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The Impact of Employing Microbacter Alfaafa – 11 (MA-11) and Organic Fertilizer on the Quantity and Quality of Rice Resulting from the Crossing of Sigupai and IRBB27

Suryani[1*], Rita Hayati[2], Helmi[3]
[1] Master of Agroecotechnology, Faculty of Agriculture, Syiah Kuala University, Banda Aceh, Indonesia
[2,3] Department of Agroecotechnology Faculty of Agriculture, Syiah Kuala University, Banda Aceh, Indonesia

ABSTRACT: The objective of this study is to assess the impact of employing Microbacter Alfaafa-11 MA-11 and organic fertilizer on the yield and quality of the F9 rice variety resulting from the crossbreeding of sigupai with IRBB27. The research was conducted at the Saree State Vocational School-PP located in the Lembah Seulawah District of Aceh Besar Regency. The physical and chemical parameters of rice were analyzed at the Seed Science and Technology Laboratory and Plant Physiology Laboratory, Faculty of Agriculture, Syiah Kuala University, between February 2023 and August 2023. This study employed a factorial Randomized Group Design (RAK) with 12 treatment combinations. Each treatment had 3 replications, and each replication consisted of 3 pots. Therefore, there were a total of 36 experimental units. The variables in this study include the initial factor: the concentration treatment of Microbacter Alfaafa-11 (MA-11) (A), which is divided into 4 levels: A0 (with no MA-11), A1 (0.05 ml MA-11 per 2.50 ml water), A2 (0.1 ml MA-11 per 2.50 ml water), A3 (0.15 ml MA-11 per 2.50 ml water). The second factor is the application of organic fertilizer treatment, which includes two components: Super Bokashi Fertilizer dose and Biofarm concentration. This factor is divided into three levels: B1 Super Bokashi (10 t ha-1), B2 Biofarm (14-liter ha-1), and B3 Super Bokashi + Biofarm (10 t ha-1 + 14-liter ha-1). The observation criteria include agronomic factors such as harvest age, as well as rice quality tests that assess physical features such as yield rice, milled rice, rice dimensions, and chemical attributes such as water content and protein content. The findings indicated that the use of Microbacter Alfaafa-11 MA-11 and organic fertilizer did not have any notable impact on the harvest age and rice quality parameters of the F9 line resulting from the crossbreeding of sigupai with IRBB27. The maximum rice yield achieved a percentage of 74.98%, with the average being slender rice. The water content ranged from 14.00% to 15.80%, while the highest protein level reached 6.93.

KEYWORDS: Activator, crossbreeding, organic fertilizer, rice quality.

INTRODUCTION

Rice plants, scientifically known as Oryza sativa L., serve as a primary source of carbohydrates for the majority of the global population. The majority of the Indonesian population, almost 95%, relies on rice as their main source of sustenance, consuming an average of 114.13 kilograms per person per year (Herlika et al., 2020). According to the Central Statistics Agency (2021), the rice harvest area in 2021 was around 10.41 million hectares, showing a drop of 245.47 thousand hectares or 2.30 percent compared to the 10.66 million hectares of rice harvest area in 2020. In 2021, the production of milled dry grain rice was 54.42 million tonnes (GKG), which is a drop of 233.91 thousand tonnes or 0.43 percent compared to the 2020 rice production of 54.65 million tonnes of milled dry grain. The rice production for food consumption in 2021 was 31.3 million tons, showing a drop of 140.73 thousand tons or 0.45 percent compared to the 2020 production of 31.50 million tons. The scarcity of high-quality seeds is a primary factor contributing to the decrease in rice production. It was clarified that the limited access to high-quality seeds was a result of a scarcity or inadequacy in supplying superior types. Seeds, as stated by Tefa (2017), are the fundamental planting materials that play a crucial role in determining the initial success of a plant-growing process.

To address this issue, one potential solution is to cultivate high-quality cultivars, such as the F9 rice line obtained by the hybridization of Sigupai and IRBB27. Superior varieties can be developed through hybridization or crossing, which enhances the genetic variety of a commodity by combining desirable traits from its parents. The hybrid parents included in the study consisted of both local and introduced kinds. The female parent was the Sigupai rice variety, while the male parent was the IRBB27 variety (Amanina et al., 2019). The Sigupai variety is a native rice strain that originates from the South West region of Aceh in Indonesia.

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This particular variety has the benefits of a delectable rice flavor and a pleasant pandan scent, along with high crop production and adaptability. It requires minimal maintenance and has low fertilizer requirements (Azis et al., 2019). The Sigupai cultivar has drawbacks, including extensive vegetative growth, tall plant stature resulting in susceptibility to lodging (Amanina et al., 2019), and a low yield of merely 4 tons per hectare in a single harvest (Darmadi and Mirza, 2018). The IRBB27 variety, developed by the International Rice Research Institute (IRRI), exhibits exceptional productivity, disease resistance, and early maturation (3.5 months), and possesses genes that result in a shorter plant structure with compact stems (Efendi et al., 2020).

Another strategy to enhance rice production and improve its productivity and quality is through the application of fertilizers (Directorate General of Food Crops, 2016). An approach to enhance rice output involves supplying fertilizer based on the specific requirements of the plants. The utilization of organic fertilizer garners significant attention from several sectors due to the abundant availability of raw materials for compost production in agricultural regions. Nevertheless, the process of recycling plant wastes remains challenging due to the inherent slow decomposition of agricultural waste (Kurniawan et al., 2014). In order to address this issue, it is imperative to create a well-proportioned blend of substances, including the incorporation of water-regulating aeration and the introduction of an activator with the ability to rapidly decompose all organic materials (Herlika et al., 2020).

An effective activator that can be utilized is MA-11. Microbacter Alfaafa (MA-11) is a very efficient microbial decomposer capable of rapidly breaking down organic compounds, hence promoting soil health and improving its texture. In addition, MA-11 consists of Rhizobium sp bacteria together with a mixture of cellulolytic, proteolytic, and amylolytic bacteria derived from the rumen of cows. The bacteria present in the cow's rumen are responsible for the decomposition of cellulose, making it more easily digestible for Rhizobium sp bacteria. These bacteria have the ability to bind nitrogen that is not in a combined form (Artarizqi, 2012).

An activator can expedite the production of organic fertilizer, whether in solid or liquid form, such as compost, super bokashi, and biofarm. Compost can enhance the physical, chemical, and biological characteristics of soil. It is derived from organic waste, including plant residues (such as straw, stems, branches, and leaves), domestic garbage, livestock manure (from cows, goats, chickens), husk charcoal, and similar materials (Herlika et al., 2020). Super Bokashi is an organic fertilizer made from solid livestock manure that has undergone decomposition by Microbacteria Alfaafa - 11 (MA-11). The objective of this breakdown process is to enhance the concentration of micro and macronutrients present in the solid waste material. Furthermore, biofarm is an organic liquid fertilizer derived from liquid cattle manure that has undergone breakdown by micro bacteria Alfaafa - 11. Based on the aforementioned description, it is imperative to conduct additional research on the impact of utilizing Microbacter Alfaafa - 11 MA-11 and organic fertilizer on both productivity and quality. The F9 rice line is obtained by crossing the sigupai variety with IRBB27.

MATERIALS AND METHODS

Place and time of research

The study was conducted at Saree State Vocational School-PP, Lembah Seulawah District, Aceh Besar Regency. The physical and chemical properties of rice were analyzed at the Seed Science and Technology Laboratory and the Plant Physiology Laboratory, Faculty of Agriculture, Syiah Kuala University. The study was conducted between February 2023 and August 2023.

Tools and materials

The utilized instruments include planting containers, wooden rulers, trays, seed blowers, wooden mortars, analytical scales, rulers, ovens, Kjeldahl flasks, moisture meters, Erlenmeyer flasks, and cameras. The utilized materials consist of inbred rice lines at the F9 stage, super bokashi, biofarm, Microbacter Alfaafa-11 (MA-11), soil, and rice.

Research design

This study employed a factorial Randomized Block Design (RAK) comprising 12 treatment combinations. Each treatment had 3 replications, with each replication consisting of 3 pots. Consequently, there were a total of 36 experimental units. The factor being studied in this research is the concentration treatment of Microbacter Alfaafa-11 (MA-11) (A). There are four levels of concentration: A0 (no MA-11), A1 (0.05 ml MA-11 per 2.50 ml water), A2 (0.1 ml MA-11 per 2.50 ml water), and A3 (0.15 ml MA-11 per 2.50 ml water). The second component is the use of organic fertilizer treatment, namely the dosage of Super Bokashi Fertilizer and the concentration of Biofarm. This factor is divided into three levels: B1, which involves applying 10 t ha-1 of Super Bokashi; B2, which involves applying 14 liters ha-1 of Biofarm; and B3, which involves applying both 10 t ha-1 of Super Bokashi and 14 liters ha-1 of Biofarm.

Research Parameters

Harvest age

The harvest age is determined by the period between planting and when the plant reaches maturity for harvesting. This is shown by the yellowing of the grain and leaves, the drooping of the stalk due to the grain being fully developed, and the hardness of the grain when pressed.

Rice Quality Test

Physical properties of rice

Prior to conducting physical property tests on rice, the rice grains are first separated from the empty grains and then weighed to ascertain the quantity, before removing the rice husks. Once all the rice grain samples have been weighed, they are processed using a rice grinding machine in order to remove the outer layer and obtain brown rice. The observed parameters for assessing the physical qualities of rice were as follows:

a. Milled Rice Yield (%)

The milled rice yield was determined by taking 230 grams of ground, dehydrated unhulled grain, which had been exposed to sunlight for 1 hour. The grain was then placed in a wooden mortar and pounded to separate the husks. The brown rice, after being separated from its husk, is first weighed to remove any impurities and then weighed again. The measurement of milled rice yield is determined by employing the subsequent formula:

$$R = \frac{\text{bbpk}}{\text{bgkg}} \text{ x } 100\ \%$$

Information:

R : yield %

bbk : weight of broken rice (g)

bgkg : weight of milled dry grain (g)

b. Rice Dimensions (mm)

The dimensions of rice can be estimated by calculating the ratio of the length (P) to the width (L) of 5 entire grains of rice, measured in millimeters. The length of the rice grain is determined by measuring the distance between its two ends, while the width is measured between the back and the belly of the entire grain. The methodology for rice form classification is presented in Table 1.

Table 1. Classification of Rice Forms

Classification of Rice Forms	*Ratio P/L*
Slender	>3,0
Medium	2,1 - 3,0
whole	1,1-2,0
Round	<1,1

Source: (IRRI, 2012)

Chemical Properties of Rice

The analysis of rice's chemical characteristics was conducted using rice flour samples. The weight of rice that underwent peeling and husking in each treatment was precisely 50 grams. Subsequently, the rice sample was pulverized in a dry spice blender, undergoing two stages of blending until achieving a smooth consistency. During the initial phase, the rice is placed into a fully dry blender and processed until it reaches a smooth consistency. Subsequently, the mixture is filtered to separate the smooth rice from the remaining grains that are not yet smooth. During the second phase, the rice, which is still coarse, undergoes further blending until it achieves a smooth consistency. The observed parameters for assessing the physical qualities of rice were as follows:

a. Water content (%)

Determination of rice moisture content was carried out using a grain moisture meter, G-won brand, and type GMK-303RS.

b. Protein Content (%)

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Rice protein content was measured using the Kjeldahl method. This method consists of 3 stages, namely digestion, distillation and titration.

1) Destruction Stage
The rice flour sample was weighed at 0.5 grams, then put into a Kjeldahl flask. Then add 10 ml of concentrated H2SO4 and 1/3 of a Kjeldahl tablet. Then the Kjeldahl flask was put into the digestion apparatus for 1 hour until the solution was clear green.
2) Distillation Stage
The solution, which has turned a distinct shade of green, is subsequently combined with 100 cc of distilled water. Subsequently, a volume of 10 ml from the solution was transferred into a measuring flask. Subsequently, a 10 ml solution of NaOH was prepared. A 5 ml solution of boric acid was prepared in an Erlenmeyer flask, followed by the addition of 3 drops of MR-MB indicator. Subsequently, the distillation apparatus is subjected to heat until it reaches its boiling point. Following the boiling process, the sample solution is transferred into a distillation device. Subsequently, distilled water is introduced, and the NaOH solution is heated until it reaches its boiling point. Once the boric acid solution has been boiled, it is then positioned beneath the container using an Erlenmeyer flask. The distillation process is continued until a solution with a green hue is achieved.
3) Titration Stage
The titration stage is carried out using HCl solution. The green distilled solution is dripped with HCl solution until it changes color to pink. The titrated volume of the reduced HCl solution is then recorded.
Protein content can be calculated using the following formula:

$$\text{Nitrogen (\%)} = \frac{\text{ml HCl x N HCl x 14,007 x fp x 100}}{\text{sample weight (mg)}}$$

$$\text{Protein Content (\%)} = \text{N (\%) x protein conversion factor}$$

Information:
dilution factor (fp) : 11
protein conversion factor : 5.95

Data Analysis

Data analysis involves doing ANOVA on each observed parameter. If the F test results indicate a significant effect, a subsequent test will be conducted using the Least Significant Difference test at a significance level of 5% (BNT 0.05).

RESULTS AND DISCUSSION

The impact of employing Microbacter Alfaafa – 11 (MA-11) and organic fertilizer on the rice harvesting age, as observed from the crossing of Sigupai and IRBB27

The F test results indicated that the application of Microbacter Alfaafa – 11 (MA-11) and organic fertilizer did not have a statistically significant impact on the age at which the harvest occurred. The mean age of the harvest can be observed in Table 2. According to Table 2, there is no statistically significant difference in harvest age. However, it is evident that the fastest harvest age was observed after injecting 0.15 ml of MA-11.

Table 2. Average Harvest Age Due To Use Of Microbacter Alfaafa – 11 (Ma-11) And Organic Fertilizer

Concentration MA 11	*Harvest Age (Days)*
A_0 (Without MA 11)	115,96
A_1 (0,05 ml MA 11)	117,59
A_2 (0,1 ml MA 11)	118,74
A_3 (0,15 ml MA 11)	119,56
Types of Organic Fertilizer	***Harvest Age***
B1 (Super bokashi fertilizer)	117,89
B2 (Biopharm)	117,94
B3 (Super bokashi fertilizer + Biofarm)	118,06

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The impact of employing Microbacter Alfaafa – 11 (MA-11) and organic fertilizer on the physical and chemical characteristics of rice derived from the Sigupai and IRBB27 crosses.

Rice Yield (%)

Table 3 displays the data regarding the average rice yield resulting from the application of Microbacter Alfaafa - 11 (MA-11) and organic fertilizer. According to Table 3, the highest rice yield is typically achieved by using a dosage of 0.05 ml of Microbacter Alfaafa - 11 (MA-11) and super bokashi fertilizer + biofarm. The table presents the rice yield values resulting from the use of Microbacter Alfaafa – 11 (MA-11) and organic fertilizer.

Table 3. Rice Yield Value Due To The Application of Microbacter Alfaafa – 11 (MA-11) and Organic Fertilizer

Treatment	*Rice Yield (%)*
A_0 (Without MA 11) B_1 (Super bokashi fertilizer)	74,88
A_0 ((Without MA 11) B_2 (Biopharm)	71,66
A_0 (Without MA 11) B_3 (Super bokashi fertilizer + Biofarm)	74,91
A_1 (0,05 ml MA 11)B_1 (Super bokashi fertilizer)	74,73
A_1 (0,05 ml MA 11) B_2 (Biopharm)	74,13
A_1 (0,05 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	74,98
A_2 (0,1 ml MA 11) B_1 (Super bokashi fertilizer)	68,04
A_2 (0,1 ml MA 11) B_2 (Biopharm)	68,58
A_2 (0,1 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	69,57
A_3 (0,15 ml MA 11) B_1 (Super bokashi fertilizer)	74,80
A_3 (0,15 ml MA 11) B_2 (Biopharm)	67,90
A_3 (0,15 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	65,87

Rice Dimensions (mm)

The average dimensions of rice, influenced by the usage of Microbacter Alfaafa – 11 (MA-11) and organic fertilizer, are presented in Table 4. The typical dimensions of rice fall within the range of 3.00 mm to 3.60 mm and exhibit various categories based on their form. The shape of the rice is determined by the genetic makeup of each genotype, which can range from slender to medium.

Table 4. Rice Dimensions Resulting From The Application of Microbacter Alfaafa – 11 (MA-11) and Organic Fertilizer

Treatment	*Ratio P/L (mm)*	*Classification of rice forms*
A_0 (Without MA 11) B_1 (Super bokashi fertilizer)	3,10	Slender
A_0 ((Without MA 11) B_2 (Biopharm)	3,40	Slender
A_0 (Without MA 11) B_3 (Super bokashi fertilizer + Biofarm)	3,10	Slender
A_1 (0,05 ml MA 11)B_1 (Super bokashi fertilizer)	3,30	Slender
A_1 (0,05 ml MA 11) B_2 (Biopharm)	3,00	Medium
A_1 (0,05 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	3,20	Slender
A_2 (0,1 ml MA 11) B_1 (Super bokashi fertilizer)	3,20	Slender
A_2 (0,1 ml MA 11) B_2 (Biopharm)	3,50	Slender
A_2 (0,1 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	3,60	Slender
A_3 (0,15 ml MA 11) B_1 (Super bokashi fertilizer)	3,00	Medium
A_3 (0,15 ml MA 11) B_2 (Biopharm)	3,30	Slender
A_3 (0,15 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	3,09	Slender

Water content (%)

Table 5 displays data regarding the average rice yield resulting from the application of Microbacter Alfaafa - 11 (MA-11) and organic fertilizer. The research findings indicate that the water content of rice falls within the range of 14.00% to 15.80%, which meets the quality standards for rice.

Table 5. Water content due to the application of Microbacter Alfaafa – 11 (MA-11) and organic fertilizer

Treatment	*Water content (%)*
A_0 (Without MA 11) B_1 (Super bokashi fertilizer)	14,80
A_0 ((Without MA 11) B_2 (Biopharm)	15,30
A_0 (Without MA 11) B_3 (Super bokashi fertilizer + Biofarm)	15,10
A_1 (0,05 ml MA 11)B_1 (Super bokashi fertilizer)	14,70
A_1 (0,05 ml MA 11) B_2 (Biopharm)	15,50
A_1 (0,05 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	15,10
A_2 (0,1 ml MA 11) B_1 (Super bokashi fertilizer)	14,80
A_2 (0,1 ml MA 11) B_2 (Biopharm)	15,50
A_2 (0,1 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	15,30
A_3 (0,15 ml MA 11) B_1 (Super bokashi fertilizer)	14,70
A_3 (0,15 ml MA 11) B_2 (Biopharm)	15,80
A_3 (0,15 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	14,00

Protein Content (%)

Table 6 displays data regarding the average rice yield resulting from the application of Microbacter Alfaafa - 11 (MA-11) and organic fertilizer. The observations indicate that the A3B1 treatment, which involved the application of organic fertilizer, resulted in the highest protein content of 6.93.

Table 6. Protein levels due to administration of Microbacter Alfaafa – 11 (MA-11) and organic fertilizer

Treatment	*Protein Content (%)*
A_0 (Without MA 11) B_1 (Super bokashi fertilizer)	2,87
A_0 ((Without MA 11) B_2 (Biopharm)	3,77
A_0 (Without MA 11) B_3 (Super bokashi fertilizer + Biofarm)	2,62
A_1 (0,05 ml MA 11)B_1 (Super bokashi fertilizer)	3,91
A_1 (0,05 ml MA 11) B_2 (Biopharm)	5,33
A_1 (0,05 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	4,61
A_2 (0,1 ml MA 11) B_1 (Super bokashi fertilizer)	5,42
A_2 (0,1 ml MA 11) B_2 (Biopharm)	4,44
A_2 (0,1 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	5,20
A_3 (0,15 ml MA 11) B_1 (Super bokashi fertilizer)	6,93
A_3 (0,15 ml MA 11) B_2 (Biopharm)	6,27
A_3 (0,15 ml MA 11) B_3 (Super bokashi fertilizer + Biofarm)	6,42

CONCLUSION

There was no statistically significant difference observed in the harvest age. The age at which a harvest can occur is determined by hereditary variables. The age at which plants are harvested is connected to their age at flowering, and the timing of flowering is determined by the genetic characteristics of each individual plant (Yulina et al., 2020). Nonetheless, a blooming period of 82-87 days post-sowing remains optimal for rice plants to achieve abundant yields. Sujinah et al. (2020) determined that the ideal time for rice plants to achieve optimal outcomes in terms of flowering is approximately 85-94 days following sowing. According to the Center for Rice Plant Research (2015), the age at which rice plants are ready for harvest can be divided into six categories: ultra-early (less than 90 days after sowing), very early (90 to 104 days after sowing), early maturing (105 to 124 days after sowing), medium (125 to 150 days after sowing), and mature (if more than 165 days after sowing).

Optimal rice production is often achieved by administering a dosage of 0.05 ml of Microbacter Alfaafa – 11 (MA-11) in combination with super bokashi + biofarm fertilizer. The yield of rice is impacted by various factors, including nitrogen. Nitrogen is an essential component in rice cultivation since it plays a crucial role in determining both the quantity and quality of the grain (Zhu et al., 2017). Nitrogen has the potential to enhance grain quality by increasing grain size, improving milling quality (including hulled rice, percentage of milled rice, and percentage of head rice), enhancing appearance quality (such as percentage of calcified rice, size of liming and liming), and improving cooking quality (including amylose content, gel consistency, peak viscosity, damage, and deterioration). In addition, Chairunnisak et al (2021) found that variety is a significant element that directly impacts milling yield. Winarno (2014) further confirms that the milled yield is influenced by factors such as the raw grain material, variety, degree of maturity, prehandling procedure, and kind of grinding equipment. The polishing of rice is another factor that affects the output of milled rice. According to Iswanto et al (2018), the polishing process of rice leads to the conversion of certain rice components into bran due to the application of friction and pressure. Consequently, this results in a reduced quantity of milled rice. Nurjaya and Maulida (2018) further said that the efficiency of the machinery employed in the milling procedure directly impacts the output of processed rice.

The mean dimensional value of rice varies between 3.00 and 3.60, and it is classified as slender or medium in shape. The shape of the rice is determined by the genetic characteristics of each genotype. According to Nasution et al (2022), the size and form of rice are determined by the dominant traits inherited from the genetic characteristics of the parents. The dimensions of rice are a fundamental criterion for assessing rice quality in the global market. The local rice typically has a rice length that falls within the medium to long range, and a rice grain form that ranges from slender to slightly spherical (Rini and Hendrival, 2017; Hendrival et al., 2018). Rice grains in Indonesia often exhibit a medium to long size. Genetic factors, agroecosystems, land fertility, and fertilization during rice farming all influence the length and shape of rice. The amylose content of long rice grains ranges from 19% to 23%. This type of rice has a resilient texture and emits a pleasant aroma (Afza, 2016).

The research findings indicate that the water content of rice falls within the range of 14.00% to 15.80%, which meets the quality standards for rice. The standard SNI 01-61282008 specifies that the acceptable range for water content in rice is from 14% to 15%, and the evaluation of milling outcomes is part of the quality criteria V. With increased moisture, the grain becomes resistant to peeling, whereas decreased moisture causes the grains to become more fragile and prone to breaking. The stability of a material during storage is influenced by its water content. Materials with a high-water content have a short shelf life, making them susceptible to deterioration during storage. The shelf life of grain is primarily determined by its water content, which can be impacted by elements such as temperature, oxygen, seed condition, storage period, and biological factors like fungi and insects (Arsyad and Saud, 2020). Kalsum et al (2020) found that elevated temperature and humidity levels can have an impact on the moisture content of grains. Elevated temperatures in the storage chamber (ranging from 30oC to 40oC) can induce alterations in the physical and chemical characteristics of the grain. Increased temperatures and higher water content will result in more significant alterations. This assertion is corroborated by Somantri, et al (2014), who demonstrate that the alteration pattern during storage is consistent across all types of rice. However, the extent of these alterations is contingent upon factors such as storage room temperature and humidity, duration of storage, and the specific rice variety.

The observations indicate that the A3B1 treatment, which involved the application of organic fertilizer, exhibited the greatest protein content at 6.93%. These findings demonstrate that the nutrient composition of this particular organic fertilizer has the capacity to enhance the amounts of protein in rice. According to Anisuzzaman et al's (2021) research, the protein and amino acid levels in rice grains were found to increase when nitrogen and organic fertilizer were added. The average protein content increased to 2.95% and 3.08%. However, the addition of organic fertilizer resulted in a decrease in amylose content and gel consistency compared to samples without organic fertilizer. Nitrogen is a crucial component in plant metabolism, but it is not easily accessible to plants (Edi, 2018). Therefore, augmenting the amount of the NPK element will also impact the growth of rice plants (Iswahyudi, et al. 2018; Tridiati, et al. 2012).

Nitrogen is essential for the development of vegetative components in plants, including leaves, stems, and roots. Plant roots absorb nitrogen in the form of nitrate and ammonium; however, this nitrate is rapidly converted to ammonium by enzymes that contain molybdenum. Greater availability of nitrogen leads to increased protein production. The process of panicle production exhibits a greater degree of nitrogen absorption compared to other processes. Additionally, there exists a close correlation between organic material and nitrogen levels, such that higher nitrogen content corresponds to increased organic content, and vice versa (Rahayu, et al. 2018). Plants assimilate nitrogen by the uptake of NO3- and NH4+ ions. Nitrogen is crucial for plants as it facilitates the synthesis of chlorophyll, which imparts the green color to plants. Facilitates the development and synthesis of amino acids (protein synthesis) and enzymes within plant cells (Edi, 2018). Insufficient nitrogen leads to reduced growth and impacts fruit output, but does not influence the overall yield if nitrogen levels are high (Yuliani et al., 2017). In addition, Potassium (K) plays a crucial role in promoting flowering and fruiting, enhancing the plant's defensive mechanisms, facilitating various chemical activities such as glucose, sugar, protein, and enzyme metabolism essential for fertility, and controlling water balance. Insufficient potassium adversely affects plants by impeding protein synthesis, causing leaves to turn yellow, tips to wrinkle, and growth to be impeded (Zulkifli et al., 2023). Rice protein contains eight out of the 10 indispensable amino acids. Rice has elevated levels of lysine in comparison to other cereals, such as corn and wheat, which aids in digestion and contributes to its superior nutritional value (Santos et al., 2013). The protein levels in rice are affected by factors such as genotype, plant cultivation system, and the analytical methodologies employed (Kim et al., 2013).

Ultimately, the utilization of Microbacter Alfaafa-11 MA-11 and organic fertilizer did not yield any noteworthy impact on the harvest age and quality of rice in the F9 rice line resulting from the crossbreeding of sigupai with IRBB27. The maximum rice yield achieved a rate of 74.98%, with the average being slender rice. The water content ranged from 14.00% to 15.80%, while the highest protein level reached 6.93.

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