ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Yield Optimization in Rice Through Combined Foliar and Inorganic Fertilization Strategies

Jessa G. Abalan*[1], Victoriano V. Casco, Ph.D.[2], Lucila V. Rocha, Ph.D.[3]
[1, 2, 3] Isabela State University, Echague Campus, Echague, Isabela, Philippines
*Corresponding Author e-mail: *jhessaguitangna@gmail.com*

Received: 04 May 2025 **Revised**: 07 June 2025 **Accepted**: 08 June 2025

Available Online: 10 June 2025

Volume IV (2025), Issue 2, P-ISSN – 2984-7567; E-ISSN - 2945-3577

https://doi.org/10.63498/etcor363

Abstract
Aim: The objective of this study is to evaluate the impact of foliar fertilizer application as a supplement to conventional inorganic fertilization on rice (*Oryza sativa* L.) yield. The research aims to assess whether the integrated use of foliar and soil-applied fertilizers can enhance nutrient use efficiency, promote physiological responses, and ultimately improve grain yield. This study sought to contribute to the development of more efficient and sustainable nutrient management strategies in rice production systems.
Methodology: The study was conducted on a 476 m² rice field located in Ramon, Isabela, Philippines, ideal for rice cultivation. The hybrid rice variety LP 937 was selected for the experiment. A Randomized Complete Block Design (RCBD) was employed to assess the effects of different treatments, with three replications to ensure statistical reliability. The experimental area was divided into three blocks, each measuring 11 m × 24 m, and further subdivided into eight plots of 3 m × 4 m. Spacing between plots was maintained at 1.5 meters, and a 1-meter gap was left between blocks to minimize interference and facilitate management.
Results: The application of the recommended fertilizer rate combined with foliar micronutrients (Treatment 6) produced the tallest plants, although differences were not statistically significant across all treatments. No significant differences were observed for tiller number, panicle length, filled grains, or 1000-seed weight. However, Treatment 5 (RCM + foliar Zn, Ca, B) showed the highest grain yield (4.17 kg/sampling area) and a 12.29% yield increase compared to the control (Farmer's practice).
Conclusion: This study demonstrates the potential of integrating RCM-based fertilization with targeted foliar micronutrient application (Zn, Ca, B) to enhance rice yield. The 12.29% yield increase observed in Treatment 5 suggests that this approach can be a valuable strategy for improving rice productivity. Further research is needed to optimize the timing and rates of foliar application under varying environmental conditions.
Keywords: Rice Crop Manager, foliar nutrients, inorganic fertilizer rice yield, Zn, Ca, B, nutrient management

INTRODUCTION

Rice, as a staple food for over half of the world's population, holds top importance in global food security initiatives. However, sustaining and enhancing rice yields encounter various challenges that can affect productivity. To maximize productivity, it is necessary to adopt an agronomic technique such as the adoption of Rice Crop Manager (RCM), a tool that helps farmers optimize their crop management practices based on scientific principles and local conditions. The system provides fertilizer application (N, P and K in variable quantities) guidelines for farmers to optimally match the needs of their rice crop in a specific field and season. Nevertheless, rice requires not only macro elements but also micronutrients, as deficiency symptoms are observed only after the crop has suffered permanent damage thereby insufficient management of nutrients poses a significant obstacle to achieving sustainable rice production.

It is known that every nutrient has its own character and is involved in different metabolic processes of plant life. Nutrients affect the disease tolerance or resistance of plants to pathogens. Nutrient deficiency and toxicity conditions inhibit normal plant growth and exhibit characteristic symptoms. For optimal growth, development, and production, plants need all the necessary nutrients in balance. Integrated nutrient management in rice has many

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

benefits to increase soil fertility and sustainable crop productivity thereby foliar fertilizer that contain micronutrients is an effective strategy to enhance yield when used in support to Rice Crop Manager (RCM) protocol.

By integrating foliar micronutrient supplementation into inorganic recommendations, an expectation for such practice can potentially address specific nutrient deficiencies that may limit yield and overall crop health in a timely and precise manner, farmers can unlock the full potential of their rice crops and improve both productivity and profitability.

Several factors contribute to the inefficiency of nutrient absorption by plants, highlighting the importance of foliar fertilizers that play a significant role, especially in addressing nutrient deficiencies by improving nutrient uptake efficiency. Foliar fertilizers play a crucial role in supplementing macro elements such as nitrogen, phosphorus, and potassium in rice cultivation. Their rapid absorption, efficient utilization, and ability to correct deficiencies make them an important component of modern nutrient management strategies in rice production. This is particularly beneficial in instances where the soil may have nutrient imbalances or deficiencies, as foliar fertilizers provide a direct supply of nutrients to the plant without relying solely on soil uptake.

Although there are limited studies on using foliar nutrition to help inorganic, more research is required to determine its efficacy as well as any antagonistic or synergistic effects.

Objectives

This study was conducted to determine the effect of nutrient management in rice.

Specifically, it aimed to:

1. assess the yield performance of rice treated with foliar supplements alongside with organic fertilizers;
2. compare the efficiency of Rice Crop Manager recommendations against farmers traditional practices and other blanket fertilizer application; and
3. identify the best nutrient management practices that maximize productivity for rice farmers.

METHODS

Research Design

The experiment was conducted using hybrid rice variety LP 937 on a 476 m² field with leveled topography with eight 3m x 4m plots per block. Eight treatments were compared: 1) Rice Crop Manager recommendation; 2) Soil analysis 100-30-60 kg NPK ha^{-1}; 3) Minus One Element Technique; 4) Farmer's practice (4.5 bags NPK ha^{-1}); and the same four treatments with the addition of foliar Zn, Ca(major elements).

Population and Sampling

The experiment was arranged in a randomized complete block design (RCBD) with three blocks, each measuring 11 × 24 meters. Each block was subdivided into eight plots (3 × 4 meters), with 1.5 meters between plots and 1 meter between blocks. Each plot was planted with rice at a density of 15 rows × 21 hills (315 hills), with three seedlings per hill, totaling 945 plants per plot.

Instrument

Plant height was measured using a meter stick, from the base of the plant to the tip of the flag leaf. The number of productive tillers (defined as actively growing tillers capable of producing a panicle) was determined by manually counting each tiller per plant. Panicle length was measured using a ruler, from the neck of the rice panicle to the end of the spikelet. After drying to approximately 14% moisture content, the weight of 1000 seeds was determined using a digital weighing scale. The weight of seeds per plot (3 m x 4 m) was obtained by harvesting and weighing all seeds from the plot. Projected seed yield per hectare was calculated using the following formula:
Seed Yield per Hectare (kg/ha) = (Yield per Sampling Area (kg) * 10,000 m²/ha) / Sampling Area (m²).

Data Collection

Growth and yield data were collected from five randomly selected plants per plot using simple random sampling at the ripening stage. The following parameters were measured:
Plant height was measured using a meter stick (to the nearest cm) from the base of the plant to the tip of the flag leaf. The number of productive tillers was manually counted, with productive tillers defined as those having more than two green leaves or being longer than two-thirds of the plant's length at the maximum tillering stage. Panicle length was measured using a ruler (to the nearest mm) from the neck of the panicle to the tip of the longest

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181
RUN RESEARCHERS RUN

spikelet. The weight of 1000 seeds were determined after sun drying to approximately 14% moisture content (measured using a moisture meter), and a 1000-seed sample was weighed using a digital weighing scale with a precision of 0.01g. The weight of seeds per plot was determined by harvesting all seeds from each plot (3m x 4m) and weighing them using a digital weighing scale with a precision of 0.01g. The projected seed yield per hectare was calculated from the weight of seeds per plot using the following formula:

Seed Yield per Hectare (kg/ha) = (Weight of seeds per plot (kg) × 10000 m^2/ha) / Plot area (m^2)

Treatment of Data

Data from the field experiment were analyzed using descriptive statistics (frequencies, means, percentages) and analysis of variance (ANOVA) to determine the effectiveness of each nutrient management approach. Post-hoc tests Tukey's HSD were used where appropriate. Statistical significance was set at $p < 0.05$.

Ethical Considerations

This study adhered to all relevant ethical guidelines. Prior to initiating fieldwork, informed consent was obtained from the farm owner. This process involved a comprehensive briefing outlining the study's objectives, the specific farm areas to be utilized, and the potential effects on the current season's harvest. This ensured that participants were fully aware of the study's procedures and provided their voluntary agreement to participate.

RESULTS and DISCUSSION

This section discusses the effects of various fertilization strategies on rice growth and yield parameters were assessed.

Plant Height. The table below presents the results of gathered data tabulated. It reveals that significant foliar microelements supplementation in support to yield optimization in rice through combined foliar and inorganic fertilization strategies

Table 1. Plant Height (cm) as affected by Foliar Micronutrient Supplementation in Support to yield optimization in rice through combined foliar and inorganic fertilization strategies

TREATMENTS	Plant Height (cm)
T_1 – Rice Crop Manager (RCM) Recommendation	80.97^{ab}
T_2 – 100-30-60 kg NPK ha^{-1} (RR)	80.58^{ab}
T_3 – Minus One Element Technique (MOET)	78.08^{b}
T_4– 4.50 bags NPK ha^{-1} (Farmer's Practice)	80.58^{ab}
T_5– Rice Crop Manager (RCM) + Zn + Ca + B	80.97^{ab}
T_6– 100-30-60 kg NPK ha^{-1}+ Zn + Ca + B	82.94^{a}
T_7– Minus One Element Technique (MOET) + Zn + Ca + B	78.48^{b}
T_8- 4.50 bags NPK ha^{-1} (Farmer's Practice) + Zn + Ca + B	78.87^{b}
F- RESULTS	**
C. V. (%)	1.74

Note: Means with common letter are not significantly different with each other using HSD.
***- significant at 1% level*

The plant height increased significantly with the fertilization methods (Table 1). The mean height indicates that the tallest plants was recorded from the treatment following the application of the recommended rate along the supplementation of foliar spray with Zn + Ca + B (T_6) showing a 4.46% increase over (T_7), a 5.16% over T_8 and 6.22% increase over the plants following the method minus one element (T_3), respectively. However, the height of the plants in T_6 was comparable to those in the other treatments which implies that the soil is deficient in zinc, calcium and boron during the early stages of the plant growth. It also shows that plants in Treatment 1 (RCM) and T_5 performed similarly to Farmer's Practice (80.97 kg ha^{-1}).

This highlights the importance of balanced nutrient management, particularly the supplementation of essential nutrients in optimizing plant growth. The overall growth performance of the treatments with NPK fertilizers

ETCOR's Website : https://etcor.org
Facebook Page : https://www.facebook.com/EmbracingTheCultureOfResearch
Twitter Account : https://twitter.com/ETCOR_research
YouTube Channel : https://tinyurl.com/YouTubeETCOR
E-mail Address : embracingthecultureofresearch@etcor.org
Mobile Number : 0939-202-9035

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Google scholar
Website: https://etcor.org
RUN RESEARCHERS RUN
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

was improve and the availability of micronutrients made a significant increase in the growth of the plants. In addition, height increase observed with the plants applied with Zn + Ca + B foliar spray might be due to the synergistic role of these nutrients and macroelement (calcium) in improving nutrient uptake, reproductive efficiency, and stress tolerance in rice and the effectiveness of foliar supplementation in optimizing rice production.

Nutrients are important for plant growth and development as its deficiency and toxicity conditions inhibit normal plant growth and exhibit characteristic symptoms The growth, development, and production of rice depends on the availability of nutrients in the soil. This aligns with the findings of Cakmak *et al.*, (2010). (Sadak & Bakry (2020) also reported the importance of zinc which is an essential micronutrient for the growth and productivity of plants. On the other calcium is necessary for new cell formation, enhances resistance to bacterial and viral diseases (Usten *et al.,* 2006) and activates several enzyme systems that regulate leaf and root growth (Mengel & Kirkby, 2001). Moreover, boron is responsible for the plant metabolism, optimal crop growth and final harvest.

With regards to the plants grown with a single nutrient omitted compared to plants receiving a complete nutrient solution were significantly smaller and exhibits stunted growth due to the limiting effect of the missing nutrient. This demonstrates the crucial role of each essential element for optimal plant development and due to the absence of even one essential nutrient can severely limit plant growth and development. The disrupted metabolic processes within the plant aligns with the claims of Kumar & Yadav (2005) that significant yield declines in rice in the treatments with imbalanced application of N, P and K fertilizers.

Number of Productive Tillers

This section shows that the tabulated data is not significant

Table 2. Plant Height (cm) as affected by Foliar Micronutrient Supplementation in Support to yield optimization in rice through combined foliar and inorganic fertilization strategies

TREATMENTS	Productive Tillers
T_1 – Rice Crop Manager (RCM) Recommendation	12.27
T_2 – 100-30-60 kg NPK ha^{-1} (RR)	11.33
T_3 – Minus One Element Technique (MOET)	10.20
T_4– 4.50 bags NPK ha^{-1} (Farmer's Practice)	10.60
T_5– Rice Crop Manager (RCM) + Zn + Ca + B	11.73
T_6– 100-30-60 kg NPK ha^{-1}+ Zn + Ca + B	11.00
T_7– Minus One Element Technique (MOET) + Zn + Ca + B	9.93
T_8- 4.50 bags NPK ha^{-1} (Farmer's Practice) + Zn + Ca + B	11.00
F- RESULTS	Ns
C. V. (%)	10.14

ns-not significant

The effect micronutrient application does not typically lead to a noticeable increase in the production of tillers. Analysis of variance reveals that there was no significant difference among the sources of fertilizer which produce the comparable number of tiller number (9.93 to 12.27). This could be attributed to nitrogen applied during the tillering stage in all treatments that augment root activity, which is especially important during rice tillering for the absorption of nutrients and water (Baral *et al.,* 2020) as well as nitrogen top-dressed at 7-14 days after transplanting promotes tillering (Ye *et al.*, 2019). However, each major nutrient and the addition from foliar zinc, calcium and boron was statistically insignificant in terms of the number of productive tilers (Table 2).

The insignificant difference in the number of productive tillers in hybrid rice used in the study remains relatively constant across different fertilizer sources due to several biological and agronomic factors. Plants might adjust their growth based on the availability of nutrients and their ability to support grain filling. Tillering ability of rice has been directly associated with the rice grain yield, as the panicle number per hill is directly proportional to the total number of tillers, irrespective of whether the tillers are productive or unproductive. This is because excess tiller production results in a dense canopy, which provides a moist micro-environment favorable for diseases and pests. However, although many tillers may be generated subsequent to a sufficient supply of nitrogen, not every tiller

ETCOR's Website : https://etcor.org
Facebook Page : https://www.facebook.com/EmbracingTheCultureOfResearch
Twitter Account : https://twitter.com/ETCOR_research
YouTube Channel : https://tinyurl.com/YouTubeETCOR
E-mail Address : embracingthecultureofresearch@etcor.org
Mobile Number : 0939-202-9035

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181
RUN RESEARCHERS RUN

contributes equally to the overall yield because typically, late emerging tillers do not contribute significantly to the grain yield of rice (Wang *et al.,* 2007).

Likewise, it shows that foliar application did not contributes in the production of more tillers which might be attributed to environmental conditions which might not optimal for nutrient absorption. Inorganic fertilizers may already provide adequate levels of essential nutrients to the rice plants and the addition of zinc, calcium, and boron might not lead to any noticeable improvements if the plant has sufficient amounts of these elements already.

Panicle Length

This section shows that the tabulated data is not significant

Table 3. Length of Panicle (cm) as affected by Foliar Micronutrient Supplementation in Support to yield optimization in rice through combined foliar and inorganic fertilization strategies

TREATMENTS	Length (cm)
T_1 – Rice Crop Manager (RCM) Recommendation	19.88
T_2 – 100-30-60 kg NPK ha^{-1} (RR)	20.93
T_3 – Minus One Element Technique (MOET)	20.14
T_4– 4.50 bags NPK ha^{-1} (Farmer's Practice)	20.80
T_5– Rice Crop Manager (RCM) + Zn + Ca + B	20.34
T_6– 100-30-60 kg NPK ha^{-1}+ Zn + Ca + B	21.52
T_7– Minus One Element Technique (MOET) + Zn + Ca + B	19.16
T_8- 4.50 bags NPK ha^{-1} (Farmer's Practice) + Zn + Ca + B	20.54
F- RESULTS	Ns
C. V. (%)	4.77

ns-not significant

The analysis of variance results indicated that fertilization did not significantly affect panicle length of rice as presented in Table 3. The panicle formation observed across all treatments did not record in number regardless of the fertilization which is primarily attributed to the fertilizers absorbed and promotes the similar length of panicle lengths. This result highlighted the effect of fertilizer to boost crop growth, particularly in panicle elongation. Panicle lengths in all treatment recorded 19.88 cm to 21.52 centimeters. The result showed that soil applications of the recommended rate of inorganic fertilizer with foliar spray of zinc, calcium and boron tend to elongate panicle however did not recorded advantage in length regardless of the type or rate of fertilization.

This consistency in panicle length suggests that the fertilizers applied were adequately absorbed by the plants, leading to uniform panicle elongation across treatments. The recorded panicle lengths ranged from 19.88 cm to 21.52 cm, did not vary among treatments. It shows that the application of the recommended rate of inorganic fertilizer combined with foliar sprays containing zinc, calcium, and boron appeared to support panicle elongation, however, it did not result in a statistically significant advantage over the other treatments. These findings highlight that while fertilizers contribute to overall crop growth, their impact on panicle elongation may be limited under the given conditions. The range of panicle length are classified as the medium panicle length category (Diptaningsari 2013).

Number of Filled Grains

This section shows that the tabulated data is not significant.

Table 4. Number of Filled Grains per Panicle as affected by Foliar Micronutrient Supplementation in Support to yield optimization in rice through combined foliar and inorganic fertilization strategies

TREATMENTS	Filled Grains
T_1 – Rice Crop Manager (RCM) Recommendation	105.40
T_2 – 100-30-60 kg NPK ha^{-1} (RR)	102.27

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181
RUN RESEARCHERS RUN

T_3 – Minus One Element Technique (MOET)	101.60
T_4– 4.50 bags NPK ha^{-1} (Farmer's Practice)	114.33
T_5– Rice Crop Manager (RCM) + Zn + Ca + B	105.27
T_6– 100-30-60 kg NPK ha^{-1}+ Zn + Ca + B	102.73
T_7– Minus One Element Technique (MOET) + Zn + Ca + B	101.80
T_8- 4.50 bags NPK ha^{-1} (Farmer's Practice) + Zn + Ca + B	118.53
F- RESULTS	ns
C. V. (%)	16.96

ns-not significant

Filled grains indicated a non-significant variation as affected by the methods of fertilization (Table 4). Specifically, removing one of the essential elements in rice (minus one element, T_7) did not drastically decrease the production of filled grains. The results might be attributed to soil reserves, nutrient redistribution and compensatory plant mechanisms. Moreover, the addition of essential elements like zinc, calcium and boron may partially fulfill the role of missing nutrients. This support to the claims of Karuna *et al*., (2019) that appropriate quality of micronutrients is necessary for better growth, flowering, fruit set and higher yield while its deficiency leads in lowering the productivity of the crop. Additionally, the use of micronutrient fertilizers can provide substantial outcomes regarding the yield characteristics and protein content, increasing nutrient accessibility and affecting the physiological parameters of the crop, as reflected in the yield increase (Fakharzadeh *et al.,* 2020).

Weight of 1000 Grains.

This section shows that the tabulated data is not significant.

Table 5. Weight of 1000 Grains (g) as affected by Foliar Micronutrient Supplementation in Support to yield optimization in rice through combined foliar and inorganic fertilization strategies

TREATMENTS	Weights of 1000 Grains (g)
T_1 – Rice Crop Manager (RCM) Recommendation	22.37
T_2 – 100-30-60 kg NPK ha^{-1} (RR)	20.85
T_3 – Minus One Element Technique (MOET)	26.67
T_4– 4.50 bags NPK ha^{-1} (Farmer's Practice)	23.67
T_5– Rice Crop Manager (RCM) + Zn + Ca + B	24.33
T_6– 100-30-60 kg NPK ha^{-1}+ Zn + Ca + B	25.12
T_7– Minus One Element Technique (MOET) + Zn + Ca + B	26.33
T_8- 4.50 bags NPK ha^{-1} (Farmer's Practice) + Zn + Ca + B	23.00
F- RESULTS	ns
C. V. (%)	10.99

ns-not significant

The weight of 1000 grains of rice were not significantly influenced by the different fertilization strategies as shown in Table 5. The treatments that involved of combining inorganic fertilizer, with and without the addition of micro nutrients or with minus one element, rice crop manager similarity produced grain weight ranged from 20.85 grams to 26.33 grams. Although minus one element technique had slightly heavier weight of 1000 grains but the difference did not vary among treatments. It shows that variations in fertilization strategies did not register a notable variation on 1000 grains. It shows that while fertilizers significantly affect total yield through tiller number and the number of grains, their influence on the weight is minor, a stable trait with limited responsiveness to external inputs.

ETCOR's Website : https://etcor.org
Facebook Page : https://www.facebook.com/EmbracingTheCultureOfResearch
Twitter Account : https://twitter.com/ETCOR_research
YouTube Channel : https://tinyurl.com/YouTubeETCOR
E-mail Address : embracingthecultureofresearch@etcor.org
Mobile Number : 0939-202-9035
Thank you for embracing the culture of research with us!

Computed Yield per Hectare

This section shows that the tabulated data.

Table 6. Computed Yield per Hectare (kg)

TREATMENTS	Computed Yield kg ha^{-1}	Percentage Increase/ Decrease
T_1 – Rice Crop Manager (RCM) Recommendation	9758.33	5.11
T_2 – 100-30-60 kg NPK ha^{-1} (RR)	8775.00	(-5.47)
T_3 – Minus One Element Technique (MOET)	7741.67	(-16.60)
T_4– 4.50 bags NPK ha^{-1} (Farmer's Practice)	9283.33	-
T_5– Rice Crop Manager (RCM) + Zn + Ca + B	10425.00	12.29
T_6– 100-30-60 kg NPK ha^{-1}+ Zn + Ca + B	8758.33	(-5.65)
T_7– Minus One Element Technique (MOET) + Zn + Ca + B	7975.00	(-14.09)
T_8- 4.50 bags NPK ha^{-1} (Farmer's Practice) + Zn + Ca + B	9850.00	6.10

The computed yield per hectare as influenced by fertilization is shown in Table 7. This was projected from the grain yield per sampling area. It shows that there was a yield advantage in yield at T_5– Rice Crop Manager (RCM) + foliar (Zn + Ca + B) of yielded 10425.00 kilograms a 12.29 percent increase over the rest of the treatments. It clearly shows that integrating RCM recommendations with foliar application of micronutrients (Zinc, Calcium, and Boron) enhances rice productivity. Next higher yielder is noted in Treatment 8 (Farmer's Practice + foliar (Zn + Ca + B) with 6.10 percent shows that the addition of foliar Zn, Ca, and B can still contribute to yield improvement. On the other hand, Rice Crop Manager (RCM) technique registered 5.11 percent. While micronutrient foliar sprays can enhance plant health and correct minor deficiencies, they cannot replace the critical functions of macronutrients in plant growth and yield formation. The removal of N, P, or K, even with foliar supplementation, disrupts essential physiological processes, leading to a significant reduction in yield as indicated by a negative value recorded in Treatment 3 (Minus One Element Technique (MOET) and Treatment 7 (Farmer's Practice + foliar (Zn + Ca + B).

The results also support to the claims of Dobermann *et al.,* (2002) in a field-specific management of macronutrients that there was an increased yield by seven (7) percent and profitability by 12 percent on 179 rice farms in Asia. Increased nutrient uptake and N use efficiency across a wide range of rice growing environments with diverse climatic conditions were related to the effects of improved N management and balanced nutrition.

Conclusion

This study demonstrates the potential of integrating RCM-based fertilization with targeted foliar micronutrient application (Zn, Ca, B) to enhance rice yield. The 12.29% yield increase observed in Treatment 5 suggests that this approach can be a valuable strategy for improving rice productivity. Further research is needed to optimize the timing and rates of foliar application under varying environmental conditions.

Recommendations

The RCM approach supplemented with foliar Zn, Ca, and B is recommended for enhancing rice yield. Further research should investigate the optimal application timing and rates under diverse environmental conditions.

REFERENCES

Baral, B. R., Adhikari, P., & Gautam, S. (2020). Tiller production and yield of rice as influenced by nitrogen levels and spacing. *International Journal of Applied Sciences and Biotechnology, 8*(1), 1–6. https://doi.org/10.3126/ijasbt.v8i1.27892

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Cakmak, I., Kalayci, M., Kaya, Y., Torun, A. A., Aydin, N., Wang, Y., Arisoy, Z., Erdem, H., Gokmen, O., Ozturk, L., & Horst, W. J. (2010). Biofortification and localization of zinc in wheat grain. *Journal of Agricultural and Food Chemistry, 58*(16), 9092–9102. https://doi.org/10.1021/jf101197h

Diptaningsari, D. (2013). *Analysis of agronomic character performance and stability of promising upland rice lines derived from local Buru Island rice through anther culture* (Master's thesis, Institut Pertanian Bogor). [Repository Link if available]

Dobermann, A., Witt, C., & Dawe, D. (2002). Performance of site-specific nutrient management in intensive rice cropping systems of Asia. *Better Crops International, 16*(1), 20–25.

Fakharzadeh, S., Hafizi, M., Baghaei, M. A., Etesami, M., Khayamzadeh, M., Kalanaky, S., Akbari, M. E., & Nazaran, M. H. (2020). Using nano chelating technology for biofortification and yield increase in rice. *Scientific Reports, 10*, 4351. https://doi.org/10.1038/s41598-020-61347-5

Karuna, K., Sharma, V., & Meena, M. (2019). Influence of micronutrient application on yield and quality of rice. *International Journal of Chemical Studies, 7*(2), 1731–1734.

Kumar, A., & Yadav, D. S. (2005). Impact of nutrient management on productivity and soil fertility under rice-wheat cropping system. *Indian Journal of Agronomy, 50*(2), 89–93.

Mengel, K., & Kirkby, E. A. (2001). *Principles of plant nutrition* (5th ed.). Kluwer Academic Publishers.

Sadak, M. S., & Bakry, B. A. (2020). Role of zinc and/or salicylic acid in improving plant tolerance to drought stress. *Plant Archives, 20*(2), 2341–2351.

Usten, D., Caglar, S., & Turhan, K. (2006). Effects of foliar calcium sprays on fruit quality in pomegranate (*Punica granatum* L.). *Acta Horticulturae, 818*, 205–210. https://doi.org/10.17660/ActaHortic.2009.818.29

Wang, F., Sui, Y., Zhao, H., Gao, Y., & Zhang, W. (2007). Effects of nitrogen application on growth and tillering of rice. *Agricultural Sciences in China, 6*(6), 715–722. https://doi.org/10.1016/S1671-2927(07)60098-3

Ye, Y., Liang, X., Chen, Y., Lu, Y., Li, F., & Zeng, R. (2019). Effects of nitrogen management on rice tillering and yield. *Agronomy Journal, 111*(3), 1235–1243. https://doi.org/10.2134/agronj2018.06.0419