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RESEARCH ARTICLE

GROWTH AND YIELD PERFORMANCE OF RATOON RICE NSIC RC 160APPLIED WITH SEAWEED-BASED FERTILIZERSUNDER DIFFERENT CUTTING HEIGHTS

Kristene Marie Gutierrez Orquia and Ma. Cecilia Gatbonton
1. College of Agriculture, Laguna State Polytechnic University -Siniloan (Host) CampusSiniloan, Laguna, Philippines.

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Abstract

This research aimed to evaluate the agronomic characteristics and yield performance of ratoon rice (NSIC RC 160) under different cutting heights and seaweed-based fertilizer applications. A 4×3 factorial experiment in a Randomized Complete Block Design (RCBD) was implemented to assess the effects of four cutting heights (45 cm, 35 cm, 25 cm, and 15 cm) and three fertilizer sources (75 % Nitrogen Urea, Vitalgro Carrageenan, and Fermented KulapoSargassum spp. Data were analyzed using ANOVA and Least Significant differences (LSD) through STAR software. Results revealed that cutting height significantly influenced plant growth and grain development. A 45 cm cutting height consistently produced the tallest plants, while 35 cm promoted earlier flowering and maturity, ideal for shorter cropping seasons. The 15 cm cutting height yielded the heaviest grains and showed numerically higher yield performance, making it favorable for grain quality enhancement. Fertilizer source had minimal impact on most yield components, though 75% Nitrogen Urea significantly increased panicle length and the number of non-productive tillers. Seaweed-based fertilizers, particularly Fermented Kulapo, showed potential as organic alternatives despite not significantly outperforming conventional fertilizers in agronomic traits. Economically, the combination of a 15 cm cutting height and Fermented Kulapo application produced the highest gross income and return on investment (ROI),underscoring its potential as a cost-effective and environmentally sustainable option for ratoon rice cultivation. These findings suggest that integrating proper cutting height with locally available organic inputs can optimize both yield quality and profitability for farmers.

Introduction:-

Rice, known scientifically as (*Oryza sativa L.*), belongs to the Poaceae family and is a key crop that feeds about half of the world's population. It provides food for millions and plays a vital role in the agricultural economy. As production costs rise and the need for sustainable methods grows, ratoon cropping has become a practical approach

Corresponding Author:-Kristene Marie Gutierrez Orquia
Address:-College of Agriculture, Laguna State Polytechnic University -Siniloan (Host) CampusSiniloan, Laguna, Philippines.

to boost yields while cutting down inputs. This technique allows rice to regrow from the leftover stubble after the main harvest, giving farmers a chance to harvest more with less land prep and lower costs (Naher et al., 2018).

Ratooning occurs when farmers cut down the main crop but let the leftover stubble grow back, so they can get a second harvest without needing as much labor, seeds, or fertilizers (Alekhya et al., 2024).
The success of ratoon rice farming really depends on a few key agronomic factors; especially how high they cut the plants and how they manage nutrients. The height at which their cut affects how well the rice stubble can grow strong ratoon tillers, as it determines the number of healthy buds and the amount of stored carbohydrates (Mareza et al., 2016).

Nutrient availability is super important for regrowth and boosting yields. Organic fertilizers, particularly those made from seaweed, are getting attention because they naturally contain plant growth regulators, micronutrients, and bio stimulants that help with stress tolerance, root growth, and tillering (Ali et al., 2021).
The NSIC RC 160, a well-liked high-yield variety in the Philippines, has proven to be effective in ratoon cropping systems when paired with the right management techniques (DA-PhilRice, 2022).

Despite recent advancements, there is limited research investigating the relationship between cutting height and the application of seaweed-based fertilizers on the growth and yield of ratoon rice, especially in locally adopted varieties. Consequently, this study seeks to assess the impact of different cutting heights and the use of seaweed-based fertilizers on the growth and yield performance of ratoon rice. The findings from this research are anticipated to enhance sustainable rice production by refining ratoon cropping methods and encouraging the utilization of organic bio-stimulants.

In recent years, rice production in Infanta, Quezon has encountered various setbacks due to both environmental and biological factors. According to data from the Office of the Municipal Agriculturist, consistent challenges such as typhoons, pest infestations, and crop diseases have led to fluctuations in yield, particularly during the wet season. Varieties like NSIC RC 160 are notably affected, showing reduced productivity due to unfavorable weather conditions and the presence of diseases such as bacterial leaf blight, sheath rot, and sheath blight. These conditions have made it increasingly difficult for farmers to maintain stable production. In response to these challenges, this study was conducted to research the potential of ratoon rice cultivated at different cutting heights and applied with seaweed-based fertilizer.

Objectives of the Study:-

This study was conducted to identify the growth and yield performance of ratoon rice applied with seaweed-based fertilizer under different cutting heights.

Materials and Methods:-

Research Site and Duration

The study was conducted at Brgy. Agos-agos, Infanta, Quezon, from April 24 to July 23, 2024. It is located within the Agos River Basin and has a tropical climate with marked wet and dry seasons.

Experimental Design and Treatments

A 4 × 3 factorial RCBD experiment with four replications was utilized. Factor A had four levels of cutting height (45 cm, 35 cm, 25 cm, and 15 cm). Factor B had three fertilizer treatments B1 75% Nitrogen from Urea (Control), B2 Vitalgro Carrageenan Plant Growth Promoter and B3 Fermented Kulapo (Sargassum spp.).

Preparation of Treatments

Fermented Kulapo was prepared by fermenting 1 kg of Sargassum spp. and 1 kg of molasses in a closed container for one month. Vitalgro Carrageenan, a commercial red algae extract, was applied every two weeks as a foliar spray.

Data Collection and Procedure

1. Plant height- Measured the height of 10 randomly selected plants in each plot using a meter stick from the base to the tip of the tallest leaf.
2. Days to 50% flowering- Monitored the plants daily and recorded the number of days it takes for 50% of the plants in each plot to reach the flowering stage.

3. Days to 80% maturity- Monitored the plants and recorded the number of days it takes for 80% of the plants in each plot to reach maturity. Maturity was determined by observing grain color change or by gently squeezing the grains to check for hardness.
4. Productive and nonproductive tillers- Counted the number of productive (bearing grains) and nonproductive (without grains) tillers from 10 randomly selected plants in each plot.
5. Filled and unfilled grains- Selected 10 sample panicles from each plot and counted the number of filled and unfilled grains on each panicle.
6. Length of the panicle- Measured the length of several 10 selected panicles in each plot using a meter stick, from the base to the tip.
7. Weight of 1000 grains- The researcher randomly samples grains from the harvest area in each plot, counted exactly 1000 grains, and recorded their weight. Calculated the average weight of 1000 grains for each plot.
8. Weight of harvest per unit area- Harvested the rice from a designated harvest area of 2m x 2.5m in each plot and weighed the total harvest.
9. Computed yield per hectare- Multiplied the weight of the harvest per unit area by harvest area 5 sqm to calculate the yield per hectare.

Statistical Analysis

Data were analyzed using Analysis of Variance (ANOVA). Treatment means were compared using the Least Significant Difference (LSD) technique at a 5% probability level by running the STAR software.

Results and Discussion:-

Growth Parameters

The findings revealed that cut height had a significant effect on plant height per week. A1, 45 cm; the tallest in both first and second weeks. A1 also had the maximum plant height at maturity (82.96 cm) and performed significantly higher than the 15 cm treatment.

Days to 50% flowering were significantly shorter at 35 cm (20 days), whereas the lowest cutting height (15 cm) induced delay in flowering (32.83 days). Flowering to harvest days were also influenced, and the 25 cm cutting height increased days to 38.83 days, while 15 cm height caused early maturity (Table 1).

The study found that excessive nitrogen fertilizer application led to taller rice plants, increasing lodging risk, especially during the booting stage. A strong positive correlation was found between plant height and lodging, while a negative correlation was found between plant height and yield. The findings suggest the need for balanced nitrogen fertilizer application to control plant height and mitigate lodging risk (D. Wu et al., 2022). However, the study analyzed the effect of early cutting and higher stubble height on ratoon rice grain yield. It found that this led to increased nitrogen accumulation in the stubble, which in turn promoted nitrogen transfer to mature panicles, resulting in increased grain yield and stability (Gai et al., 2024).

Table 1. Growth Parameters Results

Growth Parameters										
Description	Cutting Height Mean (cm)				Source of Fertilizers Mean			ANOVA		
	45	35	25	15	Control 75% Nitrogen Urea	Vitalgro Carrageenan	Fermented *Kulapo*	Cutting Height (A)	Source of Fertilizers (B)	A x B
First weekly plant height, in centimeters	60.68	54.93	48.28	39.62	51.32	50.84	50.48	0.0000**	0.8318ns	0.9918ns
Second weekly plant height, in centimeters	69.47	64.44	57.62	53.20	62.91	60.92	59.72	0.0000**	0.0942ns	0.8067ns
Plant height at maturity, in centimeters	82.96	79.43	75.67	77.56	80.96	78.24	77.52	0.0000**	0.0000**	0.2684ns
Number of days at 50% Flowering	25.58	20.00	20.25	32.83	23.38	23.31	23.56	0.0000**	0.2123ns	0.9366ns
Number of days from flowering to harvesting	27.58	28.00	38.83	26.25	30.31	30.19	30.00	0.0000**	0.0819ns	0.3318ns

*** = highly significant, * = significant, ns = not Significant*

The most productive tillers occurred at 35 cm (15.45 tillers), though statistically significant differences did not occur. There were much fewer non-productive tillers in plants treated with Vitalgro and *Kulapo* than in urea, which indicates that seaweed-based fertilizers have a positive effect on tiller efficiency.
The filled grain number was not greatly impacted by the treatments, but the unfilled grain number was significantly reduced at 25 cm and 35 cm cutting heights. Panicle length was significantly affected by the source of fertilizer, with urea giving the longest panicles (22.61 cm) compared to the organic treatments (Table 2).

According to (Yu et al., 2022) study found that intermittent irrigation and cutting height significantly impacted ratoon rice growth and yield. A 20-25 cm cutting height, when combined with intermittent irrigation, maximizes growth period and improves yield. But research shows that cutting height of 20-25 cm does not significantly impact growth and yield increases, suggesting it may not affect the number of non-productive tillers (Setiawan et al., 2014). Furthermore, over-nitrogen application can lead to lodging, a detrimental effect on panicle development, potentially affecting panicle length and overall yield, despite increased plant height (Zhang et al., 2025)

Table 2. Yield of Components Results

Yield of Components										
	Cutting Height Mean (cm)				Source of Fertilizers Mean			ANOVA		
Description	45	35	25	15	Control 75% Nitrogen Urea	Vitalgro Carrageenan	Fermented *Kulapo*	Cutting Height (A)	Source of Fertilizers (B)	A x B
Number of productive tillers	13.83	15.45	14.63	13.61	15.23	13.64	14.28	0.2854ns	0.2169ns	0.3444ns
Number of Non-Productive Tillers	2.78	2.40	2.48	2.37	3.09	2.31	2.11	0.3524ns	0.0001**	0.1997ns
Number of Filled Grains	35.13	35.39	35.75	36.83	36.09	36.26	34.98	0.7239ns	0.5993ns	0.5049ns
Number of Unfilled Grains	15.47	11.58	12.38	16.82	14.90	13.18	14.10	0.0001**	0.2407ns	0.1373ns
Length of Panicle	21.91	21.17	21.90	22.25	22.61	21.20	21.60	0.0643ns	0.0007**	0.1675ns
Weight of 1000 Grains	24.67	24.50	24.75	25.92	25.31	24.50	25.06	0.0031*	0.0580ns	0.3928ns
Weight of Harvest per Unit Area Fresh Weight grams	733.02	674.90	586.35	817.50	717.34	679.84	711.64	0.0787ns	0.8683ns	0.8802ns
Weight of harvest per unit area dry weight grams	586.42	539.92	469.08	654.00	573.88	543.88	569.31	0.0792ns	0.8682ns	0.8798ns
Computed yield per hectare fresh weight cavans	29	27	23	33	28.75	27.25	28.75	0.0725ns	0.8564ns	0.8711ns
Computed yield per hectare dry weight cavans	23	22	19	26	23.25	22	23	0.0871ns	0.9048ns	0.8777ns

*** = highly significant, * = significant, ns = not Significant*

Though interaction effects were not significant, 45 cm cutting height in combination with fermented *Kulapo*had yields that were as good as the control treatments. Organic fertilizers equaled conventional yield, suggesting they have potential to be used as sustainable options.

Conclusion and Recommendation: -

This research found cutting height and source of fertilizer also play a significant role in influencing the ratoon rice's growth and yield performance. Cutting heights ranging from 35 to 45 cm were found most efficient in allowing healthy plant growth, flowering at an early stage, and optimal maturity period. Seaweed fertilizers, especially fermented Kulapo, effectively reduced non-productive tillers and exhibited equal yield performance with traditional urea-based fertilizers. From these findings, farmers are urged to apply the cutting heights between 35–45 cm in order to maximize regrowth and productivity in ratoon rice systems. Additionally, using fermented seaweed (Kulapo) as a readily available and environmentally friendly source of nutrients can increase sustainability while minimizing the use of synthetic inputs. Future studies must also be taken to a wider range of rice cultivars and environments, and must also perform economic evaluation to further establish the practical value of this integrated method

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