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Application of Dolomite on The Growth And Yield of Various Rice Genotypes (*Oryza sativa* L.) Grown on Peat Soil

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Abstract
Rice is the primary staple food for the Indonesian population. However, land use changes have increasingly limited the availability of potential land for rice cultivation. Indonesia possesses vast areas of peatland, which offer significant opportunities for rice extensification. Nonetheless, the acidic and nutrient-poor nature of peat soils necessitates soil improvement efforts through the application of soil ameliorants. Dolomite is one such ameliorant that can enhance the chemical properties of soil and improve nutrient uptake by plants. This study aimed to evaluate the interaction between rice genotypes and dolomite application rates on the growth and yield of several rice genotypes cultivated on peatland. The experiment was conducted from June to December 2024 in Sunur Village, Nan Sabaris District, Padang Pariaman Regency, Indonesia, using a Split Plot Design in a randomized complete block layout with three replications. The results showed that the genotype and dolomite application significantly affected several agronomic parameters, particularly the 1000-grain weight. Genotypes Bujang Marantau and Caredek exhibited superior performance in most yield components. Dolomite application at 10 tons/ha proved to be the most effective dose, enhancing plant growth and productivity under peat soil conditions. These findings offer practical recommendations for optimizing rice production on marginal peatlands and promoting sustainable agricultural development in Indonesia.

Keywords: Dolomite, Peatland, Rice Genotypes, Soil Amelioration, Sustainable Agriculture

1. Introduction

Rice (*Oryza sativa* L.) is a major staple food crop for a significant portion of the global population. In Indonesia, rice serves as the primary dietary staple and is consistently expected to be available in sufficient quantity, good quality, and at affordable prices. The demand for rice continues to rise in line with the country's growing population (Warta BSIP Pasca Panen, 2023).

Despite the increasing demand, national rice production in Indonesia remains heavily dependent on paddy field cultivation. Several factors influence rice production, one of which is the choice of genotype used for cultivation. Exploration of local rice genotypes in West Sumatra conducted by Swasti *et al.* (2007) identified more than 50 genotypes still being cultivated by local farmers. Among these, several genotypes are widely recognized and hold significant economic value, including: 1) Bujang Marantau – a traditional paddy field variety from Tanah Datar Regency (Suyitno, 2019); 2) Kuriak Supayang – a genotype with a growth duration of 120–125 days and an average yield of 4.5 tons/ha. Both Bujang Marantau and Kuriak Supayang are popular among the people of West Sumatra due to their excellent cooking and eating qualities (Alviedo et al., 2023); 3) Caredek – a newly released local genotype from Solok, West Sumatra, still cultivated in its region of origin, with a yield potential of approximately 5.2 tons/ha; 4) PB 42 – a genotype with resistance to brown planthopper biotypes 1 and 2, tungro virus, and grassy stunt virus, and also tolerant to acidic soils.

Each of these genotypes exhibits varying degrees of adaptability and tolerance to different cultivation environments. Another critical challenge facing rice production is the limited availability of arable land, especially paddy fields, due to ongoing land conversion for non-agricultural purposes, which poses a threat to national rice production (Nurchamidah & Djauhari, 2017). his

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situation presents an opportunity to explore alternative cultivation areas, such as peatlands, which hold potential for rice cultivation expansion. Peat soils in particular offer a new frontier for sustainable rice production. In West Sumatra, approximately 140,000 hectares of peatlands are available in the regions of Padang Pariaman, West Pasaman, and South Pesisir (Bapedalda West Sumatra Province, 2016).

One of the major challenges in rice cultivation on peatlands is the poor chemical properties of the soil, including extremely low pH and nutrient deficiencies. Moreover, there is limited information regarding the adaptability of local rice genotypes and the optimal dolomite application rate for improving rice productivity under peat conditions. Therefore, this study addresses the following research problems: (1) To what extent does dolomite amelioration improve growth and yield of rice in peat soils? and (2) Which local rice genotype responds most favorably to dolomite treatment under acidic peatland conditions?"

According to Wulandari et al. (2014), the decomposition of woody plant materials in peatlands produces organic acids, which can be phytotoxic. Therefore, sustainable peatland management requires technological innovation to enhance rice production in these challenging soils. As noted by Siruru et al. (2018), soil ameliorants are materials applied to improve soil conditions by enhancing its chemical and physical properties, such as bulk density, porosity, temperature, and fertility. One of the most widely used ameliorants is dolomite lime. Application of dolomite has been reported to improve rice productivity on peat soils by approximately 10% (Kusnadi et al., 2022).

Although previous studies have explored the role of dolomite in improving acidic soils, limited research has focused on its interactive effects with local rice geno-types in highly acidic peat environments. This study presents a novel approach by combining genotype selec-tion with dolomite-based soil amelioration in peatland conditions, making it one of the first field trials of its kind in West Sumatra. The outcomes contribute to state-of-the-art agricultural strategies for peatland utili-zation and offer science-based recommendations for sustain-able intensification of rice farming on marginal lands.

The findings of this study are expected to provide practical recommendations for farmers regarding suit-able rice genotypes and optimal dolomite application rates for peatland cultivation. Furthermore, this research aims to contribute to the development of sustainable agricultural practices in peat-based rice farming systems.

2. Material and Methods

2.1. Materials and Equipment

The materials used in this study included dolomitic lime, peat soil, and four local rice (*Oryza sativa* L.) genotypes from West Sumatra, namely: Bujang Marantau, Kuriak Supayang, Caredek and PB-42

The equipment used in the experiment comprised hoes, ovens, weighing scales, raffia string, markers, machetes, knives, measuring tapes, labels, plastic bags, analytical balances, aluminum cups, folders, HVS paper, rubber bands, tissues, and label paper.

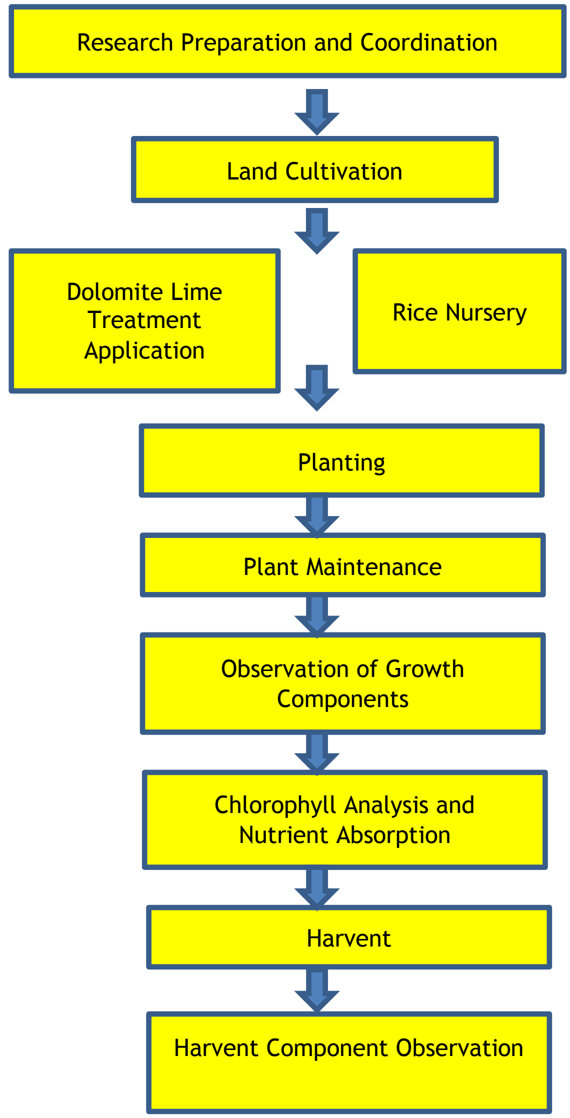

Figure 1. Research Flow Diagram

2.2. Experimental Design and Procedure

The experiment employed a Split Plot Design based on a Randomized Complete Block Design (RCBD) with three replications. The main plots consisted of the four rice genotypes (G_1 –G_4), while the subplots consisted of four levels of dolomite application: 0 tons/ha (equivalent to 0 kg/plot), 5 tons/ha (equivalent to 1.5 kg/plot), 10 tons/ha (equivalent to 3.0 kg/plot) and 15 tons/ha (equivalent to 4.5 kg/plot)

A total of 16 treatment combinations were generated (4 genotypes × 4 dolomite doses), each replicated three times, resulting in 48 experimental units. Within each plot, 5 plants were designated as non-destructive samples and 4 plants as destructive samples for growth analysis, yielding a total plant population of 2,304.

Dolomite application was carried out after the formation of main and subplots. The dolomite was evenly incorporated into the soil and incubated for two weeks prior to transplanting the rice seedlings, allowing for proper chemical interaction between the amendment and the peat substrate.

Data collection was conducted throughout the rice growth cycle, covering both vegetative and generative phases. Observations were made by direct measurement of plants within each plot, with five plants selected as non-destructive samples and four plants as destructive samples for growth analysis. Measurements were taken at designated growth stages, including 15, 45, and 75 days after transplanting (DAT), as well as at harvest time.

The observed variables consisted of both growth parameters and yield components. In this study, several agronomic traits were measured to assess the performance of local rice genotypes under varying dolomite amelioration rates in peatland conditions. **Days to flowering** was recorded as the number of days from sowing until 50% of the plants in each plot reached anthesis. **Days to harvest** was determined from the planting date to the point when approximately 90–95% of the grains turned golden yellow, indicating physiological maturity.

Plant height was measured at full flowering stage from the base of the stem at soil level to the tip of the tallest leaf (flag leaf) using a measuring tape. The **number of tillers** was assessed by manually counting all productive tillers that bore panicles on five randomly selected plants per plot.

Panicle length was measured from the panicle base (the node of emergence) to the tip of the main panicle using a ruler or digital caliper, and averaged across five panicles per genotype-treatment combination. **The number of filled grains per panicle** was determined by manually threshing the panicle, separating filled grains from unfilled ones, and counting the number of filled grains per panicle from five representative samples.

The percentage of filled grains per panicle was calculated by dividing the number of filled grains by the total number of grains (filled plus unfilled) and multiplying by 100. This percentage reflects grain fertility and sink filling capacity. **Thousand-grain weight** was measured by randomly selecting 1000 well-filled grains, drying them to approximately 14% moisture content, and weighing them using an analytical balance with 0.01 g precision.

Finally, **grain yield per hectare** was calculated by harvesting the total grain yield from each experimental plot, converting the weight to a hectare basis, and adjusting it to 14% grain moisture content using the following formula:

$$\text{Yield}\left(\text{tons}/_{\text{ha}}\right) = \frac{\text{Plot yield (kg)}}{\text{Plot area (m}^2\text{)}} \times 10$$

This yield reflects the combined influence of the measured agronomic traits and the treatment effects.

All collected data were statistically analyzed using analysis of variance (ANOVA) to test for significant effects of genotype, dolomite application rate, and their interaction. When significant differences were found, mean separation was carried out using Duncan's New Multiple Range Test (DNMRT) at a 5% significance level. Statistical analyses were performed using Statistical Tool for Agricultural Research (STAR) software, developed by the International Rice Research Institute (IRRI).

3. Results and Discussion

3.1. Days to Flowering and Harvest Time

The observation results for days to flowering and harvest time of rice as influenced by dolomite application are presented in Table 1.

The flowering stage in rice represents a critical physiological transition from vegetative growth to reproductive development. In this study, dolomite application at different rates did not result in any observable changes in the days to flowering or harvest. All treatments, including the control, recorded an average flowering time of 101.5 days and harvest time of 150.5 days, indicating that the application of dolomite did not influence the duration of these phenological phases.

Table 1. Average days to flowering and harvest of rice under different dolomite application rates

Treatment (Dolomite dose)	Days to Flowering	Days to Harvest
0 tons/ha	101.5	150.5
5 tons/ha	101.5	150.5
10 tons/ha	101.5	150.5
15 tons/ha	101.5	150.5

Note: The data represent the average of four rice genotypes and were not subjected to ANOVA testing (F-test) at the 5% significance level.

The consistency in flowering and harvest times across treatments suggests a strong genetic control over these traits. Genetic factors are known to be the primary determinants of flowering time, as each genotype possesses a unique duration for vegetative development and a genetically defined response to environmental cues. Longer vegetative phases generally result in delayed flowering, while genotypes with shorter vegetative phases flower earlier.

According to the classification system provided by the Indonesian Center for Rice Research (Balai Besar Penelitian Tanaman Padi, 2015), rice genotypes can be categorized into six maturity groups based on harvest age: ultra-early (<85 days), super early (85–94 days), very early

(95–104 days), early (105–124 days), medium (125–150 days), and late (>150 days). Based on this classification, the genotypes used in this study fall into the medium maturity group for flowering and the late group for harvest.

The observations revealed that the application of dolomite at varying doses (0, 5, 10, and 15 tons/ha) did not result in any numerical or statistical differences in both days to flowering and days to harvest. As shown in Table 1 of the study, all treatments consistently recorded an average flowering time of 101.5 days and an average harvest time of 150.5 days across all genotypes.

This consistency across treatments indicates that phenological traits such as flowering and maturity are predominantly controlled by genetic factors rather than by soil amendment treatments. The lack of variation suggests that dolomite application, while beneficial in modifying soil chemical properties, does not interfere with the intrinsic developmental timeline of the rice genotypes studied.

According to the classification by BB Padi (2019), the observed flowering time places the genotypes in the medium maturity group, while the harvest time places them in the late maturity category. This uniformity is likely due to the synchronized transition of the rice plants from vegetative to reproductive stages, and the consistent development of spikelets and grain filling across treatments.

3.2. Plant Height and Number of Tillers

The results of the analysis of variance indicated that the application of dolomite significantly affected plant height and number of tillers. The average values for plant height and tiller number at 7 weeks after transplanting (WAT) are presented in Table 2.

Table 2. Plant height (cm) and number of tillers (stems) of West Sumatra rice genotypes after dolomite application at 7 WAT

Treatment (Dolomite dose)	Plant Height (cm)	Number of Tillers (stems)
0 tons/ha	57,90 ± 6,37 c	14,20 ± 5,36 b
5 tons/ha	61,05 ± 7,17 bc	17,18 ± 5,88 ab
10 tons/ha	63,75 ± 7,69 ab	19,65 ± 6,71 a
15 tons/ha	68,32 ± 9,20 a	19,45 ± 4,09 a
CV = 27.18%.		

Note: The data represent the average of four rice genotypes and were not subjected to ANOVA testing (F-test) at the 5% significance level.

Table 2 demonstrates that plant height significantly increased with dolomite application, particularly at the higher doses. The tallest plants were observed with 15 tons/ha dolomite (68.32 cm), which was significantly higher than the control (0 tons/ha, 57.90 cm) and 5 tons/ha (61.05 cm), but not significantly different from the 10 tons/ha treatment (63.75 cm). The application of 10 tons/ha also resulted in significantly taller plants than the control. These differences can be attributed to improvements in soil chemical properties, particularly soil pH and nutrient availability, following dolomite application. Peat soils are typically acidic and nutrient-deficient, and dolomite acts as an effective soil ameliorant by neutralizing acidity and supplying essential nutrients such as calcium and magnesium. According to Kusnadi *et al.* (2022), while dolomite application on peatland can improve soil conditions, plant height response may vary due to the inherent physical and chemical constraints of peat soils, which limit consistent increases in vegetative growth. Moreover, plant height in local rice genotypes is largely influenced by both genetic factors and soil amendments such as dolomite, which improves root development and nutrient uptake by increasing soil pH.

Regarding the number of tillers, significant differences were also observed across treatments. The highest number of tillers was found in the 10 tons/ha (19.65 stems) and 15 tons/ha (19.45 stems) treatments, both of which were significantly different from the control (14.20 stems). However, the 5 tons/ha treatment (17.18 stems) did not significantly differ from either the control or the higher doses, suggesting a moderate effect at this application rate. The variation in tiller number can also be attributed to genetic diversity among the four local genotypes evaluated. Different genotypes inherently vary in their ability to produce tillers due to differences in tiller bud initiation and development. This aligns with findings by Yunidawati & Koryati (2022) and Anwar *et al*. (2021), who emphasized the importance of genotype in determining tillering capacity.

The results of the study indicated that dolomite application had a significant quantitative effect on both plant height and number of tillers at 7 weeks after transplanting (WAT). As shown in Table 2, plant height increased progressively with higher dolomite doses. The control treatment (0 tons/ha) recorded the shortest average plant height at 57.90 cm, whereas the tallest plants were observed in the 15 tons/ha treatment with an average height of 68.32 cm. Intermediate values were observed for 5 tons/ha (61.05 cm) and 10 tons/ha (63.75 cm), indicating a positive response to dolomite up to the highest dose.

Similarly, the number of tillers per plant followed a comparable trend. The control treatment produced the fewest tillers, averaging 14.20 tillers per clump. The application of 5 tons/ha increased the tiller number to 17.18, while 10 and 15 tons/ha treatments further increased the average tiller count to 19.65 and 19.45, respectively. Both higher doses were statistically superior to the control and indicate that 10 tons/ha may represent an optimal threshold, beyond which gains in tiller number begin to plateau.

The increase in plant height and tiller number can be attributed to improvements in soil pH and nutrient availability following dolomite application. Dolomite supplies essential macronutrients such as calcium (Ca) and magnesium (Mg), which are crucial for cell elongation, chlorophyll synthesis, and enzymatic activity. Furthermore, the amelioration of soil acidity through dolomite enhances root growth and nutrient uptake, thereby supporting more vigorous vegetative development.

These results clearly demonstrate that dolomite application, particularly at 10–15 tons/ha, significantly enhances early vegetative growth of rice on peat soils, suggesting that appropriate soil amelioration can offset the limitations of acidic, nutrient-deficient substrates.

3.3. Panicle Length

The analysis of variance showed that the application of dolomite had no statistically significant effect on the panicle length of rice plants. The average panicle length of rice following different dolomite doses is presented in Table 3.

Table 3. Panicle length (cm) of West Sumatra rice genotypes under various dolomite application rates

Treatment (Dolomite dose)	Panicle Length (cm)
0 tons/ha	23,62 ± 0,92
5 tons/ha	23,80 ± 0,98
10 tons/ha	23,86 ± 0,66
15 tons/ha	23,91 ± 1,09
CV = 3.61%.	

Note: Data were transformed using ($\sqrt{x}$ + 0.5). Values are not significantly different according to the F-test at the 5% level.

The analysis of variance revealed that the application of dolomite had no statistically significant effect on panicle length across treatments. As presented in Table 3, the average panicle length demonstrated a slight numerical increase with higher dolomite application rates. Specifically, panicle lengths recorded were 23.62 cm at 0 tons/ha, 23.80 cm at 5 tons/ha, 23.86 cm at 10 tons/ha, and 23.91 cm at 15 tons/ha.

Despite the observed trend indicating a marginal increase in panicle length with increasing dolomite doses, the differences were not statistically significant at the 5% probability level, as confirmed by the F-test. These findings suggest that while dolomite application may contribute to a modest enhancement in panicle development, the effect was not substantial enough to result in statistically meaningful variation under the conditions of this study.

The relatively narrow range of panicle length values indicates that genotypic characteristics and environmental conditions may play a more dominant role in determining panicle morphology than soil amelioration alone. Further genotype-specific analysis may be necessary to elucidate the potential interactive effects of dolomite on panicle development in rice cultivated on peat soils.

Panicle length is an important trait associated with yield potential, as it can influence the number of spikelets and grains per panicle. While the genetic makeup of the rice genotype is a major determinant of panicle architecture, environmental conditions and soil amendments can also contribute. The slight increase in panicle length with dolomite application aligns with the general understanding that improved soil chemical properties—such as increased pH and enhanced nutrient availability—can support better vegetative and reproductive growth.

Dolomite application improves peat soil conditions by raising the pH from highly acidic levels (e.g., from 3.5 to 5.0) and reducing the concentrations of toxic elements and organic acids (Sunarsih et al., 2018). In mineral soils, dolomite can elevate pH from 4.5 to 6.0, thereby creating more favorable conditions for root development and nutrient uptake (BSIP Jambi, 2025). As reported by Katili et al. (2022), increasing soil pH through liming also reduces the solubility of phytotoxic elements such as aluminum (Al) and manganese (Mn), which often interfere with nutrient absorption in acid soils.

Dolomite provides essential nutrients, particularly calcium (Ca) and magnesium (Mg), which are critical for chlorophyll synthesis, enzyme activation, and overall plant metabolic processes (Gunawan et al., 2023). The presence of CaO and MgO in dolomite enhances nutrient availability and helps neutralize soil acidity (Parmar & Meenakshi, 2025). Some studies have even suggested that dolomite can stimulate the development of rice panicles when applied at appropriate doses, particularly in local varieties adapted to suboptimal soils (Widjajanto et al., 2023). However, the lack of a significant effect in this study may be attributed to genotype-specific responses or to the relatively narrow range of panicle lengths across treatments. Further investigation with genotype-specific analysis and longer-term soil improvement may be required to fully understand the impact of dolomite on panicle traits.

3.4. Number of Filled Grains per Panicle

The analysis of variance revealed that the number of filled grains per panicle was not significantly affected by dolomite application. The average number of filled grains per panicle for rice plants treated with various dolomite doses is presented in Table 4.

Table 4 shows a numerical increase in the number of filled grains per panicle with increasing dolomite dosage up to 10 tons/ha, followed by a slight decrease at the 15 tons/ha treatment. Although these changes were not statistically significant, the trend suggests that moderate dolomite application (specifically at 10 tons/ha) may positively influence grain filling, potentially due to improvements in soil chemical properties and nutrient availability.

This pattern aligns with findings by Prayitno & Aji (2021), who reported that dolomite has an important effect on rice growth and yield, particularly at optimal doses. A decline in performance at the highest application rate (15 tons/ha) indicates that excess dolomite may not confer additional benefits and could potentially disrupt nutrient balance or cause secondary deficiencies. Gultom dan Mardaleni (2013), also emphasized that an application rate of around 10 tons/ha was optimal for improving soil pH and supporting plant development on acid soils.

Table 4. Number of filled grains per panicle (grains) of West Sumatra rice genotypes after application of different dolomite doses

Treatment (Dolomite dose)	Number of filled grains per panicle (grains)
0 tons/ha	234,19 ± 51,47
5 tons/ha	239,33 ± 44,08
10 tons/ha	254,50 ± 30,03
15 tons/ha	251,05 ± 46,59
CV = 20.10%.	

Note: Values in the same column followed by the same uppercase letters are not significantly different according to DNMRT at the 5% level.

The effectiveness of dolomite in enhancing the number of filled grains is attributed to its role in neutralizing soil acidity. Peat soils are typically low in pH, limiting the availability of essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K), while increasing the solubility of toxic elements like aluminum (Al). Dolomite reduces Al toxicity and increases the solubility and uptake of P and other macronutrients (Sari & Nila, 2019; Jaya et al., 2023), creating more favorable conditions for grain development.

Genotypic variation also plays a crucial role in determining the number of filled grains per panicle. In this study, the genotypes Bujang Marantau and Redek consistently produced higher values than Kuriak Supayang and PB-42, reflecting significant genetic differences in grain production potential. This supports the importance of selecting suitable genotypes in combination with appropriate soil amendments to maximize productivity.

The highest number of filled grains per panicle was recorded at the 10 tons/ha dolomite application, with an average of 254.50 grains, which represents an increase of approximately 8.7% compared to the control (0 tons/ha). Although this difference was not statistically significant at the 5% level, it suggests that moderate dolomite application may enhance grain filling, likely due to improvements in soil pH and nutrient availability in peat soils.

The slight reduction observed at 15 tons/ha indicates that excessive dolomite may not provide additional benefits and could potentially disrupt nutrient balance. These results align with previous studies indicating that optimal ameliorant dosing is critical for maximizing physiological performance and yield components in rice.

Furthermore, Basuki dan Sari, (2019) concluded that dolomite application significantly contributes to increased rice yields by improving root growth environments and enhancing nutrient uptake. The findings of this study reinforce those observations and suggest that while dolomite improves conditions for grain filling, attention must be paid to dose optimization and genotypic responses.

3.5. Percentage of Filled Grains per Panicle (%)

The analysis of variance indicated that the percentage of filled grains per panicle was not significantly affected by the application of dolomite. The average values for this trait across different dolomite application rates are presented in Table 5.

Table 5. Percentage of filled grains per panicle (%) of local West Sumatra rice genotypes following dolomite application.

Treatment (Dolomite dose)	Filled grain percentage per panicle (%)
0 tons/ha	70,85 ± 10,30
5 tons/ha	72,04 ± 11,01
10 tons/ha	75,84 ± 5,20
15 tons/ha	72,32 ± 9,10
CV = 14.76%.	

Note: Values followed by the same uppercase letters in the column are not significantly different based on DNMRT at 5% significance level.

Table 5 shows that the highest percentage of filled grains per panicle was achieved at the 10 tons/ha dolomite dose, with an average of 75.84%. In contrast, the lowest was observed at 0 tons/ha (70.85%). Although the differences were not statistically significant, this trend suggests a potential benefit of dolomite in enhancing grain filling up to an optimal application rate. Notably, the 10 tons/ha treatment yielded the best results across all local rice genotypes, implying that this dosage may contribute to improved panicle fertility.

Regression analysis between dolomite dosage and the percentage of filled grains per panicle produced a quadratic equation: $Y = -0.0471x^2 + 0.8707x + 70.354$ (Figure 2), where Y is the filled grain percentage and x is the dolomite dosage (tons/ha). This equation suggests that without dolomite application, the filled grain percentage is approximately 70.35%, and each additional ton of dolomite increases this value by about 0.87%, up to a certain point. The coefficient of determination ($R^2 = 0.6439$) indicates that approximately 64.39% of the variation in filled grain percentage is explained by dolomite dosage, while the remainder is influenced by other factors such as soil properties, nutrient availability, and environmental conditions.

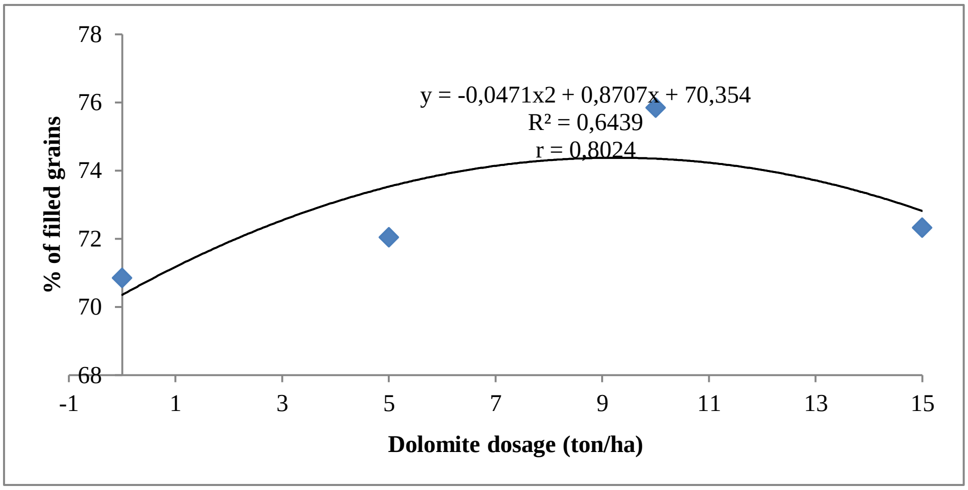

Figure 2. Regression curve between dolomite dosage and percentage of filled grains per panicle.

Among the tested genotypes, *Bujang Marantau* consistently exhibited the highest percentage of filled grains, approaching the ideal benchmark of 85%. Conversely, *Kuriak Supayang* and *Caredek* had lower performance, indicating the need for further improvement in grain quality and fertility. According to Ahmadu et al. (2021), the total number of grains per panicle is positively correlated with the number of filled grains. Therefore, increasing grain set is a key determinant of rice yield.

Figure 1 further illustrates the positive association between the number of filled grains per panicle and total grain number, confirming that filled grain percentage contributes directly to final yield outcomes (Safriyani et al., 2019). This result supports previous studies indicating that dolomite can improve the physical and chemical properties of peat soils, particularly by raising soil pH and enhancing nutrient availability, which in turn promotes better plant growth and grain filling.

The highest percentage of filled grains per panicle (75.84%) was recorded at the 10 tons/ha dolomite application, representing an improvement of approximately 7% compared to the control (70.85%). This increase, although not statistically significant at the 5% level, indicates that dolomite application at moderate levels may enhance panicle fertility and grain filling.

The regression analysis further supported this trend, revealing a quadratic relationship between dolomite dosage and filled grain percentage, with a coefficient of determination ($R^2 = 0.6439$) indicating that approximately 64.39% of the variation in filled grain percentage was attributable to dolomite application.

The decline in percentage at the highest dose (15 tons/ha) suggests that excessive application may not yield proportional benefits and could interfere with nutrient dynamics. These findings underscore the importance of dose optimization when using soil amendments like dolomite to improve reproductive success in rice cultivated on peat soils

The improvement in grain quality, particularly the percentage of filled grains, is closely associated with dolomite's ameliorative effect on soil fertility. The presence of calcium (Ca) and magnesium (Mg) from dolomite is essential for cell division and photosynthesis, which are vital for reproductive development (Sari & Nila, 2019; Aprianto et al., 2021). Overall, the application of dolomite not only improves soil conditions but also plays a vital role in enhancing the reproductive success of local rice genotypes cultivated in peatlands.

3.6. Thousand-Grain Weight (g)

The analysis of variance revealed that the thousand-grain weight of West Sumatra rice genotypes was significantly affected by the interaction between genotype and dolomite application rates. The average values for this trait are illustrated in Figure 3.

Figure 3 demonstrates an increase in the thousand-grain weight across all genotypes with the application of dolomite. This trait was influenced by several agronomic parameters, including the number of productive tillers, plant height, and the number of grains per panicle. These findings are consistent with Aziz et al. (2023), who reported that dry grain weight and thousand-grain weight in rice varieties are significantly affected by the number of productive tillers, plant height, and panicle grain count.

Krismawati & Sugiono (2016) highlighted that grain weight is also largely determined by post-anthesis conditions, such as leaf condition, the availability of photosynthates, and climatic factors. These environmental and physiological variables influence the carbohydrate supply from photosynthesis, ultimately determining grain size and weight. Supporting this, Ristianingrum et al. (2016) emphasized that the thousand-seed weight reflects the accumulation of dry grain matter and grain dimensions, which are closely related to husk development and grain filling.

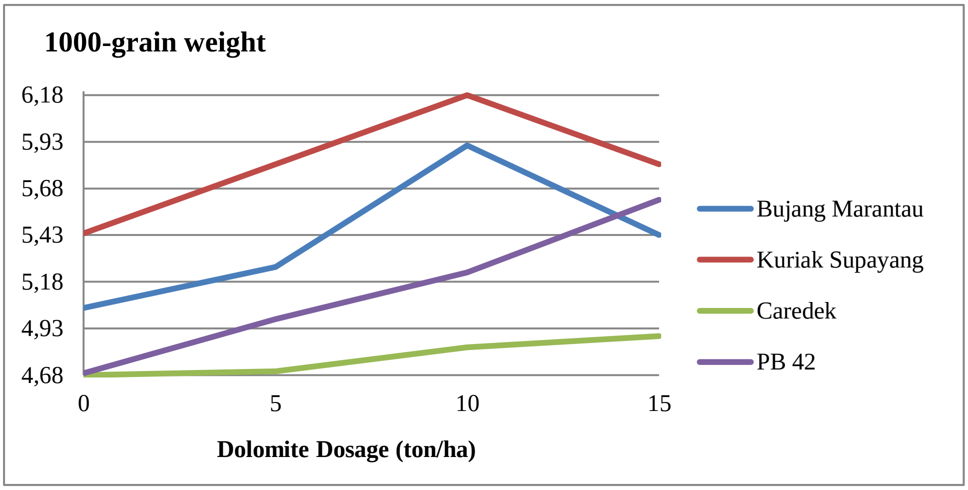

Figure 3. Interaction curve between rice genotype and dolomite application rate on the thousand-grain weight of rice.

An appropriate fertilizer dose plays a crucial role in plant growth and yield. Increased nutrient availability from dolomite application can enhance grain filling, thereby improving thousand-grain weight. Optimal fertilization improves photosynthate allocation, contributing to better grain quality and mass (Salawati et al., 2019). Additionally, rice genotype significantly influences the thousand-grain weight. Each genotype exhibits distinct adaptive traits and responses to fertilizer, which result in varied grain weights across treatments. The genetic correlation coefficient for thousand-grain weight was higher than the environmental coefficient, indicating that genetic factors have a stronger influence on this trait. This suggests that genotype selection, in combination with optimized dolomite application, can be a key strategy to improve grain weight and enhance rice yield potential, especially under acidic soil conditions such as peatlands.

3.7. Yield per Hectare (tons/ha)

The analysis of variance indicated that dolomite application had no statistically significant effect on rice yield per hectare. However, numerical differences were observed among treatments, as shown in Table 6.

Table 6. Average rice yield per hectare (tons/ha) in response to various dolomite ameliorant doses in West Sumatra local rice genotypes.

Dolomite Dose (ton/ha)	Average Yield (tons/ha)
0	2,30 ± 0,22 b
5	2,30 ± 0,14 b
10	2,30 ± 0,60 b
15	2,70 ± 0,38 a

Note: Values followed by different lowercase letters in the same column are significantly different according to DNMRT at 5% significance level. Data were transformed using ($\sqrt{x}$ + 0.5).

Table 6 illustrates that although not statistically significant, rice yield tended to increase with higher dolomite application rates. The highest average yield (2.70 tons/ha) was achieved at 15 tons/ha dolomite, while all lower doses resulted in the same average yield of 2.30 tons/ha.

Among the genotypes tested, *Bujang Marantau* showed the highest yield potential, with an average of 2.76 tons/ha. In contrast, *Kuriak Supayang* had the lowest yield (1.83 tons/ha), indicating a lower response to dolomite application. The genotypes *Cedek* and *Pb-42* produced intermediate yields of 2.72 and 2.27 tons/ha, respectively.

A regression analysis was conducted to further examine the relationship between dolomite dosage and rice yield, as shown in Figure 4.

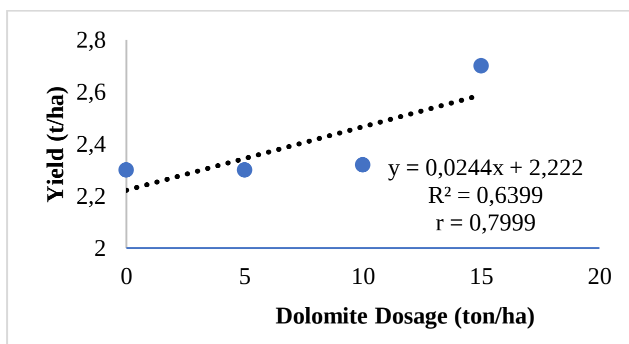

Figure 4. Regression curve showing the relationship between dolomite dosage (ton/ha) and rice yield (tons/ha).

The regression equation obtained was: $Y = 0.0244x + 2.222$ ($R^2 = 0.6399$). This equation indicates that, in the absence of dolomite, the baseline yield was 2.222 tons/ha. Each additional ton of dolomite per hectare was associated with an estimated increase in yield of 0.0244 tons/ha. The coefficient of determination ($R^2 = 0.6399$) suggests that approximately 63.99% of the variability in yield can be explained by dolomite dosage. The correlation coefficient (r = 0.7999) reflects a strong positive relationship between dolomite application and rice yield, though the relationship is not perfectly linear.

The trend observed supports the notion that dolomite application contributes to improved rice productivity, especially in peatland soils. This is consistent with the findings of Prayitno dan Aji (2021), who reported that higher dolomite dosages generally enhance crop yield. Aprianto et al. (2021) emphasized the importance of liming to optimize crop production in acidic soils.

Dolomite increases the availability of essential nutrients such as calcium (Ca) and magnesium (Mg), which are vital for rice growth and development (Gunawan et al., 2023). Additionally, dolomite improves soil physical properties, enhances aeration and drainage, and promotes better root development and nutrient uptake. These combined effects contribute to increased rice productivity in acidic soils (Aprianto et al., 2021; Gunawan et al., 2023).

Figure 5. Research documentation

4. Conclusion

The study demonstrates that while dolomite application had no statistically significant impact on most growth and yield traits, it notably improved thousand-grain weight and showed numerical increases in yield up to 15 tons/ha. Genotypic differences were also evident, with Bujang Marantau showing superior performance. These findings underscore the importance of genotype selection and optimal dolomite dosage (10–15 tons/ha) for rice cultivation in acidic peatland. An important advantage of this study compared to previous research lies in its comprehensive evaluation of multiple local rice genotypes under varying dolomite doses in actual peat soil conditions. Unlike many earlier studies that focused on a single variety or used artificial substrates, this research provides a more realistic assessment of genotype–soil amendment interactions in field conditions. Additionally, the identification of an optimal dolomite dose (10 tons/ha) that enhances key yield components without adverse effects adds practical value for sustainable rice cultivation on marginal peatlands.

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References

Ahmadu, I. S., Rilwanu, Y. A., Babaji, B. A., Kura, H. N., Goma, L., & Yahqub, M. (2021). Yield and yield components of low land rice (*Oryza sativa* L.) as affected by different cultivation methods in the Sudan savannah. *Journal of Agriculture and Environment, 17*(2), 79–88.

Alviedo, Usman, Y., & Hakimi, R. (2023). Analisis usahatani padi Bujang Marantau di Nagari Gantung Ciri Kecamatan Kubung Kabupaten Solok. *MAHATANI: Jurnal Agribisnis (Agribusiness and Agricultural Economics Journal), 6*(1), 13. https://doi.org/10.52434/mja.v6i1.1887

Anwar, C., Nursaputra, M., & Iswanto, I. (2021). *Mahasiswa, warga dan hutan seri 1: Data tenurial dan proses fasilitasi kemitraan KHDTK Hutan Pendidikan UNHAS.*

Aprianto, P., Salampak, S., & Kresnatita, S. (2021). Pengaruh pemberian amelioran dolomit dengan pupuk kandang ayam terhadap tanaman pakcoy yang tumbuh di lahan gambut. *Journal of Environment and Management, 2*(2), 131–139. https://doi.org/10.37304/jem.v2i2.2941

Aziz, U. A., Mutakin, J., & Fajarfika, R. (2023). Pengaruh penyiangan dan jarak tanam terhadap pertumbuhan dan hasil padi sawah (*Oryza sativa* L.) sistem TOT musim ke dua di Kecamatan Wanaraja Kabupaten Garut. *Prosiding Seminar Nasional Pertanian 2023, 33,* 210–223.

Balai Besar Penelitian Tanaman Padi. (2015). *Klasifikasi umur padi.*

Bapedalda West Sumatra Province. (2016). *Buku data status lingkungan hidup daerah tahun 2014* (p. 553). http://bapedalda.sumbarprov.go.id

Basuki, & Sari, V. K. (2019). Efektifitas dolomit dalam mempertahankan pH tanah Inceptisol perkebunan tebu Blimbing Djatiroto. *Buletin Tanaman Tembakau, Serat & Minyak Industri, 11*(2), 58–64. https://doi.org/10.21082/btsm.v11n2.2019.58

BB Padi. (2019). *Klasifikasi umur padi.* http://bbpadi.litbang.pertanian.go.id/index.php/tahukah-anda/120-kalsifikasiumur-padi

BSIP Jambi. (2025). *Increasing soil pH using dolomite for optimal rice growth.* Balai Standarisasi Instrumen Pertanian Jambi.

Gultom, H., & Mardaleni. (2013). Penggunaan urea tablet dan kapur dolomit terhadap pertumbuhan dan produksi tanaman padi sawah pada tanah gambut. *Jurnal Dinamika Pertanian, 28*(1), 15–24.

Gunawan, G., Susana, R., & Listiawati, A. (2023). Pengaruh dolomit dan pupuk NPK terhadap pertumbuhan dan hasil tanaman kacang hijau pada lahan gambut. *Jurnal Sains Pertanian Equator, 12*(2), 178. https://doi.org/10.26418/jspe.v12i2.62021

Jaya, I., Sabahannur, S., & Aminah, A. (2023). Pengaruh pemberian dosis kapur dolomit terhadap pertumbuhan dan perkembangan bibit kakao (*Theobroma cacao* L.) klon 45. *AGrotekMAS Jurnal Indonesia: Jurnal Ilmu Peranian, 3*(3), 62–67. https://doi.org/10.33096/agrotekmas.v3i3.267

Katili, H. A., Sayedi, R., Puspapratiwi, D., & Ladonu, I. (2022). Upaya peningkatan produksi jagung berbasis aspek kesuburan tanah di Kecamatan Simpang Raya. *Jurnal Ilmiah Mahasiswa Fakultas Pertanian, 2*(3), 262–268. https://doi.org/10.52045/jimfp.v3i1.426

Krismawati, A., & Sugiono. (2016). Potensi hasil galur-galur harapan padi hibrida di lahan sawah Kabupaten Malang, Provinsi Jawa Timur. *Buletin Plasma Nutfah, 22*(1), 21–30.

Kusnadi, H., Desayati, Fauzi, E., Ishak, A., Firizon, J., & Wawan Eka Putra. (2022). Produktivitas padi di lahan rawa dengan kapur dolomit. *Jurnal Pertanian, 13*(2), 47–53. https://doi.org/10.30997/jp.v13i2.5548

Nurchamidah, L., & Djauhari. (2017). Pengalih fungsian lahan pertanian ke non pertanian di Kabupaten Tegal Laeli. *Jurnal AKTA, 4*(4), 699–706.

Parmar, D., & Meenakshi. (2025). Transformation of dolomite powder into value added fertilizer and its effect on growth and yield of tomato plant. *Comunicata Scientiae, 16*(February), 1–10. https://doi.org/10.14295/CS.v16.4261

Prayitno, M. B., & Aji, A. P. (2021). Pengaruh pemberian kapur dolomit dan pupuk urea terhadap emisi gas metana (CH4) pada tanaman padi (*Oryza sativa* L.) di tanah gambut. *Penerbit & Percetakan Universitas Sriwijaya,* 682–688.

Ristianingrum, A., Chozin, M. A., Machfud, M., Sugiyanta, S., & Mulatsih, S. (2016). Optimalisasi keberlanjutan pengembangan usaha padi organik di Kabupaten Cianjur, Jawa Barat. *Jurnal Manajemen dan Agribisnis, 13*(1), 37–49. https://doi.org/10.17358/jma.13.1.37

Safriyani, E., Hasmeda, M., Munandar, M., & Sulaiman, F. (2019). Korelasi komponen pertumbuhan dan hasil pada pertanian terpadu padi-*Azolla*. *Jurnal Lahan Suboptimal, 7*(1), 59–65. https://doi.org/10.33230/jlso.7.1.2018.344

Salawati, Ende, S., & Lukman. (2019). Optimasi lahan pada sistem tumpang sari jagung manis. *Jurnal Agroqua, 17*(2), 115–125. https://doi.org/10.32663/ja.v

Sari, N., & Nila, I. R. (2019). Dekomposisi mineral dolomit melalui proses kalsinasi. *Hadron, 1*(02), 22–24.

Siruru, H., Syafii, W., Wistara, N. J., & Pari, G. (2018). The effect of steam duration on quality and characteristics of activated charcoal of sago waste. *Jurnal Ilmu dan Teknologi Kayu Tropis, 16*(2), 115–130.

Sunarsih, S., Sari, I., & Riono, Y. (2018). Pengaruh dosis pengapuran terhadap peningkatan pH tanah dan produksi tomat (*Lycopersicum esculentum* Mill.) pada media gambut. *Jurnal Agro Indragiri, 1*(01), 266–276. https://doi.org/10.32520/jai.v1i01.676

Suyitno. (2019). Padi sawah (*Oryza sativa*) varietas Bujang Marantau adaptif di wilayah Junjung. http://cybex.pertanian.go.id/mobile/artikel/78623/PadiSawahoryzaSativa-Varietas-Bujang-Marantau-Adaptif--Di-Wilayah-Junjung-Sirih/

Swasti, E., Syarif, A., Suliansyah, I., & Erawati, N. (2007). Eksplorasi, identifikasi dan pemanfaatan koleksi plasma nutfah padi asal Sumatera Barat. *Laporan Penelitian Program Intensif Riset Dasar Tahun 2007.*

Warta BSIP Pasca Panen. (2023). Sertifikasi mutu beras sebagai pencegah manipulasi mutu. *Warta BSIP Pasca Panen, 2.*

Widjajanto, D. W., Dwi Purbajanti, E., Adi Kristanto, B., & Agron Agri R, I. J. (2023). The effect of dolomite and silicon application on rice (*Oryza sativa* cv. Situ Bagendit) cultivation on its performance. *International Journal of Agronomy and Agricultural Research (IJAAR), 22*(2), 21–26. http://www.innspub.net

Wulandari, L., Sarifuddin, & Hidayat, B. (2014). Effect of sea water and mineral materials on soil chemical, growth and production of rice in peat. *Jurnal Online Agroekoteknologi, 2*(4), 1376–1383.

Yunidawati, W., & Koryati, T. (2022). Pengaruh umur dan jumlah bibit per lubang tanam terhadap pertumbuhan dan produksi padi sawah (*Oryza sativa* L.). *Jurnal Institusi Politeknik Ganesha Medan, 5*(1), 116–131. https://doi.org/10.33395/juripol.v5i1.11315