Evaluation of Planting Season and Cultivar on Post-Harvest Production and Physical Quality of Milled Rice

Martos Havena[1], Syarifah Riska Mela Putri[2]

[1](Agrotechnology, Science and Technology Faculty/ University of Pembangunan Panca Budi, Indonesia)
[2](Public Health Departement, Widya Husada School of Health Science, Indonesia)

Abstract:
Background: Indonesia is a tropical country that has two seasons; rainy and dry seasons. Characteristic differences between these seasons can make differences in production and physical quality of post-harvest rice. The objective of the study was to determine the influence of season and cultivars on the production and physical quality of post-harvest rice.
Materials and Methods: This research used Factorial Random Block Design with Dry Season (S1) and Rainy Season (S2) as the first factor, while the second factor was cultivar, Ciherang (K1), Mekongga (K2) and Inpari (K3) and 4 replications for each treatment. Parameters observed were rice production, percentage of milled rice yield, grain weight of groats and broken grains.
Results: The results showed those season and rice cultivars used give significant influence on rice production but there was no interaction between season and cultivar, and percentage of milled rice yield was influenced by cultivar but not by season. The grain weight of the groats and the broken grains were not influenced by the season and the cultivars used but rather the post-harvest technique performed.
Conclusion: From the results of this study, Ciherang cultivars were the best cultivars planted both during the rainy and dry seasons. One effort that can be made to improve the production and physical quality of milled rice is to map specific cultivars for each season as well as appropriate post harvest cultivation and harvesting techniques in each season.
Key Word: ciherang, inpari, mekongga, rice, season

I. Introduction

Indonesia is an agrarian country where the majority of its people work as farmers, planting especially rice. This is because rice is the main food of the majority of Indonesia's population. Rice (*Oryza Sativa* L.) is one of the main foods in the world and is also the main food of more than half the world's population, particularly in Asia.[1]

Rice provides 56 to 80 percent of total calories consumed in Bangladesh, Cambodia, Indonesia, Laos, Myanmar, Thailand and Vietnam. It is a major source of carbohydrates and plays an important role in nutrition intake.[2] Many rice varieties continue to be developed to obtain high quality rice and high production. However, farmers are sometimes confronted with seasonal constraints that result in reduced production and quality of rice. There are variations in the price of rice brought by farmers to markets that are influenced by annual climate change. This situation makes the domestic price very unstable.[3]

Rice varieties that have high survival skills need to be developed by countries that have diverse environments and seasons.[4] Many agronomic factors should be considered when choosing a rice cultivar for production. Environmental and seasonal factors influence grain yield and grinding each year. Because the environment is different every year, several years of testing and observations are required to make valid comparisons among cultivars.

In harvesting and improving the quality of harvested rice, the level of losses incurred, the efficiency of operations and their causes are influenced by weather-related factors, rice variations, and the technology used. Harvesting and threshing during the wet season brings wet crop problems, high water droplets susceptible to decay due to fungal and microbial invasion, difficulties in threshing, handling and transporting the grain regardless of whether the method is mechanical or manual, and the critical need for immediate drying rice. It is clear that one problem in the process stage influences the quality and efficiency of the next stage; also, mitigation measures at that stage are required.[3]

Responding to this problem, continuous research is definitely required to increase rice production in each harvest season. This study aims to determine the influence of the harvest season and rice cultivars on the quality of rice efficiency and production.

II. Material And Methods

Study Location : This research was conducted at Dusun Paluh Merbau, Tanjung Rejo Village, Percut Sei Tuan Subdistrict, Deli Serdang Regency, North Sumatera Province which is 15 m above sea level and 1.5-2,0 km from the coast; Laboratory Growth Center Kopertis Region 1 and Laboratory Pembangunan Panca Budi University from April 2016 until April 2017.

The materials used in this study were rice cultivars with evaluation of potential outcomes of Ciherang, Mekongga, Inpari. This research used Factorial Random Block Design with 2 Factors of Treatment; the first factor is Season consisting of Dry Season (S1) and Rainy Season (S2); while the second factor is Cultivar consisting of Ciherang (K1), Mekongga (K2) and Inpari (K3) Cultivars with 4 experiment replications. In order to find out the influence of the treatment in the test, variant analysis was used. Furthermore, if there was significant influence, the data analysis were continued by using Duncan Multiple Range Test (DMRT) at 5% real level.

Trial Implementation : This research was conducted in two stages. The planting in the dry season was done from April until July 2016 and the planting in the rainy season took place from October 2016 until January 2017. The stages of rice cultivation include preparation of tools and materials, harvesting, grain drying to moisture content of 14%, milling, and weighing components of physical quality of milled rice. Observations included rice production and percentage of milled rice yield.

III. Result

Rice Production

Based on the data obtained, the highest average of rice production was during the rainy season as much as 7.09 tons, while the cultivars that produced the most rice were Ciherang cultivars with 7.91 tons. Detailed data on rice production based on season and cultivars are presented in the following Figure 1 and Figure 2.
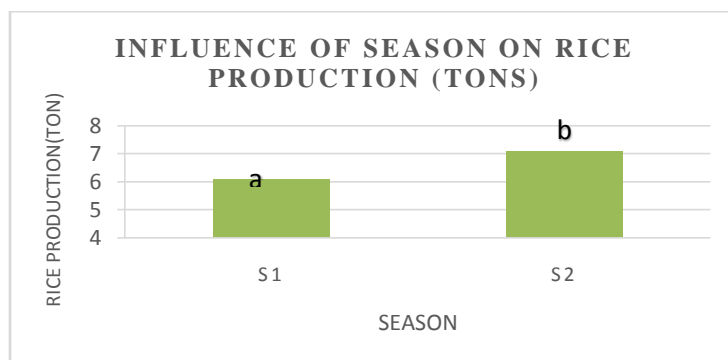

Figure 1. Average rice production (ton) based on season.
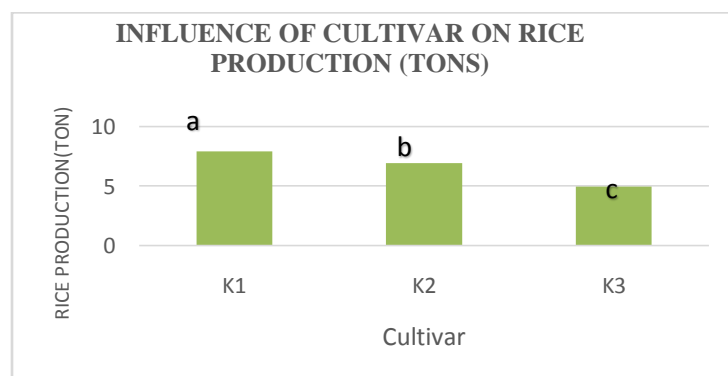Ex : S1 (Dry season) and S2 (Rainy season).

Figure 2. Average rice production (ton) based on cultivars.
Ex : K1 (cultivar Ciherang) , K2 (cultivar Mekongga) and K3 (cultivar Inpari).

Percentage of Groat Grain Weight and Broken Grain (%)

Based on the data obtained, the highest percentage of groat grains rice was demonstrated by Mekongga cultivar with 7.13% and the lowest was Ciherang cultivar with 6.83% during the rainy season, while the highest broken grain percentage was demonstrated by Mekongga cultivar with 8.23% during the dry season and the lowest was Ciherang cultivar at 8.05% during the rainy season. Full data percentage of groat grain weight and broken grains based on season and cultivars is presented in the following table 1.

Table 1. Percentage of Groat Grain Weight and Broken Grain (%) based on season and cultivars

Cultivar	Groat grain (%)		Broken grain(%)	
	Dry Season	Rainy Season	Dry Season	Rainy Season
Ciherang	6,9 a	6,83 a	8,15 a	8,05 a
Mekongga	7,02 a	7,13 a	8,23 a	8,2 a
Inpari	7,12 a	7,05 a	8,18 a	8,13 a

Description: The average number followed by the same letter shows no significant difference based on the 5% DMRT test.

Percentage of Milled Rice Yield

Based on the data obtained, the highest percentage of milled rice production in the dry season was demonstrated by ciherang cultivar with 65% and the lowest was inpari cultivar with 50,5%. In the rainy season, the highest yield of milled rice was found in ciherang cultivar with 64.25% and the lowest was inpari cultivar with 51.5%. The data percentage of milled rice yield based on season and time is illustrated in the following figure 3.
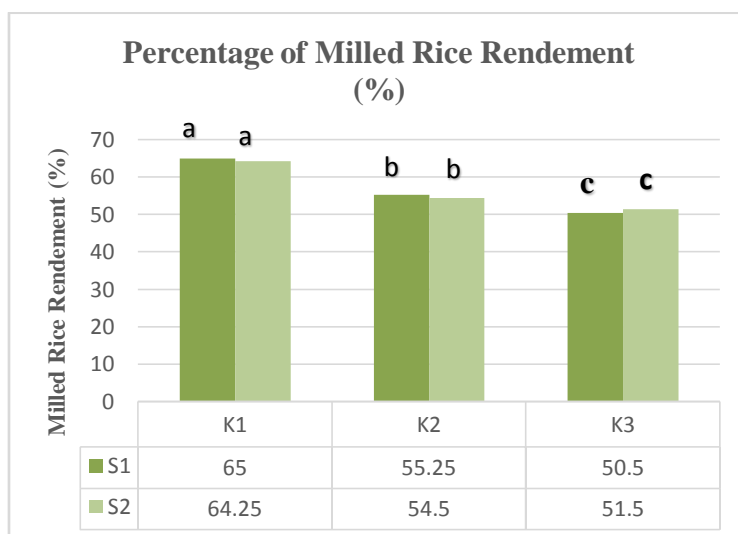

Percentage of Milled Rice Rendement (%)

	K1	K2	K3
S1	65	55.25	50.5
S2	64.25	54.5	51.5

Figure 3. Percentage of Rice Mill Yield by season and cultivar.
ex : K1 : Ciherang, K2 : Mekongga, K3 : Inpari, S1 : Dry Season, S2 : Rainy Season.

IV. Discussion

Rice Production

The weight of grain harvested in the rainy season was higher than that of in the dry season. This was due to the high rainfall in the rainy season, causing higher water content in the rice. Latiri et al. states that crop production is highly correlated with rainfall during the growing season.[5] The cultivars used were also very influential on the rice production where Ciherang cultivar was the cultivar with the highest rice production compared to the others. According to Sumarno et al., superior variety was a component of rice cultivation technology that is adopted well by farmers to improve agricultural production. However, statistical analysis showed no correlation between season and cultivar with rice production.[6]

Percentage of Groat Grain Weight and Broken Grain (%)

The results of statistical analysis showed that there was no significant influence of season, cultivar treatment and their interactions on the percentage of grain weight of groats and broken grains. This might be due to high or low rice groats and broken rice due to post-harvest handling techniques. Grain water level also determined the formation of grains groats and grains broken in the process of rice milling. According to Soerjandoko, variations in percentage of rice head and broken rice could be caused by different rice cultivation sites or post-harvest handling.[7] Broken rice can occur if, at the time of grinding, the grain is still wet or too dry.

The rest of the small rice fracture forms a grain of groats. Broken rice can also be caused by the process of milling. New millstone can produce high broken rice, whereas already worn-out millstone produce less broken rice.

Percentage of Milled Rice Yield

The result of statistical analysis showed that there was no interactional influence of season and cultivar treatment on the average percentage of milled rice production but cultivars had a significant effect on the production of milled rice. Ciherang cultivars were the best cultivar in both the rainy and dry seasons. This could be due to the superiority of Ciherang cultivar compared to the other two cultivars and suitability for planting in tidal rice fields. Uncultivated dry paddy grain water content was also one of the reasons for the high production of milled rice from these varieties.

The quality of milled rice produced from the milling process was influenced by several factors, including varieties, the water content of dry grain harvest and dry milled grain,[8,9] a factor of pre-harvest (the location of rice crops, cultivation techniques, fertilization,[7,10] post-harvest handling (drying process, packaging, and storage conditions), and grinding machine condition and milling technique. [9,10]The non-seasonal influence on the production of milled rice could be due to good post-harvest handling process so that the water content in the rice was not too high or low i.e. between 13-14%. Grain at a relatively low / dry water content will increase the number of broken grains to increase the amount of broken rice during grinding. Similarly, grain with too high water content will result in relatively soft grain, causing the high brown rice during milling. So in other words, the quality of milled grain will influence the quality of rice produced. The process of milling is also one of the stages in postharvest handling of rice that plays an important role and also determines the level of rice yield and quality of milled rice produced. Of the 20.51 percent loss of crop yields and post-harvest crops resulted from imperfect post-harvest handling, causing the yield loss in the milling stage up to 2.04 percent.

V. Conclusion

Different seasons and cultivars used had significant effect on rice production. Production of rice was higher in the rainy season and Ciherang was a rice cultivar with the highest production, but there was no interaction between seasons and cultivars on the rice production. The rice cultivars used also had a very significant influence on the milled rice yield. Ciherang cultivar was a cultivar that produces the highest rice yield in both rainy and dry seasons. The grain weight of the groats and the broken grains were not influenced by the season and the cultivars used, but rather the post-harvest technique performed.

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