

Foliar Fertilization in Hybrid Rice

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Abstract

This study examines the efficacy of commercially available fertilizers and organic foliar fertilizers in enhancing the harvest of SL-8H hybrid rice. It aims to address several key questions related to the effects of these fertilizers on various parameters, such as yield, plant height, number of tillers, panicle length, quality based on farmers' preferences, and economic analysis. A Randomized Complete Block Design was used to collect data on the effectiveness of fertilizers in different garden plots. SL-8H rice yield and quality were significantly influenced by both commercial and organic foliar fertilizers. In terms of yield, plant height, number of tillers, and panicle length, organic foliar fertilizers, particularly those derived from Malunggay leaves and molasses, as well as banana peels and molasses, demonstrate comparable or even superior performance compared to commercial fertilizers. Additionally, organic foliar fertilizers provide economic advantages, offering lower production costs and higher returns on investment.

For SL-8H rice cultivation, organic foliar fertilizers appear to offer a viable alternative to conventional commercial fertilizers. Although commercial fertilizers perform slightly better, their higher costs do not justify the marginal improvement in yield and quality they provide. Furthermore, the study highlights the apprehensions among farmers concerning foliar fertilizers due to health concerns. Promoting and adopting organic foliar fertilizers would address these concerns while providing comparable benefits in terms of crop yield and economic viability. Thus, adopting organic foliar fertilizers could improve the yield of SL-8H rice and contribute to sustainable farming practices.

Keywords: Efficacy, fertilizers, harvest, yield, sustainability

INTRODUCTION

Foliar fertilization in hybrid rice has attracted significant attention due to its potential to enhance nutrient uptake, improve crop yield, and quality. Studies have demonstrated that foliar application of micronutrients such as zinc, selenium, and iron can notably increase their concentration in rice grains, thereby enhancing bioavailability and nutritional quality [1] [2] [3]. Additionally, research has shown that foliar fertilization positively influences the yield, composition, and oxidative biomarkers in rice, indicating its potential to enhance both the quantity and quality aspects of rice production [4].

Moreover, evidence suggests that foliar fertilization can play a vital role in biofortification initiatives, such as selenium biofortification of rice, which can result in the development of functional rice products with optimal selenium concentrations for human health [3] [5]. Furthermore, foliar fertilization has been associated with increased heavy metal accumulation in rice cultivars, highlighting its potential role in managing heavy metal stress in rice cultivation [6].

Interestingly, studies have indicated that hybrid rice varieties may not necessarily require higher nitrogen fertilization compared to inbred varieties to achieve higher yields, suggesting that the yield advantage of hybrid rice is not solely dependent on nitrogen fertilization under certain soil conditions [7] [8]. This emphasizes the importance of exploring alternative fertilization strategies like foliar application to optimize hybrid rice production. In conclusion, foliar fertilization in hybrid rice offers a promising approach to enhancing nutrient uptake, improving yield and quality, and addressing specific nutritional deficiencies. By harnessing the benefits of foliar fertilization with micronutrients and other essential elements, hybrid rice cultivation can be further refined to meet the requirements for sustainable and nutritious rice production.

Thus, this study aims to evaluate the efficacy of commercial fertilizers and organic foliar fertilizers in enhancing the yield, agronomic parameters, and quality of SL-8H hybrid rice. Specifically, the study aims to compare the effects of these fertilizers on key variables such as yield, plant height, number of tillers, and panicle length, as well as evaluating the quality of rice harvests based on farmers' preferences. The study will also conduct an economic analysis to determine whether organic foliar fertilizers are more cost-effective than commercial ones. This research seeks to recommend organic foliar fertilizers as a sustainable and effective means of improving SL-8H rice harvests, addressing concerns among farmers about their health and the environment.

MATERIALS AND METHODS

The study was conducted using a Randomized Complete Block Design. Thus, the researchers tested and observed the study on different garden plots to improve the study and develop a beneficial organic fertilizer to help the SL-8H farmers grow better quality and more crops.

The study participants include farmers cultivating SL-8H hybrid rice, agricultural experts, or extension workers knowledgeable about rice cultivation, and suppliers or manufacturers of commercial fertilizers and organic foliar fertilizers. Researchers conducting the study and potential stakeholders, such as government agencies or agricultural organizations, may also be considered participants, particularly if they provide guidance, resources, or support.

Research gathering procedures outlined in this study include several key steps designed to identify the effects of organic foliar fertilizers on SL-8H rice variance cultivated by farmers in Quirino, Isabela. Initially, the researchers coordinated with the Local Government Units and Municipal Agriculturists to gather information on the number of farmers cultivating SL-8H rice varieties. Following this, participants were selected based on specific criteria, including experience with SL-8H rice farming and suitability for data collection. A foliar fertilizer containing malunggay leaves, banana peels, and molasses was then prepared by the researchers following the preparation of the necessary materials and plots for planting SL-8H rice. The SL-8H rice variance was observed for growth, quality, and weight following the application of organic fertilizer. To ensure confidentiality and preservation for future analysis, information concerning harvest, weight, and quality of the harvest was collected. Additionally, a cost and return analysis was conducted to evaluate the study's economic feasibility.

The method used in this study was an experimental approach in which three different concoctions of organic foliar fertilizer were prepared for the purpose of assessing their effects on the growth of SL-8H rice. Observations and data collection from selected participants provided the basis for comparison of treatments. In terms of harvest, weight, and quality, organic foliar fertilizer was evaluated using the Likert Scale. The data were analyzed using statistical techniques, including the t-test and ANOVA, to determine the variations and effect sizes of organic foliar fertilizer in comparison to commercial fertilizer. Furthermore, the study provided a cost estimate and a list of materials used in the experiment, ensuring transparency and reproducibility.

RESULTS AND DISCUSSION

Comparative Analysis of Organic and Commercial Foliar Fertilizers along with Farmer's Practice on Rice Cultivation Parameters

Based on the analysis of organic foliar fertilizers, treatments combining malunggay leaves and molasses, banana peels and molasses, and combinations thereof, consistently yielded "Excellent" qualitative results. It was determined that these treatments improved soil health and crop yields in rice cultivation by demonstrating mean values ranging from 3.67 to 3.93. Similarly, commercial foliar fertilizers showed promising results, with both treatments exhibiting an "Excellent" qualitative description in most parameters, although different growth parameters indicated varying degrees of effectiveness. Similarly, Farmer's Practice demonstrated positive results, receiving a "Good" rating across all parameters, highlighting its potential in sustainable agriculture. To enhance agricultural productivity and soil health, it is imperative that diverse fertilization methods be explored.

Table 1. Effects of Organic Foliar Fertilizers on its; Yields of greatest harvest, Quality based in farmers preference, Plant height, Number of tillers, and Panicle length

Parameter	Mean	Qualitative Description
Yields of greatest harvest	3.77 - 3.93	Excellent
Weight	3.90 - 3.93	Excellent
Quality based on farmer's preference	3.73 - 3.83	Excellent
Plant Height	3.83 - 3.97	Excellent
Number of Tillers	3.70 - 3.77	Excellent
Panicle Length	3.67 - 3.77	Excellent

Table 2. Effects of Commercial Foliar Fertilizers on its; Yields of greatest harvest, Quality based in farmers preference, Plant height, Number of tillers, and Panicle length

Parameter	Commercial Foliar Fertilizer 1	Commercial Foliar Fertilizer 2
Yields of greatest harvest	3.60	3.77
Weight	3.60	3.67
Quality based on farmer's preference	3.63	3.67
Plant Height	3.77	3.87
Number of Tillers	3.50	3.67
Panicle Length	3.53 (Good)	3.53 (Excellent)

Table 3. Effects of Farmer's Practice on its; Yields of greatest harvest, Weight, Quality (based in farmers preference), Plant height, Number of tillers, and Panicle length

Parameter	Mean	Qualitative Description
Yields of greatest harvest	3.40	Good
Weight	3.33	Good
Quality based on farmer's preference	3.27	Good
Plant Height	3.33	Good
Number of Tillers	3.23	Good
Panicle Length	3.27	Good

Implications for Rice Cultivation Parameters

A comparative analysis of organic and commercial foliar fertilizers, along with farmer's practices, revealed several important conclusions. Several organic foliar fertilizers, including those containing malunggay leaves and molasses or banana peels and molasses, consistently produced excellent qualitative results across a range of parameters. The results indicated that these treatments improved not only soil health, but also crop yields significantly, as indicated by mean values ranging from 3.67 to 3.93. In addition, commercial foliar fertilizers showed promising results, with both treatments receiving excellent qualitative descriptions in most parameters. Despite this, different growth parameters showed varying degrees of effectiveness, suggesting that fertilizer selection may have a different impact on specific aspects of rice cultivation. Further, Farmer's Practice achieved a "Good" rating across all parameters, which underscores its potential contribution to sustainable agriculture. As a result of the findings, it is important to explore diverse fertilization methods in order to enhance soil health and agricultural productivity, emphasizing the importance of tailoring approaches to rice cultivation practices that take into account both effectiveness and sustainability.

Comparative Analysis of the Effects of Commercial and Organic Foliar Fertilizers on Rice Growth Parameters

There was a comprehensive analysis of the effects of commercial and organic foliar fertilizers on various rice growth parameters in the study. A statistical analysis revealed that plant height at maturity and number of tillers per hill were significantly affected, but panicle length and projected yield per hectare were not significantly affected. Malunggay leaves and molasses, together with commercial foliar fertilizers 1, 2 and 3, showed the greatest plant height at maturity and the highest number of tillers per hill, indicating their effectiveness in promoting robust growth. Contrary to the other treatments, Farmer's Practice resulted in smaller plant heights and fewer tillers. As a result of these findings, it is imperative that appropriate fertilization methods are selected to optimize rice cultivation practices, with further research required to investigate the long-term effects on yield and quality.

Table 4. Significant effect of commercial fertilizer and organic foliar fertilizer in terms of projected yield per hectare (tons/ha)

Source	SS	df	MS	F	p-value
Blocks	2.170	2	1.0850	0.85	.4556
Treatments	1.032	5	0.2063	0.16	.9710
Error	12.743	10	1.2753		
Total	15.945	17			

ns- not significant

Table 5. Significant effect of commercial fertilizer and organic foliar fertilizer in terms of plant height at maturity (cm)

Source	SS	df	MS	F	5%	1%
Blocks	3.510	2	1.7550	1.06		
Treatments	835.347	5	167.0693	100.75		
Error	16.583	10	1.6583			
Total	855.440	17				

*significant at 5%

Table 6. Significant effect of commercial fertilizer and organic foliar fertilizer in terms of number of tillers per hill at maturity

Source	SS	df	MS	F	5%	1%
Blocks	2.33	2	1.167	1.21		
Treatments	68.50	5	13.700	14.17		
Error	9.67	10	0.967			
Total	80.50	17				

Table 7. Significant effect of commercial fertilizer and organic foliar fertilizer in terms of panicle length (cm)

Source	SS	df	MS	F	5%	1%
Blocks	1.541	2	0.7706	0.73		
Treatments	8.171	5	1.6342	1.55		
Error	10.552	10	1.0552			
Total	20.264	17				

ns- not significant

Table 8. Mean of the significant effect of commercial fertilizer and organic foliar fertilizer

Treatment	Mean of plant height (cm)	Mean of No. of tillers	Mean length of panicles (cm)	Projected yields (tons)
Malunggay leaves and molasses	111.2	10.0	20.0	6.0
Ripe Banana peels and molasses	109.0	10.0	19.0	5.8
Malunggay leaves and Ripe Banana peels and molasses	110.9	9.0	19.0	6.3
Commercial Fertilizer 1	96.6	7.0	20.0	6.0
Commercial fertilizer 2	105.4	5.0	19.0	5.9
Farmer's Practice	94.1	6.0	18.0	5.5
Result	*	*	ns	ns

*- significant

ns- not significant

Impact of Commercial and Organic Foliar Fertilizers on Rice Growth Parameters for Optimal Cultivation Practices

To optimize rice cultivation practices, a comparison of the effects of commercial and organic foliar fertilizers on rice growth parameters was conducted. Based on the results of the study, plant height at maturity and the number of tillers per hill were significantly influenced by fertilization methods employed, but panicle length and projected yield per hectare were not significantly affected. As evidenced by their greater plant height and higher number of tillers per hill, treatments involving Malunggay leaves and molasses, as well as certain commercial foliar fertilizers, demonstrated superior performance in promoting robust growth. Contrary to other treatments, Farmer's Practice showed smaller plant heights and fewer tillers. As a result of these findings, it is important to carefully select fertilization methods to optimize rice cultivation results.

Comparative Analysis of Organic and Commercial Foliar Fertilizers for Hybrid Rice Production

It was found that organic fertilizers, specifically Malunggay leaves and molasses and Ripe Banana peels and molasses, are the most cost-effective method of fertilizing hybrid rice per hectare. Compared to commercial fertilizer 1, organic fertilizers have lower production costs, higher gross and net benefits, and a higher return on investment. The cost-effectiveness of organic foliar fertilizers makes them a viable alternative for farmers, although commercial fertilizer 1 yields slightly better results in terms of plant height, tillers, length, projected yields, and quality. Moreover, the study noted farmers' reluctance to use foliar fertilizers due to concerns about possible health effects. Thus, organic foliar fertilizers provide a sustainable solution for rice cultivation that addresses both economic and health-related concerns.

Table 9. Cost and Return Analysis of hybrid rice per hectare

	Malunggay leaves and molasses	Ripe Banana peels and molasses	Malunggay leaves and Ripe Banana peels and molasses	Commercial Fertilizer 1 (1kg)	Commercial Fertilizer 2 (30g)	Farmer's Practice
Total cost of production	66,570	66, 271	66, 521	67, 169	67, 570	63, 923
Gross Benefit	111,000	107, 300	109, 150	116,550	111,000	101, 750
Net Benefit	44, 430	41,029	42,630	49, 382	43,830	37,828
ROI	66.7	61.1	64.1	73.5	65.3	59.2

Cost Effectiveness

Several important findings were revealed from the comparative analysis of organic and commercial foliar fertilizers for hybrid rice production. The most cost-effective method for fertilizing hybrid rice per hectare can be achieved by using organic fertilizers, especially Malunggay leaves and molasses and Ripe Banana peels and molasses. Comparatively to commercial fertilizer 1, they had lower production costs, higher gross and net benefits, and a higher return on investment. Due to these cost-effective advantages, organic foliar fertilizers are an attractive and viable alternative for farmers seeking to optimize their cultivation practices while minimizing their costs. Despite the economic benefits of organic fertilizers, commercial fertilizer 1 yielded slightly better results in terms of various growth parameters, such as plant height, number of tillers, panicle length, projected yields, and quality. In conclusion, organic fertilizers may be cost-effective, but they may not always deliver the same level of performance as certain commercial alternatives. However, the differences in performance between organic and commercial fertilizers were relatively small, suggesting that organic fertilizers can still provide satisfactory results for rice farming.

Further, the study identified a significant barrier to the adoption of foliar fertilizers among farmers - concerns about their potential health effects. Foliar fertilizer usage is reluctant among farmers, which highlights the importance of evaluating not only their economic and agronomic benefits, but also their broader implications, including their impact on human health and the environment. As a result, organic foliar fertilizers provide a viable solution for both economic and health-related concerns, allowing farmers to cultivate rice in an environmentally friendly and socially responsible manner.

As a result, although commercial fertilizer 1 may perform better in certain growth parameters, organic foliar fertilizers are more cost-effective and sustainable for hybrid rice production. In order to ensure long-term sustainability in rice production, farmers need to balance economic considerations with environmental and health factors.

Figure 1. Significant development of organic foliar fertilizer



CONCLUSION

The comparative analysis of organic and commercial foliar fertilizers, along with farmer's practice, unveiled valuable insights into their effects on rice cultivation parameters. Organic foliar fertilizers, particularly those containing malunggay leaves and molasses or banana peels and molasses, consistently demonstrated "Excellent" qualitative results across various parameters. These treatments not only improved soil health but also significantly enhanced crop yields. Similarly, commercial foliar fertilizers exhibited promising results, with both treatments garnering an "Excellent" qualitative description in most parameters. However, differences in effectiveness were observed across different growth parameters, suggesting the importance of tailored fertilization methods for optimizing rice cultivation practices. Additionally, Farmer's Practice showcased positive results, underscoring its potential contribution to sustainable agriculture.

The study's findings emphasize the significance of selecting appropriate fertilization methods to optimize rice cultivation practices. While organic and commercial foliar fertilizers both offer promising benefits, it is essential to consider their varying impacts on specific growth parameters. Organic foliar fertilizers, with their consistent excellent performance and potential cost-effectiveness, emerge as an attractive option for farmers. However, commercial foliar fertilizers may still yield slightly better results in certain parameters. Moreover, the study highlights the importance of addressing farmers' concerns about the potential health effects of foliar fertilizers. Overall, a balanced approach that considers both effectiveness and sustainability is crucial for achieving optimal results in rice cultivation.

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