PROJECT REPORT

Promotion of Sustainable Rice Production through the Application of Bio-fertilizers and Organic Amendments

SEPTEMBER 2025

RATIONALE

This report presents and focuses solely on the evaluation of the requested company's product relative to the control. Other company entries were excluded to maintain objectivity and prevent conflicts arising from cross-comparisons.

RATIONALE

Rice (*Oryza sativa* L.) is a major cereal crop and staple food in many countries, especially in Asia, providing a significant source of energy (21%) and protein (15%) for more than half of the world's population (Debnath et al., 2020; Maclean et al., 2002; Depar et al., 2011). Despite its importance, rice yields have been declining in recent years due to population growth and unsustainable farming practices. This decline emphasizes the urgent need for sustainable agricultural systems.

Sustainable agriculture involves managing farming systems to uphold productivity, renewal capacity, biodiversity, and ecosystem health without harming future farming potential. However, ongoing cultivation on the same land, driven by population pressure, has led to soil fertility decline. Even with the use of inorganic fertilizers, crop yields remain limited (Santos et al., 2012).

While traditional agriculture has been vital for satisfying the food needs of a growing global population, it has created a reliance on chemical fertilizers and pesticides, mainly made up of nitrogen (N), phosphorus (P), and potassium (K). The overuse of chemical fertilizers leads to environmental problems like groundwater contamination, eutrophication of water bodies, and soil acidification (Youssef & Eissa, 2014). Over time, chemical inputs also weaken plant root systems, making crops more vulnerable to diseases (Chun-Li, 2014).

In response to these challenges, bio-fertilizers—containing beneficial microorganisms—are gaining attention as environmentally friendly alternatives to chemical fertilizers. These microorganisms, such as nitrogen fixers and phosphate-solubilizing bacteria, improve nutrient uptake, promote root health, and boost soil fertility (Khosro & Yousef, 2012). The use of organic farming practices, including amendments like compost and vermicompost, complements bio-fertilizers by further improving soil health, structure, and biodiversity (Raja, 2013). Organic inputs also decrease dependence on chemical fertilizers, ensuring food safety while restoring the natural balance of agricultural ecosystems.

The combination of bio-fertilizers and organic farming promotes biodiversity by increasing populations of beneficial bacteria and fungi, including arbuscular mycorrhizal fungi (AMF) and plant growth-promoting rhizobacteria (PGPR), which improve nutrient availability and crop resilience. These sustainable practices support long-term productivity, environmental protection, and economic viability for farmers, making them vital parts of future agricultural systems.

OBJECTIVES

General: To promote a sustainable rice production by enhancing soil fertility, crop yield, and environmental health through the application of bio-fertilizers and organic amendments.

Specific:

1. To evaluate the effects of bio-fertilizers and organic amendments on soil fertility in rice production systems.
2. To assess the impact of bio-fertilizers and organic amendments on rice crop growth, yield, and quality.
3. To determine the economic viability of integrating bio-fertilizers and organic amendments into sustainable rice farming practices.

METHODOLOGY

Location

The study was conducted in Brgy. Switch, Ramon Magsaysay, Zamboanga del Sur (8°02'46.0"N 123°28'56.2"E).

Experimental Design, Layout, and Entry Assignments

The study employed Descriptive Analysis to evaluate and summarize the data gathered from the Biofertilizer Derby. This approach was used to describe the overall performance and characteristics of the different biofertilizers applied, as well as the responses observed in terms of agronomic parameters (plant height, number of productive tillers, and chlorophyll content). Measures such as mean and percentage were calculated to show the variability of the data. Additionally, descriptive statistics were used to illustrate the trends and patterns in rice production performance under different treatments through tables, charts, and graphical summaries, providing a clear overview of the results and making comparisons among treatments easier. Treatments were designated as follows:

Control = RCM (Rice Crop Manager)

T_1 = Ultra-Pure

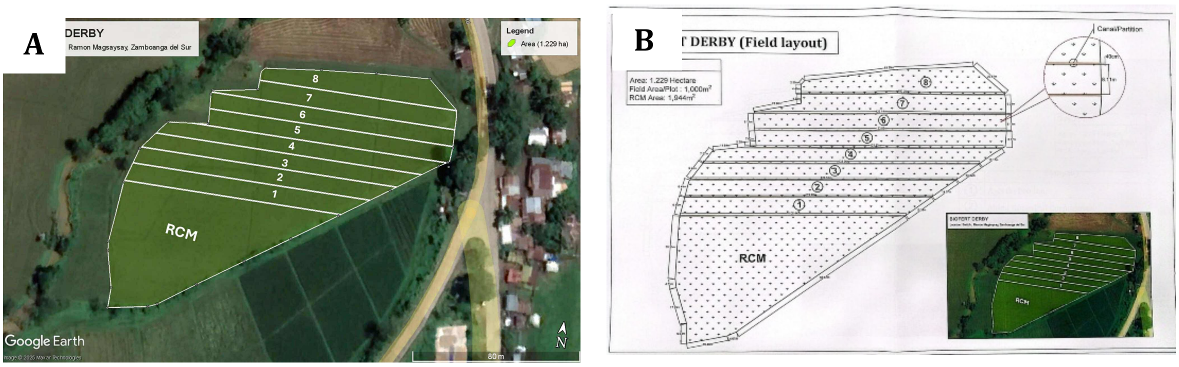

Figure 1. (A) GPS map of field site (B) Field lay-out measured area using GPS devices

The plot size for each treatment except RCM was 1000 sqm, while the RCM plot was larger than 1000 sqm. All treatment plots followed the recommended management practices for land preparation, residue management from the previous crop, crop establishment (manually transplanted), and nursery management. The farmer cooperatives handled these practices and recorded them with the researcher.

Selection of Participants and Registration

The selection process starts with formal registration. Interested participants obtain registration and workplan forms from any DA-RFO IX office in the region. To promote inclusivity, submissions are accepted either in person or online. However, strict adherence to the registration deadline is maintained. Late entries are not accepted to preserve the integrity of the process.

Once the registration period closes, the organizing committee evaluates the submissions and selects ten official participants. Priority is given to those using verified, commercially available, and accessible technologies. Emphasis is placed on Fertilizer and Pesticide Authority (FPA)-approved bio-fertilizers and innovative fertilizer management protocols. Selected participants receive official notification and are invited to a briefing, where they are required to submit their finalized work plans, calendars of activities, projected costs, and a detailed package of technologies.

Field Demonstration Setup

The field demonstration is the centerpiece of the derby. Each participant was assigned a 1,000-square-meter plot, allocated through a coding system to ensure fairness. A one-meter buffer zone separated plots to avoid cross-contamination and provide space for seedbeds. DA-RFO IX Research Division provides the demonstration field, while participants supply their chosen rice varieties and bio-fertilizer products.

To validate results, the derby spans two consecutive cropping seasons—one wet and one dry season. This approach ensures the replicability of findings under different environmental conditions. Along with participants' plots, control plots using traditional farmer practices and DA-RFO IX's best nutrient management technologies were established for comparison.

Fertilizer Management

As for the type of fertilizers, amounts, application rates, and timing, recommendations were based on baseline information and cooperator interviews, with adjustments made to achieve a target yield of 5.3 tons/ha. The sources of macronutrients—nitrogen (N), phosphorus (P), and potassium (K) for all treatments were derived from the Rice Crop Manager recommendations, and, in addition, the biofertilizer Ultra-Pure from Agri Go Pro Companies was applied. 1st application (Early) Basal, 2nd application (Active Tillering) Side Dress, and 3rd application (Panicle Initiation) Top Dress with 1.17 L/hectare.

Implementation and Monitoring

The research was based on strict implementation and monitoring protocols. DA-RFO IX Research Division oversaw all nutrient technology applications to ensure compliance and transparency. Participants' bio-fertilizer application techniques were carried out in the presence of DA representatives. To ensure consistency, overall field maintenance—including cleanliness, pest control, and water management—was managed by the farmer cooperators. However, cultural practices specific to certain technologies were accommodated when necessary.

Monitoring was a vital part of the research. A dedicated team from DA-RFO IX Research Division documents all field activities and makes sure any changes are recorded. Participants confirmed these records by signing the datasheets, promoting accountability and agreement on data accuracy.

Data Collection and Evaluation

The study assesses participants' entries based on agronomic performance and economic viability. Yield data were collected from the entire plot and standardized to 14% moisture content for consistency. Additionally, crop-cut sampling was used to evaluate yield components in each treatment plot, with samples randomized and placed at least one meter away from the plot edge. Beyond yield, a cost-return analysis was conducted to evaluate the profitability of each entry.

Harvesting

Harvesting was carried out under the supervision of DA-RFO IX Research Division representatives and in the presence of participants to ensure fairness. Harvesting occurred when 85% to 100% of the panicles turned yellow, indicating physiological maturity. A single (1) crop cut of 2m x 2.5m (5m2) was taken from each treatment plot in a randomized manner, at least one (1) meter away from the plot edge. The harvested sample was placed in a sack with treatment labels and threshed manually. Moisture content was measured for calculating the adjusted yield per hectare. The harvest from each plot was stored in clean sacks labeled with the plot number and entry name, either inside the sacks or attached/written on them, then weighed and recorded. The harvested rice was returned to the landowner as a gesture of collaboration and community involvement.

Field day and Preferential Analysis

The rice field day provided an opportunity to showcase the benefits of sustainable rice production practices using biofertilizers and organic amendments. It also involved farmers, stakeholders, and agricultural practitioners in sharing knowledge and promoting technology. Preferential data was collected through preferential analysis. This analysis took place during the farmers' field day at the Biofertilizer study site, specifically in Brgy. Switch, Ramon Magsaysay, Zamboanga del Sur. It occurred a day before harvest, when most of the entries were 85-100% mature. A total of 40 farmers participated by voting for their preferred biofertilizer, depositing paper ballots in a box. After counting the votes, farmers discussed their choices. Preferential analysis (PA) produces two types of data: (a) quantitative preference scores for each variety, calculated as the number of positive votes minus the negative votes, divided by total votes cast, and (b) a list of agronomic characteristics farmers liked about their preferred biofertilizers. The preference data collected was entered into the preference test data sheet in the field book for submission and analysis.

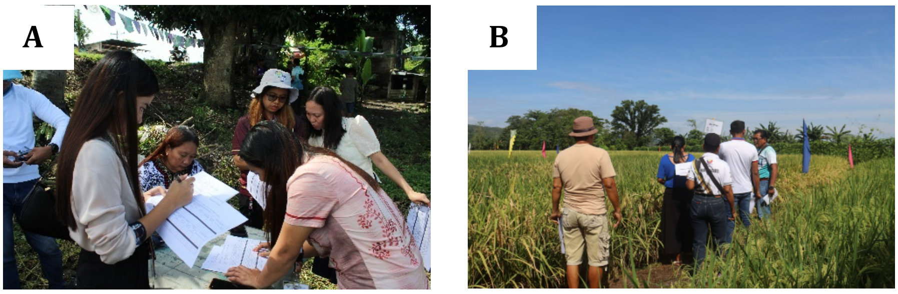

Figure 2: Farmers field tour and preferential analysis during Farmers' Field Day in Switch, Ramon Magsaysay, Zamboanga Del Sur (A) RCPC personnel, (B) Farmers.

Rules and Compliance

Strict adherence to derby rules maintains the integrity of the competition. All field activities took place at designated sites and in the presence of DA-RFO IX staff. Participants were required to disclose all inputs and associated costs to ensure transparency. If participants wish to withdraw, a formal written request is mandatory. Non-compliance, including unethical practices or misrepresentation, may lead to disqualification.

RESULTS AND DISCUSSION

Background of the Derby

Table 1 shows data from a comprehensive trial conducted in an irrigated ecosystem in Brgy. Switch, Ramon Magsaysay, Zamboanga Del Sur, with our partner, the Regional Crop Protection Center (RCPC). This study aimed to assess how integrating bio-fertilizers and organic amendments can significantly improve sustainable rice production by enhancing soil health, yields, and economic viability. The trial used a specific rice variety, NCIS Rc 748 H, which was manually transplanted. The plot areas, each measuring 1000 sqm, were mapped using GPS.

Table 1: *Farmer cooperators and crop information*

LOCATION	FARMER COOPERATOR	AREA	DATE OF ESTABLISHMENT	DATE OF HARVEST	CROP ESTABLISHMENT METHOD	VARIEY USED
Brgy. Switch, Ramon Magsaysay, Zamboanga Del Sur	Regional Crop Protection Center (RCPC)	1.24 Ha	June 02, 2025	September 02, 2025	Manually transplanted	NCIS Rc 748 H

GPS map of Field sites

Figure 3: Brgy Switch, Ramon Magsaysay, Zamboanga Del Sur. (irrigated)

The maps above display the GPS tracks of the biofertilizer derby trials recorded with a Garmin GPS device, used to verify the area. Measuring rice fields with GPS devices offers a significant advantage by providing precise fertilizer recommendations tailored to each field's specific size and features. This accurate geospatial data enables the Rice Crop Manager Advisory Services to calculate the exact field size and determine the optimal fertilizer application rates accordingly.

Table 2. Timing of Fertilizer and Biofertilizer application

Treatment	Product	Timing Application	Dosage
RCM	Complete Urea	Basal (0-10 DAT) Active Tillering (17-13 DAT) Panicle Initiation (28-34 DAT)	74 kg 209 kg
Agri Go Pro	Ultra-Pure	1st application (Early) Basal 2nd application (Active Tillering) Side Dress 3rd application (Panicle Initiation) Top Dress	1.17 L/ hectare

Table 2 illustrates the timing of nutrient management practices, especially fertilizer application, at various stages of crop growth. Each application stage is denoted in days after planting (DAP), showing when the fertilizer should be applied relative to planting. The specified range (e.g., 0-10 DAP) allows flexibility depending on crop development and environmental conditions. These timings help ensure the crop receives essential nutrients during key growth stages, boosting growth, development, and overall yield. Additionally, a detailed summary of the biofertilizer treatments tested in the experiment is included, listing product names, application timings, and dosages per hectare. Agri Go Pro companies follow a unique application protocol that varies by crop growth stage, including the method used (basal incorporation, side-dressing, top-dressing, or foliar spraying) and the frequency throughout the growth cycle. The sources of macronutrients—nitrogen (N), phosphorus (P), and potassium (K)—for all treatments are based on Rice Crop Manager recommendations, complemented with biofertilizers from Agri Go Pro Companies, specifically Ultra-Pure biofertilizer. The applications consisted of a first application (Early) as basal, a second application (Active Tillering) as side dressing, and a third application (Panicle Initiation) as top dressing at 1.17 L per hectare.

Agronomic Parameters

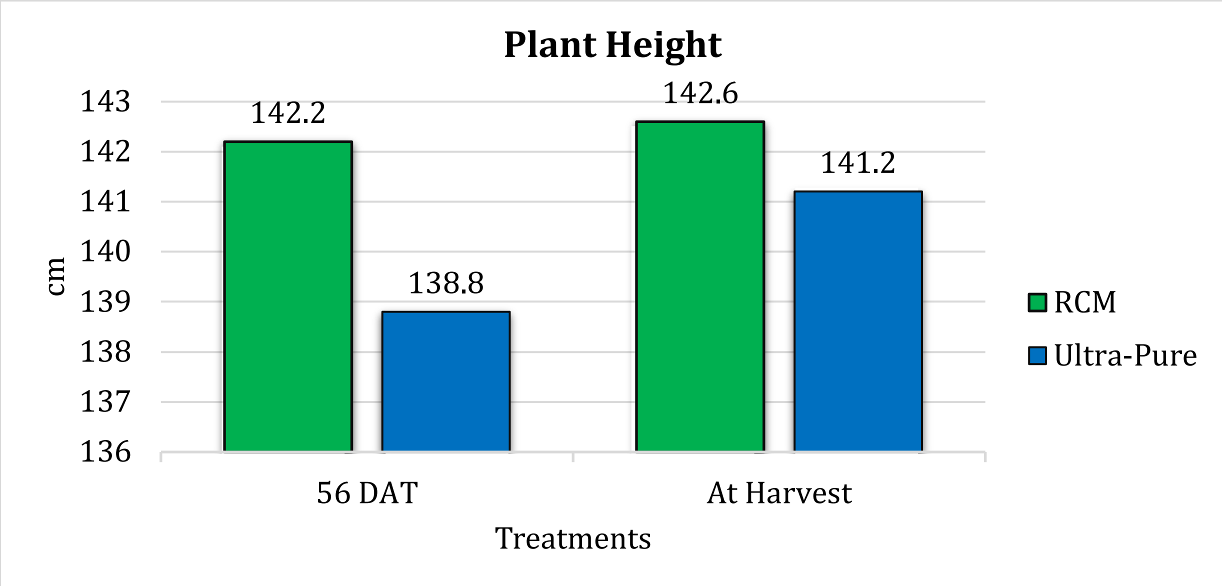

Figure 4: Plant Height in 56 Days after Transplanting (DAT) and at Harvest

Plant height at 56 days after transplanting (DAT) showed significant variation among treatments, indicating differences in genetic potential and responsiveness to nutrient management and environmental factors. The Rice Crop Manager (RCM) treatment produced the tallest plants with an average height of 142.2 cm, followed by the Ultra-Pure treatment at 138.8 cm, reflecting their effectiveness in promoting early vegetative growth. At harvest, distinct differences remained evident, with RCM (142.6 cm) maintaining the tallest plants, closely followed by Ultra-Pure (141.2 cm). These results suggest that both treatments provided optimal growth conditions, enhancing vegetative development and plant vigor throughout the growing period.

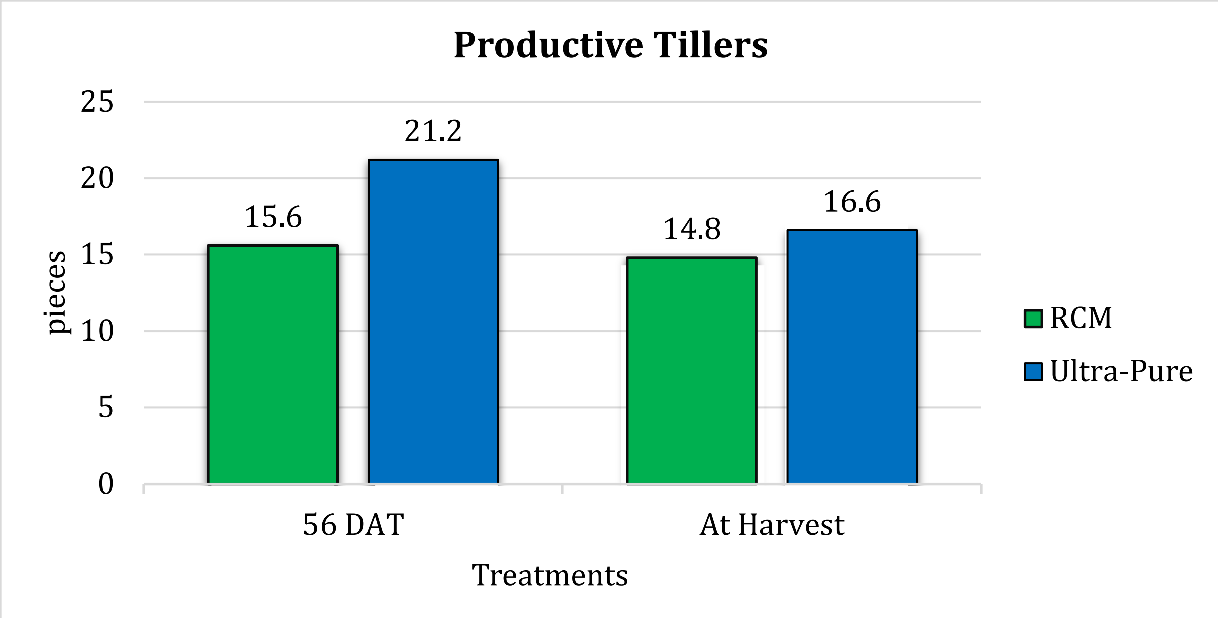

Figure 5: No. of Productive Tillers in 56 Days after Transplanting (DAT)and at Harvest

The number of productive tillers at 56 days after transplanting (DAT) showed significant differences among the various treatments, highlighting the impact of genetic traits and management practices on tillering patterns. The Ultra-Pure treatment recorded the highest number of productive tillers (21.2), indicating improved tiller initiation and establishment, which are key factors for potential grain yield. This was followed by the Rice Crop Manager (RCM), with an average of 15.6 tillers. Similarly, at harvest, Ultra-Pure remained superior with 16.6 tillers, surpassing RCM (14.8). The consistent performance of Ultra-Pure across both growth stages indicates strong vegetative vigor and sustained tillering ability, which could lead to increased panicle density and potentially higher yields.

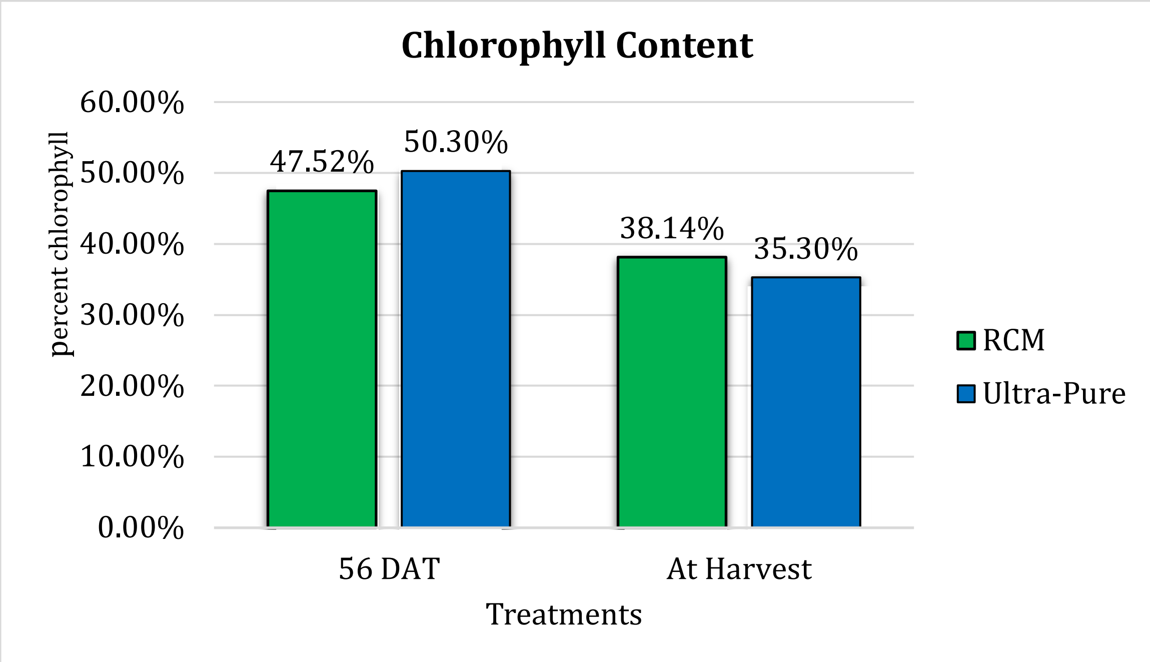

Figure 6: Chlorophyll Content in 56 Days after Transplanting (DAT) and at Harvest

The chlorophyll content at 56 days after transplanting (DAT) showed significant differences among the various treatments, indicating variations in photosynthetic efficiency and nutrient use. Ultra-Pure had the highest chlorophyll content (50.30%), showing superior photosynthetic potential and better adaptability to environmental conditions. This was closely followed by the Rice Crop Manager (RCM), with a chlorophyll content of 47.52%. At harvest, a similar pattern of variation was seen among the treatments. However, the RCM treatment displayed the highest chlorophyll content (38.14%), implying sustained photosynthetic capacity and effective nutrient absorption during later growth stages. Ultra-Pure, with 35.30%, maintained an intermediate level, suggesting that although its chlorophyll levels slightly decreased over time, it stayed within a range that supports efficient photosynthesis and overall plant health.

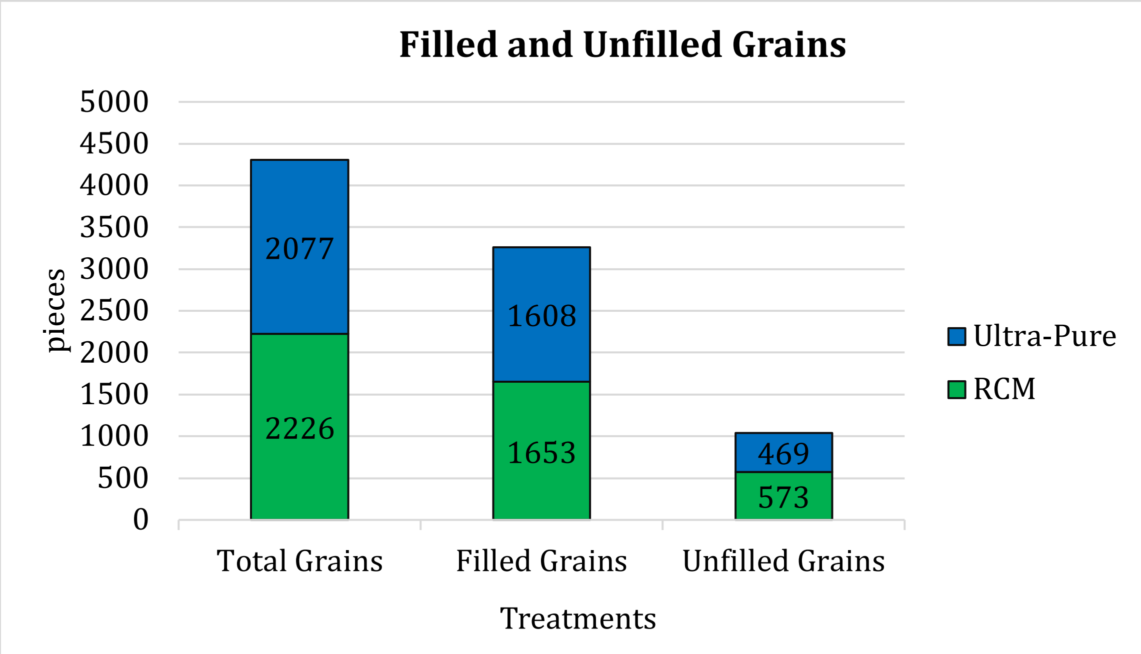

Figure 7. Total number of Filled and Unfilled Grains

The total number of filled and unfilled grains was determined to assess the effect of treatments on grain filling and overall productivity. The RCM treatment produced a total of 2,226 grains, of which 1,653 grains were filled and 573 were unfilled. Meanwhile, the Ultra-Pure biofertilizer treatment yielded a total of 2,077 grains, consisting of 1,608 filled grains and 469 unfilled grains.

Although the total number of grains was slightly higher in the RCM treatment, the Ultra-Pure biofertilizer showed a greater proportion of filled grains, indicating a higher grain filling percentage and potentially better grain quality. This suggests that applying Ultra-Pure biofertilizer improved the crop's physiological efficiency, leading to better grain development and filling. The increased number of filled grains in the Ultra-Pure treatment points to improved nutrient uptake and translocation during the reproductive stage, resulting in a more productive panicle and possibly higher yield.

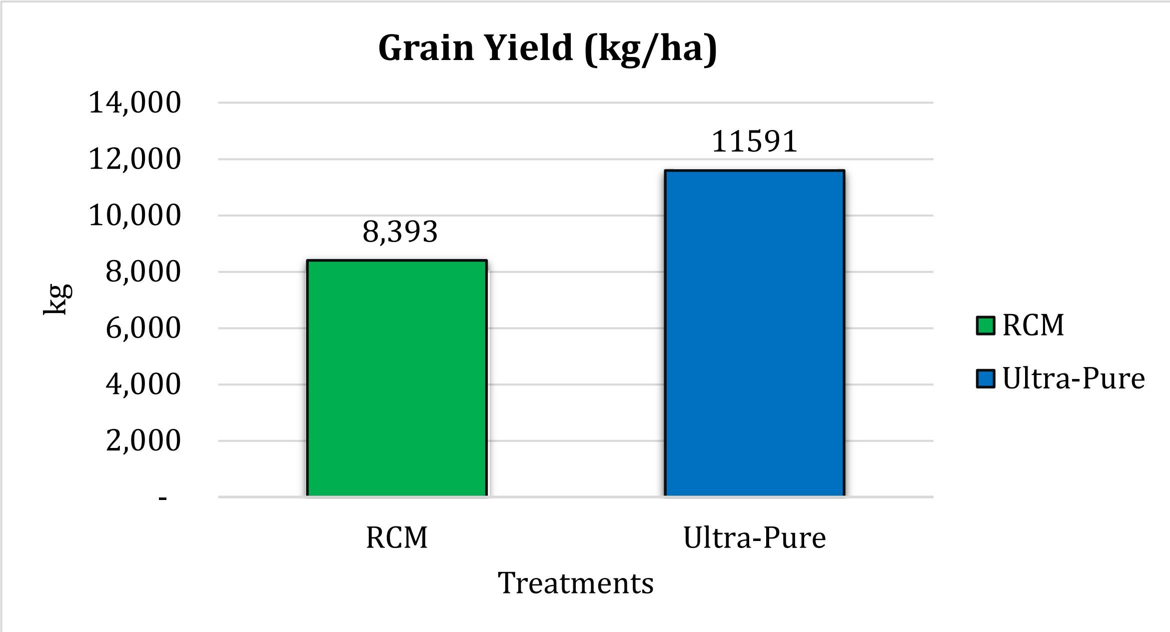

Figure 8: Grain Yield in kilogram per hectare

The results showed a significant difference in grain yield among treatments. The application of Ultra-Pure biofertilizer produced the highest yield of 11,591 kg/ha (11.59 t/ha), surpassing the RCM recommendation, which yielded 8,393 kg/ha (8.39 t/ha). This suggests that, although the RCM recommendation alone already provides a substantial yield due to its balanced macro-nutrient composition, adding Ultra-Pure biofertilizer further increased yield. The improvement can be linked to the synergistic effects of biofertilizer application, which enhances nutrient uptake, boosts soil microbial activity, and promotes better plant growth and grain filling. Overall, combining RCM and Ultra-Pure biofertilizer shows potential for higher productivity and better return on investment (ROI) in rice farming.

Farmers' Biofertilizer Preference

Preferential analysis of Biofertilizer study was conducted during the Farmers' Field Day in Switch, Ramon Magsaysay, Zamboanga Del Sur. The table shows the results of the evaluation of different Biofertilizer entries based on their agronomic performance in the field. It revealed that the Ultra-Pure was the most preferred Biofertilizer compared to RCM (Rice Crop Manager), according to combined scores from male and female voters. Farmers described the top Biofertilizers as having longer panicle lengths, larger and cleaner grains, taller plants, strong, bigger, and numerous tillers, low shattering, and early maturity.

Table. 4 Biofertilizer study site in Bryg. Switch, Ramon Magsaysay, Zamboanga Del Sur.

Treatments	Male		Female		Total Votes		Score
	/	X	/	X	/	X	(/-X)/N
RCM	0	4	0	2	0	6	-0.150
Ultra-Pure	0	4	10	5	10	9	0.025
N- Total Number of Voters	40						

*/ - most preferred; X – less preferred

Table. 5.0 Actual itemized cost per treatment (Php).

Materials and Supplies						
Treatments	Seeds (18 kg)	Fertilizer		Biofertilizer Cost (Php)	Molluscicide	Total
		complete 4 bags and 24 kg	urea 4 bags and 9 kg			
RCM	6900	9696.16	13088	0	680	30,364.16
Ultra-Pure	6900	9696.16	13088	10494.9	680	40,859.06

Labor Cost															
Treatments	Seedbed Preparation	Seed Soaking and Incubation	Seed Sowing	Land Preparation				Seedling Care	Pulling & Bundling of seedlings	Transplanting	Fertilization	Spraying	Combined Harvesters	Maintenance	Total
				Plowing	Harrowing	Levelling	Repair Dikes								
RCM	500	500	500	3000	3000	1000	1000	500	3000	4000	1000	0	7000	1000	26,000.00
Ultra-Pure	500	500	500	3000	3000	1000	1000	500	3000	4000	1000	1500	7000	1000	27,500.00

Materials + Labor					
Treatments	Grain yield (kg)	Gross Income (Php)*	Total production cost(Php)	Net Income (Php)	ROI (%)
RCM	8392.56	193,028.84	56,364.16	136,664.68	242.47
Ultra-Pure	11591.16	266,596.74	68,359.06	198,237.68	289.99

* Assumed buying price of rice is Php 23.00 per kilo

Cost and Return Analysis

The return on capital invested varied across all treatments, influenced by yield and expenses incurred as shown in Table 5. The highest gross income of Php 266,596.74 was obtained by Ultra-Pure, based on a price of Php 23.00/kg, followed by RCM with Php 193,028.84. The study's results revealed that all treatments generated a positive net income and return on investment (ROI). Among the entries, the highest ROI was recorded in Ultra-Pure (289.99%). The Rice Crop Manager (RCM) recommendation also produced a favorable ROI of 242.47%.

Conclusion

The study on "Promotion of Sustainable Rice Production through the Application of Bio-fertilizers and Organic Amendments" demonstrated that combining bio-fertilizers with Rice Crop Manager practices improves rice growth and yield. Results showed that RCM (Rice Crop Manager) produced the tallest plants, and Ultra-Pure also recorded the highest number of productive tillers, chlorophyll content, and grain yield. RCM (Rice Crop Manager) served as the main source of macronutrients, helping to improve soil fertility and crop performance. However, when RCM was combined with the bio-fertilizer Ultra-Pure, that treatment led to an even higher yield.

In terms of economic return, both RCM and Ultra-Pure treatments proved to be profitable. The RCM treatment had a positive ROI, while the Ultra-Pure treatment showed a significantly higher ROI, demonstrating that combining bio-fertilizers with Rice Crop Manager not only boosts productivity but also increases farmers' profitability.

Overall, the results confirm that combining RCM and bio-fertilizers like Ultra-Pure can greatly support sustainable rice production by enhancing soil fertility, crop yields, and farmers' income while also protecting environmental health. Further testing in other rice ecosystems is recommended to confirm these findings and encourage the adoption of bio-fertilizer-based nutrient management strategies.

Photo Documentation

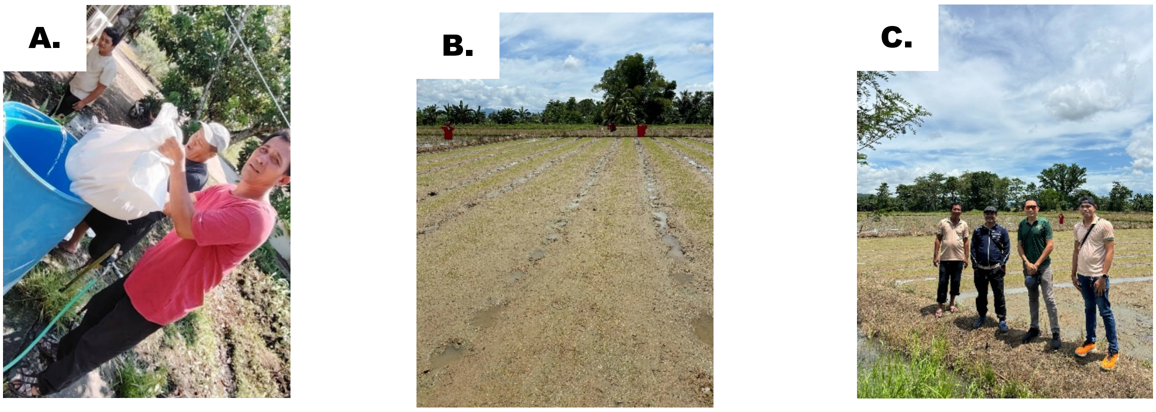

Figure 1: (A) Seed Soaking, (B) Seed Sowing, (C) Site Validation

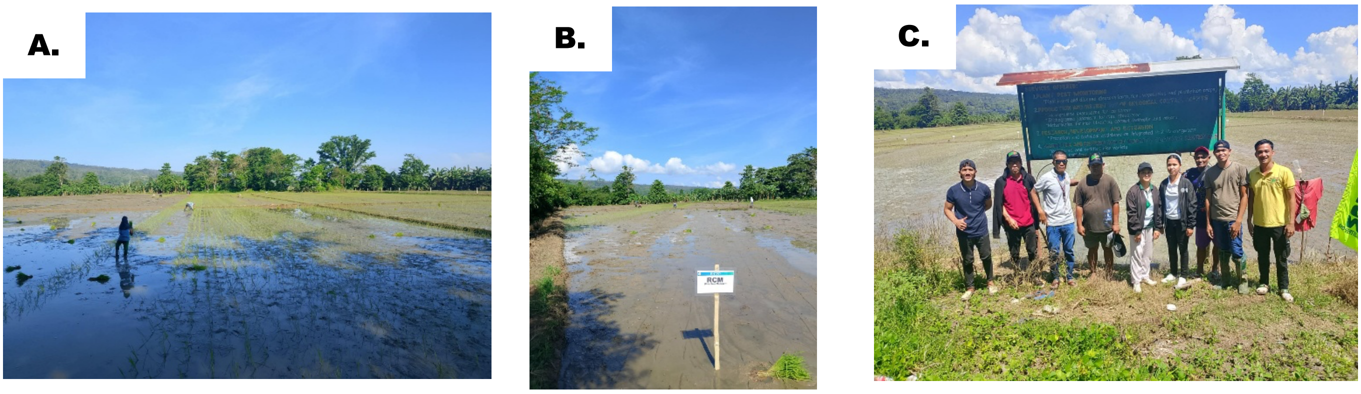

Figure 2: Brgy Switch, Ramon Magsaysay Site (A) Field Layout, (B) Planting for Biofert Derby, (C) Photo opportunity with the participating companies.