was also discovered that 74.16% percent of farmers did not realize that rice straw could be composted. It was found that only 13.48% of farmers admitted to

knowing that rice straw could be composted and 12.36% claimed little knowledge on the subject. According to Sardjono *et al.* [19], farmers' knowledge is the prime factor in utilizing and managing rice straw waste into organic fertilizer. Knowledge is an essential prerequisite that can inform farmer's decision in adopting composting technology; hence, the role played by extension workers in promoting compost fertilizer technology becomes paramount [20].

Based on the findings from interviews done on 12 extension workers officials (PPL) at Klungkung region, it was found that 100% of them never conducted any socialization effort on rice straw composting. There was 58.33% (seven people) extension worker officials who occasionally performed socialization effort on composting and 16.67 (two extension worker officials) who once performed socialization effort on composting, but focused their socialization effort on cow manure composting. While 25% (three extension worker officials) admitted never to conduct any socialization effort on composting at all. In principle, extension workers play a significant role in popularizing composting technology among farmers [21].

Based on findings from the survey conducted, it was discovered that 78.65% of farmers were incognizant with the notion that rice straw had to be implemented back to the soil as compost. Around 82% of farmers were also incognizant with the notion that utilizing of rice straw compost could reduce synthetic fertilizer application. In general, farmers possessed little knowledge on the benefit of rice straw. Farmers also suffered from the lack of information on progress made in rice straw application that could benefit farmers economically and socially [10]. Rice straw poses a tremendous economic potential for farmers, but the lack of awareness in developing its alternative utilization has reduced the economic benefit that can be gained from it [22]. The majority of farmers had not realized the potential farm waste holds and had not realized that farm waste could be utilized as profitable source material for various industries [23].

There were 40.45% farmers who had no notion that rice straw compost can be beneficial for soil fertility and 26.97% who claimed to know about it and 32.58% who admitted some knowledge on how beneficial rice straw compost is to soil fertility. Farmers' knowledge on the benefit of rice straw compost for soil fertility is also affected by their education level, as shown in figure 2.

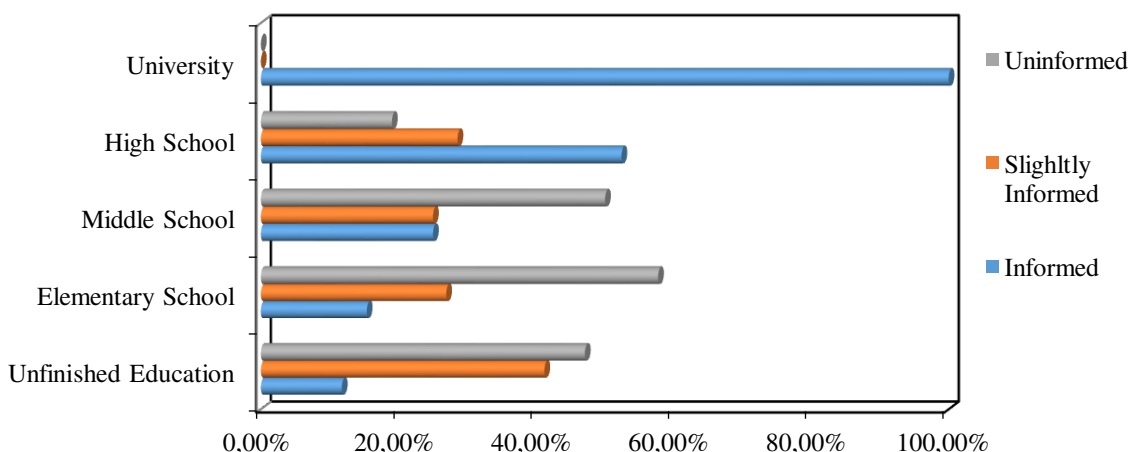


Figure 2. Knowledge level of the benefit of fertile soil compost in lieu with their education level.

Farmers' knowledge on the benefit of rice straw compost on soil fertility tends to be acquired from stories they tell among themselves or was acquired during their formal education period and not from personal experiences. The survey also revealed that 68.54% of farmers did not know that rice straw compost contains plant needed nutrients, only around 17.98% of farmers claimed to know about it and 13.48% of farmers that had a little notion of it. This unawareness of rice straw nutrients content, when turned into fertilizer, led farmers in Sri Lanka to throw away their rice straw [17]. Farmers' level of knowledge on rice straw nutrients content in lieu with their education level is shown in figure 3.

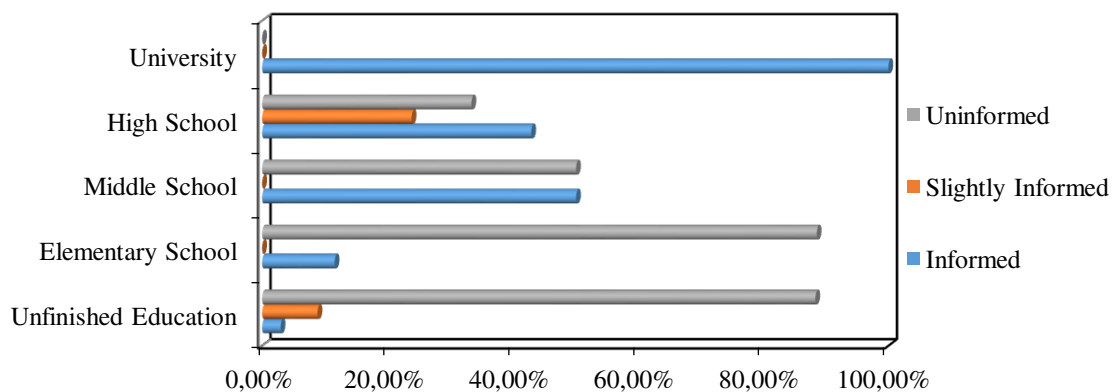


Figure 3. Farmers' level of knowledge on rice straw nutrients content in lieu with their education level

Rice straw has not been viewed as a fertilizer material along this time by the majority of farmers, and this can be seen by the 84.27% of farmers that claimed to had no notion that burning rice straw means throwing away organic fertilizer material. Around 11.24% claimed to know about it, and 4.49% claimed to had a little notion of it. This finding is in accordance with the opinion put forth by Amamsiri and Wickramasinghe [17] which stated that the majority of farmers were incognizant of the value rice straw hold as fertilizer material, this unawareness has led to the wasting of rice straw.

According to Sherawat and Sindhu [24], there was a huge gap between awareness and actual utilization of farm waste by farmers. This gap occurred due to lack of workshops, lectures, and technical demonstration on farm waste management on the field. Based on findings from this research, it was found that from 89 respondents, there were 97.75% of farmers who never participated in a rice straw composting workshop, only 2.25% (two farmers) who claimed to participate once, and only once in a rice straw composting workshop. Unfortunately, the skill gained from that workshop was never put into practice.

According to the farmers, the main obstacle in composting rice straw was their ignorance on the way or means to compost rice straw. Knowledge of fast composting technique is one factor that informed the adoption of composting technology [25]. The second obstacle in rice straw composting according to the farmers was the lack of manpower for doing the composting work. Even though on average there were three to five members in each farmer's family, yet there was only one person who helped in farm work. According to Supaporn *et al.* [12], composting rice straw would require the farmer to engage extra help and incurred additional cost due to the complexity and work-intensive nature of composting rice straw. The third obstacle farmers faced in composting rice straw is the limited amount of time available to them since aside from farming, the farmers in Klungkung have to participate in traditional communal activities that reduce the time available to them to do composting work. Not to mention that those farmers have to

prepare their field for the next planting season. Singh and Nain [21] opined that the difficulty in utilizing and composting rice straw while also stems from the lack of available time was also due to the additional manpower needed and the extraneous preparation works that were required. In the case in Thailand, several factors significantly affected farmers' decision to compost rice straw. Those factors were education level, the frequency of rice straw composting workshops, knowledge and technology, and the limited number of manpower [12].

4. Conclusion

There are no farmers who compost rice straw, and it was found that 97.75% of farmers admitted not to compost rice straw due to their ignorance on the way and means of composting rice straw. There were 74.16% of farmers had no notion that rice straw could be turned into compost. The main obstacle in composting rice straw faced by the farmers was their ignorance on the way and means to compost rice straw. Based on the findings in this study, efforts to socialize rice straw composting have to be undertaken by extension workers. A rice straw composting method that is easy to perform, fast, and able to provide quality output has to be prepared.

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