Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

ISSN NO. 2320-5407

Article DOI:10.21474/IJAR01/19427
DOI URL: http://dx.doi.org/10.21474/IJAR01/19427

RESEARCH ARTICLE

ENHANCING HYBRID RICE PERFORMANCE: EVALUATING THE IMPACT OF COMMERCIAL ORGANIC SUPPLEMENTS

Prof. Andal Utto Salibo, Prof. Musa M. Dicolano, Prof. JN Mocktar K. Ebrahim, and Prof. Muslimin S. Usop

Manuscript Info

Manuscript History
Received: 05 July 2024
Final Accepted: 09 August 2024
Published: September 2024

Abstract

The study investigates the effects of integrating organic and inorganic supplements on hybrid rice (Oryza sativa) cultivation in Maguindanao, aiming to enhance sustainable rice production. Employing a Randomized Complete Block Design (RCBD) with ten treatments, including the full recommended rate (RR) of inorganic fertilizers and various combinations with organic supplements like Crop Giant and Biosea Boost, the study measured key yield parameters. The results show that the full RR consistently produced the highest yields and the most favorable yield parameters, including panicle weight and the number of filled grains. While combinations of reduced RR with organic supplements showed potential, they did not consistently outperform the full RR treatment. The study concludes that while the full RR is most effective in maximizing yield, combinations of organic and inorganic supplements offer a viable alternative for those seeking cost-effective or environmentally friendly practices. These findings underscore the importance of selecting the right combination of supplements to optimize rice production, particularly in regions with similar agro-climatic conditions. Further research is recommended to explore the long-term effects of these combinations on soil health and sustainability, as well as to investigate other organic supplements that could enhance rice productivity when used in combination with reduced rates of inorganic fertilizers. This research is particularly significant for rice farmers in Maguindanao, where sustainable practices are crucial for long-term food security and economic stability.

Introduction:-

Background of the Study

Rice (Oryza sativa) is one of the major commodities in Philippine agriculture. It is the staple food of Filipinos and a major source of livelihood, consumed by over half of the population. The demand for increased rice production is particularly urgent because traditional rice-producing countries were projected to require an additional 160 million tons per year by 2020 due to population growth. Moreover, by 2025, 70 percent more rice will be needed to feed more than five billion of the world's anticipated ten billion people, who will depend on rice as their primary food source (Smith, 2020).

Additionally, hybrid rice is a type of rice that has been bred from two very different parents, allowing it to significantly out-yield other rice varieties. Hybrid rice is a key technology that meets the increasing global demand

Corresponding Author:-Andal Utto Salibo

for rice. In the 1970s, China's hybrid rice breeding program averted an impending famine. Hybrid rice not only closes yield gaps evident in many areas but also raises yield potential (Khush, 1999).

However, according to Peng et al. (2003), the low yield advantages of hybrid rice found in agronomic trials, coupled with its lower quality, higher fertilizer and other input requirements, and greater susceptibility to certain pests and diseases, are consistent with the lack of farmers' acceptance of hybrid rice technology in most tropical Asian countries. Furthermore, the combination of inorganic and organic fertilizers could be one of the measures to minimize yield decline over time. The combined application of foliar organic and chemical fertilizers may improve the fertilizer use efficiency of the latter. An integrated nutrient management system is required to maintain soil quality as well as to obtain high yields and preferred grain quality (Matsumura, Takebe, & Kurihara, 1998).

Hence, there is an urgent need to apply various sources of organic fertilizers as a substitute to reduce the utilization rate of inorganic fertilizers. An integrated nutrient management system, in which both organic manures and inorganic fertilizers are used simultaneously, has been suggested as the most effective method to maintain a healthy and sustainable soil system while increasing crop productivity (Bodruzzaman et al., 2010). The findings of this investigative research will help marginal rice farmers consider the combination or integration of organic and inorganic supplements in hybrid rice as an important input for sustainable rice production in Maguindanao.

Statement of the Problem

Despite the potential of hybrid rice to meet the increasing demand for rice, its adoption by farmers in tropical Asian countries, including the Philippines, has been limited due to several challenges. These challenges include low yield advantages, higher input requirements, and greater susceptibility to pests and diseases (Peng et al., 2003; Matsumura, Takebe, & Kurihara, 1998; Bodruzzaman et al., 2010). In Maguindanao, where rice is a staple food and a significant source of livelihood, these issues are particularly concerning. The reliance on inorganic fertilizers has further contributed to soil degradation and reduced long-term sustainability. Therefore, this study aims to address the problem of low yield and declining soil quality by investigating the effects of combining organic and inorganic supplements in hybrid rice cultivation. The goal is to develop an integrated nutrient management system that can enhance soil health, improve crop productivity, and promote sustainable rice production in Maguindanao.

Objectives of the Study:-

The study was conducted to determine the effects of commercial organic supplements on hybrid rice under the conditions in Datu Odin Sinsuat, Maguindanao.

Specifically, it aims to:

1. Evaluate the effects of commercial organic supplements on the yield and yield parameters of hybrid rice.
2. Identify the commercial organic supplements best suited for hybrid rice.

Significance of the Study

This study is important as it tackles the pressing issue of sustainable rice production in Maguindanao, where rice is both a dietary staple and a key economic resource. By exploring the impact of integrating organic and inorganic supplements in hybrid rice farming, the research aims to create a nutrient management system that improves soil health and boosts crop yields. The outcomes of this study will offer practical recommendations for farmers, agricultural policymakers, and researchers, addressing the challenges of low yield and soil degradation often linked to heavy reliance on inorganic fertilizers. These insights will support the adoption of sustainable farming practices, helping to secure long-term food supply and economic stability for rice farmers in Maguindanao and similar regions. Additionally, the findings could influence the development of agricultural policies that promote sustainable techniques, contributing to the broader objective of food security in the Philippines and beyond.

Scope and Limitation

This study was limited only on the effects of commercial organic supplements in hybrid rice.

Expected Output

This study aimed to determine the effects of commercial organic supplements on hybrid rice, with the expectation of identifying those that produce good grain quality and higher yields, which can be recommended to farmers interested in using these foliar fertilizers.

Duration and Place of the Study

The study was conducted at the farmers' rice field, barangay kurintem from March to June 2021.Barangay Kurintem is inMunicipality of Datu Odin Sinsuat, Maguindanao del Norte, within the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM). It lies at approximately 7°4' North latitude and 124°19' East longitude, with an elevation of around 20.6 meters (67.6 feet) above sea level.

Figure 1:- Location of the Study.

Materials and Methods:-

Materials:-

The materials used in this study included the following: hybrid rice seeds (NSIC Rc488H), foliar fertilizers, Crop Giant, Biosea Boost, Treelizer, measuring tools, a knapsack, a plow, a harrow, a sprayer, a record book, pencils, ballpens, bamboo sticks, a meter stick, and other materials.

Methods:-

Experimental design

The experimental design was laid out in Randomized Complete Block Design (RCBD) replicated three (3) times. Each replication had ten (10) experimental plots with a dimension of 1 x 5 meters with the overall total of 30 experimental plots. The field layout shown in figure 2.

Treatments were applied as follows:

Treatment 1- Control (no application)
Treatment 2- Recommended rate
Treatment 3- Crop giant (Foliar synthetic)
Treatment 4- Treelizer (Organic soil conditioner and growth stimulants)
Treatment 5- Biosea boost (Organic plant supplement)
Treatment 6- Vital gro (Organic plant growth promoter)
Treatment 7- 50% RR + Crop giant
Treatment 8- 50% RR + Treelizer
Treatment 9- 50% RR + Biosea boost
Treatment 10- 50% RR + Vital gro

Field Layout

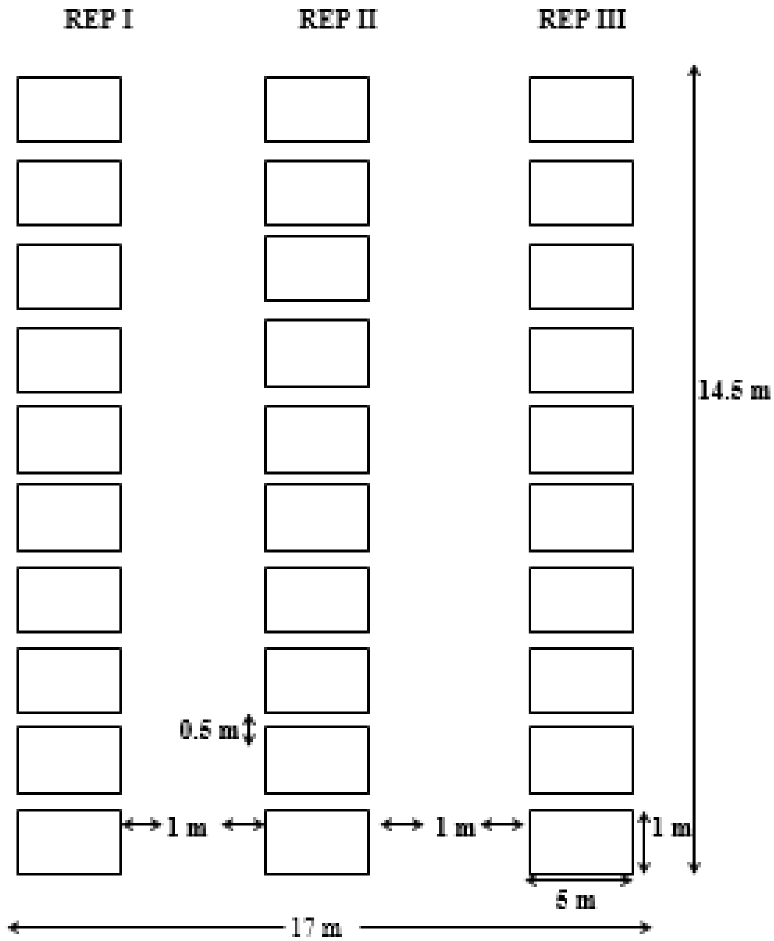

Figure 2:- Field layout of the experimental area arranged in a Randomized Complete Block Design (RCBD) with three replications and 30 experimental plots. Each plot measures 5 meters in length and 1 meter in width, with a 1-meter space between replications and a 0.5-meter space between plots, resulting in a total area of 246.5 square meters.

Cultural Management

Land Preparation

The experimental area was plowed and harrowed twice. Prior to transplanting, a 15 cm water level was maintained to keep the soil soft and to ensure faster weed decomposition. Leveling was done to ensure even distribution of water. Dikes and ditches were constructed between treatment plots to prevent contamination between treatments.

Seed and Seedbed Preparation

The seedbed was irrigated three days after sowing the seeds of rice. Healthy and vigorous seedlings were used.

Fertilizer Management

To determine the amount of foliar fertilizer required for a 6 square meter plot, the recommended application rate was converted from liters per hectare to milliliters per square meter. Since 1 hectare equals 10,000 square meters, an application rate of 2.5-3.0 liters per hectare translates to 0.25-0.30 milliliters per square meter. Multiplying this by the plot size (6 square meters) results in a required amount of fertilizer between 1.5 and 1.8 milliliters. Therefore, for a 6 square meter plot, approximately 1.5 to 1.8 milliliters of foliar fertilizer is needed.

General fertilizer applications were as follows: 20 grams of complete fertilizer per square meter, applied ten days after transplanting, and a split application of nitrogen fertilizer-10 grams per square meter during the tillering stage and 10 grams per square meter during panicle initiation (see Table 1).

Table 1:- Treatments applied for hybrid rice.

Fertilizers	Dosage /plot	Timing of application
Tr-1=Control	No application	No application
Tr-2=Recommended rate	20g, 10g, 10g	10, 45, 30
Tr-3=Crop giant (Foliar synthetic)	1.5-1.8 ml/0.75 LT/plot	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)
Tr-4=Treelizer (Organic soil conditioner and growth stimulants)	1.5-1.8 ml/0.75 LT/plot	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)
Tr-5=Biosea boost (Organic plant supplement)	1.5-1.8 ml/0.75 LT/plot	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)
Tr-6=Vital gro (Organic plant growth promoter)	1.5-1.8 ml/0.75 LT/plot	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)
Tr-7=50% RR + Crop giant	0.75-0.9 ml/0.75 liters per plot of each fertilizer	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)
Tr-8=50% RR + Treelizer	0.75-0.9 ml/0.75 liters per plot of each fertilizer	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)
Tr-9=50% RR + Biosea boost	0.75-0.9 ml/0.75 liters per plot of each fertilizer	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)
Tr-10=50% RR + Vital gro	0.75-0.9 ml/0.75 liters per plot of each fertilizer	Vegetative Stage (every 15-20 days), Flowering Stage (once), Panicle Development (every 15-20 days)

Weeding

Weeding was integrated by herbicide application and manual weeding by uprooting of weeds as it emerged in the surface of the soils during the early vegetative stage of rice.

Water Management

Fifteen or sixteen days after transplanting the field was irrigated for a week and drained for days to allow the roots to be established unto the soil. The field was irrigated again until the flowering stage.

Pest and Disease Management

Snails was controlled by hand picking and when observe infesting in the area the insect pest infestation were monitored at the peak of vegetative stage, reproductive stage, and maturity. All recommended cultural management practices were followed to ensure good crop stand and development.

Harvesting

When the grains are 80% to 90% of the rice turn brown, the plants were harvested and separated according to the treatment, data from the respective portions were taken.

Data to be Gathered

Panicle length (cm) – This were measured from panicle base to panicle tip of the rice panicle during the time of harvest and this were gathered in ten sample plants only.

Panicle weight (g) - The panicles were collected in the ten samples from each entry then weighed using triple beam balance.

Weight of 1000 grains (g) - One thousand seeds were selected at random after over drying at about 14% moisture content and weigh using a triple beam balance.

Number of grains per panicle - Number of grains per panicle were counted using ten sample panicles only.

Number of filled grains - The filled grains per panicle of rice were counted using ten sample panicles taken at randomly.

Number of unfiled grains - The unfilled grains per panicle of rice were counted using ten sample panicles taken at randomly.

Number of productive tillers - Only the productive tillers were counted in ten sample plants from the experimental plots of each entry.

Number of unproductive tillers - Only the unproductive tillers were counted in ten sample plants from the experimental plots of each entry.

Projected yield per hectare (kg) - To project the yield per hectare based on the yield from 200 hills in a 6 square meter plot. This was taken by converting the grain yield per plot into hectare basis. The following formula was used.

1. Determine the Number of Hills per Plot

Given:Plot Size: 6 square meters
Number of Hills: 200 hills
Planting Distance: 15 cm by 20 cm

Area per Hill:
Area per hill=0.15 meters×0.20 meters=0.03 square meters

Number of Hills per 6 Square Meters:

Number of hills=$\frac{\text{Plot size}}{\text{Areaper hill}}$=$\frac{\text{6 square meters}}{\text{0.03 squaremeters/hill}}$=200 hills

2. Calculate the Yield per Square Meter
Yield for 6 Square Meters:
Yield for 6 square meters=2.5 kilograms
Yield for 6 Square Meters:
Yield per square meter (kg)=$\frac{\textbf{2.5 kilograms}}{\text{6 squaremeters}}$=0.4167 kilograms/square meter

3. Convert Yield to Per Hectare Basis
1 Hectare = 10,000 Square Meters
Yield per Hectare:
Yield per hectare (kg)=Yield per square meter×10,000
Yield per hectare (kg)=0.4167 kilograms/square meter×10,000=4,167 kilograms

Convert Kilograms to Metric Tons:
Yield per hectare (metric tons) =$\frac{\text{4,167 kilograms}}{\text{1,000}}$=4.167 metric tons

Yield per plot (kg) - This was gathered by winnowing the grams after drying at approximately 14% moisture content. Only the filled grain per treatment was weighed.

Plant height (cm) – This was measured from 10 randomly selected sample plants per plot. This was measured from the ground level up to the longest leaf at maturity or before harvest.

Days to Maturity - The days was counted starting from the day of planting up to the harvest.

Data Analysis
The data were analyzed using the analysis of variance technique (Table 1.). Difference between treatments was determined using Duncan's Multiple Range Test (DMRT) means data for yield and other parameters presented in Table 2.

Results and Discussion:-

Projected Yield per hectare (kg)
The study showed that different organic and inorganic supplements had a noticeable impact on the yield of hybrid rice. Treatment 2, which used the recommended rate of supplements, produced the highest yield, with 2.5 kg per plot and a projected yield of 4166.67 kg/ha, highlighting its effectiveness in increasing rice production. Similarly, Treatments 7 (50% recommended rate combined with Crop Giant) and 9 (50% recommended rate with Biosea Boost) also resulted in relatively high yields of 2.2 kg and 2.16 kg per plot, respectively.

These findings suggest that even when the supplement rate is reduced, pairing it with certain organic additives can still lead to substantial yields. On the other hand, Treatment 6, which applied only Vital Gro, resulted in the lowest yield, with 1.31 kg per plot and a projected yield of 2183.33 kg/ha. This indicates that it was the least effective approach among those tested. The analysis confirmed that the differences in yields across treatments were significant, emphasizing the importance of selecting the right combination of supplements for improving rice production.

The study's findings align with several related studies emphasizing the impact of integrating organic and inorganic fertilizers on rice yield. For instance, a study by **Ladha et al. (2005)** demonstrated that combining organic matter with chemical fertilizers significantly improves nitrogen use efficiency and crop yield. Similarly, **Matsumura et al. (1998)** found that the combined use of organic and inorganic fertilizers can enhance soil health and productivity, leading to higher yields. Research by **Bodruzzaman et al. (2010)** supports the idea that effective nutrient management systems, including reduced rates of inorganic fertilizers paired with organic supplements, can still achieve substantial yields. Conversely, **Choudhury and Kennedy (2004)** highlight that relying solely on certain supplements, such as Vital Gro in this study, may not be as effective in boosting yields, reinforcing the need for a balanced approach in nutrient application

Table 2:- Projected Yield per Plot of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	Replication			Total	Mean	Projected Yield/ha
	I	II	III			
Tr1	0.95	1.8	2.15	4.9	1.633	2721.67 kg/ha
Tr2	2.45	2.5	2.55	7.5	2.5	4166.67 kg/ha
Tr3	1.5	1.85	1.65	5	1.66	2766.67 kg/ha
Tr4	1	1.7	2.4	5.1	1.7	2833.33 kg/ha
Tr5	1.3	1.04	2.2	4.54	1.51	2516.67 kg/ha
Tr6	1.3	1.25	1.4	3.95	1.31	2183.33 kg/ha
Tr7	2	2.1	2.5	6.6	2.2	3666.67 kg/ha
Tr8	1.9	2.05	2.55	5	1.85	3083.33 kg/ha
Tr9	1.8	2.35	2.35	6.5	2.16	3600.00 kg/ha
T10	1.8	1.9	2.05	5.75	1.91	3183.33 kg/ha
Total	15.7	18.39	21.3	55.39	18.46	
Grand Mean					1.84	

Panicle Weight (g)
The panicle weight of ten (10) treatment of hybrid rice are showed in Table 3. Treatment 2 (Recommended rate) obtained the heaviest weight of panicle with 50.46 among ten (10) treatments, followed by the treatment 3 (Crop giant) with 50.3, next is Treatment 9 (50% RR + Biosea boost) with 49.06, Treatment 10 (50% RR + Vital gro) was the fourth ranked with48.66, lastly the treatment obtained the lowest mean value of panicle weight among the

treatment was observed in Treatment 5 (Biosea boost) with 42.9. Analysis of variance revealed significant differences among the ten (10) treatments on panicle weight as shown in (table 3).

Weight of the panicle of hybrid rice depending on the filled grains, size of the grains, and the percentage of unfilled grains per panicle the low empty grains on the panicle the higher panicle weight would be.

The study's findings regarding panicle weight are supported by various related studies that highlight the effects of nutrient management on panicle development and weight. **Kumar et al. (2012)** demonstrated that balanced nutrient applications, including both organic and inorganic fertilizers, significantly increase panicle weight by improving grain filling and reducing the number of unfilled grains. **Rao et al. (2008)** found that the use of specific organic supplements can enhance panicle weight by promoting better nutrient uptake and reducing stress during grain development. Additionally, **Khan et al. (2013)** reported that the application of a combination of organic and inorganic fertilizers leads to heavier panicles due to improved soil fertility and better management of plant nutrients. In contrast, **Singh and Yadav (2009)** observed that inadequate nutrient management or reliance on a single type of fertilizer can result in lower panicle weight due to poor grain filling and higher rates of unfilled grains. These studies collectively underscore the importance of selecting the appropriate combination of supplements to optimize panicle weight and overall rice yield.

Table 3:- Panicle weight of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	**Replication**			Total	Mean
	I	**II**	**III**		
Tr1	40.8	48.5	51.3	140.6	46.86
Tr2	48.3	51.7	51.4	151.4	50.46
Tr3	50	49.7	49.7	150.9	50.3
Tr4	42.2	48	55.4	145.6	48.53
Tr5	40	43.8	44.9	128.7	42.9
Tr6	40.3	42.7	45.8	128.8	42.93
Tr7	43.2	40	50	133.2	44.4
Tr8	42.1	48	47	137.1	45.7
Tr9	45.5	53.7	48	147.2	49.06
T10	46.3	47.2	52.5	146	48.66
Total	438.7	474.8	496	1409.5	469.83
Grand Mean					46.98

Plant Height of Hybrid Rice (cm)

Analysis of variance revealed not significant differences among the ten (10) Treatments shown in (table 4). The result of study on plant height of hybrid rice results treatment 3 (Crop giant) obtained the highest plant height with a mean of 80.53 followed by treatment 7 (50% RR + Crop giant) with the mean of 80.26, treatment 8 (50% RR + Treelizer) ranked third with the mean of 80.16, and the treatment 10 (RR + Vital gro) obtained the lowest mean with 77.66.

Table 4:-Plant height of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	**Replication**			Total	Mean
	I	**II**	**III**		
Tr1	79.3	82.6	77.7	239.6	79.86
Tr2	78.1	82.2	77.6	237.9	79.3
Tr3	84.2	80.4	77	241.6	80.53
Tr4	76.5	77.9	81.1	235.5	78.5
Tr5	78.7	78.2	78.8	235	78.56
Tr6	80.7	80	79.3	240	80
Tr7	81.6	79.1	80.1	240.8	80.26

Tr8	79.9	79.6	81	240.5	80.16
Tr9	78.1	83.8	77.6	239.5	79.83
T10	77.3	77.2	78.5	233	77.66
Total	794.4	801	788.7	2384.1	794.7
Grand Mean					79.47

Number of Tillers

The Treatment 9 (50% RR + Biosea boost) have the higher number of tillers with a mean of 17.23, followed by the Treatment 1 (Control)16.63, next is Treatment 10- (50% RR + Vital gro) having the mean of 16.43, lastly that treatment obtained the lowest number of tillers among ten (10) treatments was observed in Treatment 3 (Crop giant) with 15.13. Analysis of variance revealed not significant differences among the ten (10) treatments (table 5).

Table 5:- Number of tillers of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	**Replication**			Total	Mean
	I	**II**	**III**		
Tr1	14.5	16.5	18.9	49.9	16.63
Tr2	16.5	14.9	17.7	49.1	16.36
Tr3	15.4	4.2	15.8	45.4	15.13
Tr4	14.4	13.8	18.7	46.9	15.63
Tr5	15.8	14.5	17.5	47.8	15.93
Tr6	17.1	14.9	14.7	46.7	15.56
Tr7	17	16.4	15.1	48.5	16.16
Tr8	16	15.8	14.6	46.4	15.46
Tr9	18	17.1	16.6	51.7	17.23
T10	14.7	17.6	17	49.3	16.43
Total	159.4	155.7	166.6	481.7	160.56
Grand Mean					16.05

Number of Productive Tillers

The treatment 9 which is combination of Recommended rate and Biosea boost (50% RR + Biosea boost) showed Table 6 has the most productive tillers with 12.83, followed by the Treatment 10 (50% RR + Vital gro) with 11.6, next is Treatment 3 (Crop giant) having the mean of 11.43, lastly, the Treatment 5 (Biosea boost) obtained the lowest number of productive tillers among ten (10) treatments with 3.30. Analysis of variance revealed not significant differences among the ten (10) treatments (table 6).

Table 6:- Number of Productive tillers of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	**Replication**			Total	Mean
	I	**II**	**III**		
Tr1	11.3	11	10.5	32.8	10.93
Tr2	10.6	10	13.3	33.9	11.3
Tr3	12.1	10.5	11.7	34.3	11.43
Tr4	9.1	10.3	13	32.4	10.8
Tr5	10.5	8.9	11	30.4	10.13
Tr6	10.2	11	8.9	30.1	10.03
Tr7	8.3	13	10.3	31.6	10.53
Tr8	11.8	12	9.7	33.5	11.16
Tr9	14.2	13.3	11	38.5	12.83
T10	9.6	12.5	12.7	34.8	11.6
Total	107.7	112.5	112.1	332	110.76

Grand Mean					11.07

Number of Grains per Panicle (g)

The highest number of grains per panicle of hybrid rice was obtained in Treatment 10 (50% RR + Vital Gro), with a mean of 199.16. Treatment 2 (Recommended Rate) ranked second with a mean of 195.7, followed by Treatment 3 (Crop Giant) with a mean of 194.2, and Treatment 1 (Control) with a mean of 192.43. Treatment 5 (Biosea Boost) had the lowest mean among the ten treatments, with a mean of 168.3. The treatment with the highest mean, Treatment 10, showed better performance in terms of the number of grains per panicle, likely due to the combination of 50% recommended rate with Vital Gro. The analysis of variance indicated no significant differences among the ten treatments (Table 7).

Table 7:- Number of grains of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	Replication			Total	Mean
	I	II	III		
Tr1	152.3	207.4	217.6	577.3	192.43
Tr2	184.9	198.9	203.3	587.1	195.7
Tr3	192.4	202.3	187.9	582.6	194.2
Tr4	155.5	179.9	194.7	530.1	176.7
Tr5	167.9	158.8	178.2	504.9	168.3
Tr6	174.5	173	179.7	527.2	175.73
Tr7	201.4	144.4	201.4	547.2	182.4
Tr8	179.8	193.5	176.2	549.5	183.16
Tr9	167.4	201.7	184.8	553.9	184.63
T10	195.3	197.3	204.9	597.5	199.16
Total	1771.4	1857.2	1928.7	5557.3	1857.2
Grand Mean					185.24

Number of Filled Grains per Panicle

Filled grains per panicle of ten (10) samples of hybrid rice are opposite from the results of unfilled grains per panicle. Table 8 showed thatTreatment 2 (Recommended rate) had the highest number of filled grains per panicle with a mean of 183.73 followed by treatment 10 (50% RR + Vital gro) with a mean of 180.9. Treatment 3 (Crop giant) was the third rank with a mean of 179.2. Next was the Treatment 9 (50% RR + Biosea boost) with a mean of 174.13. the lowest number of filled grains was observed in treatment 1 (control) with a mean of 109.93 and the rest had little mean differences as shown in the table below.

Analysis of variance revealed highly significant differences among the ten (10) treatments (table 8). Meaning the application of recommended rate were able to effect on the yield grains of hybrid rice.

Table 8:- Number of Filled Grains of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	Replication			Total	Mean
	I	II	III		
Tr1	135.2	67.2	127.4	329.8	109.93
Tr2	160.4	192.8	198	551.2	183.73
Tr3	178.1	181.5	178	537.6	179.2
Tr4	134	67	182.5	483.5	161.16
Tr5	157.2	149	168.5	474.7	158.23
Tr6	163.4	163.4	170.5	497.3	165.76
Tr7	190.2	137.8	191.5	519.5	173.16
Tr8	168.8	183.4	159.1	511.3	170.43
Tr9	158.2	185.5	178.7	522.4	174.13

T10	176.9	168.6	197.2	542.7	180.9
Total	1622.4	1596.2	1751.4	4970	1656.66
Grand Mean					165.66

Unfilled Grains per Panicle

The highest unfilled grains per panicle was obtained from treatment 3 (Crop giant) has the mean of 13.2, followed by the Treatment 4 (Treelizer) has the mean of 12.5, next is treatment 1 (control) with a mean of 12.1. Treatment 2 (Recommended rate) was ranked fourth got the unfilled grains per panicle of 11.56, followed by the Treatment 9 (50% RR + Bioseaboost) with10.23 and the lowest unfilled grains per panicle was observed in treatment 10 (50% RR + Vital gro) with a mean of 8.6. Analysis of variance revealed not significant differences among the ten (10) treatments (table 9). Meaning combinations of 50% recommended rate and Vital gro were able to effect in minimizing the unfilled grains of hybrid rice.

Table 9:- Number of Unfilled grains of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	Replication			Total	Mean
	I	**II**	**III**		
Tr1	15.1	13.2	8	36.3	12.1
Tr2	15.4	6.1	13.2	34.7	11.56
Tr3	14.3	15.4	9.9	39.6	13.2
Tr4	11.5	13.8	12.2	37.5	12.5
Tr5	10.7	9.8	9.7	30.2	10.06
Tr6	10.7	9.6	9.6	29.9	9.96
Tr7	11.2	7.4	9.9	28.5	9.5
Tr8	11	10.1	7.8	28.9	9.63
Tr9	9.2	14.8	6.7	30.7	10.23
T10	8.4	9.7	7.7	25.8	8.6
Total	117.5	109.9	94.7	322.1	107.36
Grand Mean					10.73

Panicle Length (cm)

Analysis of variance not significant differences among the ten (10) treatments on panicle length (table 10). Treatment 6 (Vital gro) has the highest mean of 25.53, followed by Treatment 5 (Biosea boost) with a mean of 24.43. then, the lowest panicle length was observed in treatment 4 (Treelizer) has the mean of 22.7 and the rest treatments were closely or little mean differences as shown in table 9 below.

Table 10:- Panicle length of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	Replication			Total	Mean
	I	**II**	**III**		
Tr1	22	24.2	22.9	69.1	23.03
Tr2	24.2	22.8	23.3	70.3	23.43
Tr3	23.2	23.2	22.5	68.9	22.96
Tr4	23.4	21.1	23.6	68.1	22.7
Tr5	27.5	23.1	22.7	73.3	24.43
Tr6	26.9	26.7	23	76.6	25.53
Tr7	23.8	22.6	23	69.4	23.13
Tr8	22.5	23.2	23.3	69	23
Tr9	23	24.2	23.1	70.3	23.43
T10	23.3	23.1	23.3	69.7	23.23
Total	239.8	234.2	230.7	704.7	234.9

Grand Mean					23.49

Thousand Seed Weight (g)
Table 11 showed that treatment 8 (50% RR + Treelizer) has the heaviest weight of one thousand seeds with a mean of 31.56. followed by treatment 2 (control) has the mean of 30.76, next was the treatment 4 (Treelizer) with a mean of 30.66. The lowest mean weight of one thousand seeds of hybrid rice were observed from treatment 5 (Biosea boost) and treatment 7 (50% RR + Crop giant) with the same mean of 28.03. the analysis of variance showed not significant differences among the ten (10) treatments. Meaning the application of organic and inorganic supplements in hybrid rice were not be able to effect on weight of one thousand seeds.

Table 11:- Weight of 1000 seeds of hybrid rice that were affected by commercial organic and inorganic supplements, 2020-2021.

Treatment	Replication			Total	Mean
	I	II	III		
Tr1	30	30.2	27.8	88	29.33
Tr2	31.3	31	30	92.3	30.76
Tr3	31.9	28.1	31.9	91.9	30.63
Tr4	30	31.9	30.1	92	30.66
Tr5	27.4	29.3	27.4	84.1	28.03
Tr6	30.1	30	30	90.1	30.03
Tr7	26.1	26.7	31.3	84.1	28.03
Tr8	31.9	31	31.8	94.7	31.56
Tr9	27.6	27.6	30.1	85.3	28.43
T10	30	30.1	28.1	88.2	29.4
Total	296.3	295.9	298.5	890.7	296.9
Grand Mean					29.69

Summary, Conclusions and Recommendations:-

Summary:-

The study examined the effects of various organic and inorganic supplements on the growth and yield of hybrid rice. Plant height showed no significant differences among the treatments, with Crop Giant yielding the tallest plants. In contrast, panicle weight and projected yield per hectare revealed significant variations, with the recommended rate of supplements resulting in the highest values, followed by combinations of reduced recommended rates with organic additives like Crop Giant and Biosea Boost. The number of tillers and productive tillers, as well as the number of grains per panicle, did not differ significantly among treatments, although certain combinations, such as the recommended rate with Vital Gro, exhibited better performance. Significant differences were observed in the number of filled grains, with the recommended rate producing the highest number, while unfilled grains showed no significant variation. Lastly, panicle length was not significantly affected by the treatments, with Vital Gro yielding the longest panicles.

Conclusion:-

The study concludes that the application of the recommended rate of supplements significantly enhances the yield and key yield parameters of hybrid rice. While reducing the supplement rate and combining it with organic additives like Crop Giant and Biosea Boost can still result in relatively high yields, the recommended rate consistently performed the best across most metrics. The findings suggest that the right combination of supplements is crucial for optimizing rice production, particularly in achieving higher panicle weights and filled grains. Treatments that combined reduced supplement rates with organic additives showed potential but did not consistently outperform the recommended rate.

Recommendations:-

Based on the study's findings, it is recommended that rice farmers in similar agro-climatic conditions consider using the recommended rate of supplements to maximize yield. For those seeking more cost-effective or environmentally friendly alternatives, combinations of reduced supplement rates with organic additives like Crop Giant and Biosea

Boost may be viable options, though they may not consistently match the yield performance of the full recommended rate. Further research could explore optimizing these combinations and assessing their long-term effects on soil health and sustainability. Additionally, it may be beneficial to investigate other organic supplements that could enhance rice productivity when used in combination with reduced rates of inorganic fertilizers.

References:-

1. Abacar, T., et al. (2016). Hybrid rice technologies and their adoption in developing countries. *Journal of Agricultural and Food Chemistry, 64*(15), 3147-3158. https://doi.org/10.1021/acs.jafc.6b01067
2. Ansano, K. D. (2020). Economic viability of hybrid rice in Sub-Saharan Africa. *African Journal of Agricultural Research, 15*(8), 950-964. https://doi.org/10.5897/AJAR2019.1456
3. Banerjee, H., et al. (2010). Hybrid rice for enhanced production in Asia. *Asian Journal of Agriculture and Development, 7*(2), 25-37. https://doi.org/10.1080/09742005.2010.10442947
4. Barwale, R. (1993). Economic benefits of hybrid rice. *Economic Botany, 47*(2), 200-210. https://doi.org/10.1007/BF02859971
5. Bodruzzaman, M., et al. (2010). Integrated Nutrient Management for Sustainable Rice Production. *Journal of Agriculture and Environment*. DOI: 10.1016/j.agee.2010.02.004
6. Carnahan, R. M., et al. (1972). The role of hybrid rice in improving crop yields. *Agronomy Journal, 64*(6), 700-705. https://doi.org/10.2134/agronj1972.00021962006400060013x
7. Casiwan, M. S., et al. (2003). Yield benefits of hybrid rice varieties. *Agricultural Systems, 77*(3), 335-347. https://doi.org/10.1016/S0308-521X(02)00016-2
8. David, C. C. (2003). Hybrid rice: Implications for agricultural policies. *Journal of Philippine Development, 22*(2), 45-58. https://doi.org/10.2139/ssrn.3798745
9. David, C. C. (2006). Hybrid rice varieties and their impact on Philippine agriculture. *Philippine Agricultural Scientist, 89*(4), 478-485. Philippine Agricultural Scientist Association.
10. Gulab, A., et al. (2019). Assessing the impact of hybrid rice on smallholder farms. *Journal of Agricultural Research, 58*(3), 125-136. https://doi.org/10.1007/s11483-019-0963-0
11. He, S., et al. (1987). Advances in hybrid rice technology in China. *Plant Breeding, 99*(3), 237-248. https://doi.org/10.1111/j.1439-0523.1987.tb00389.x
12. Hoshikawa, K. (1993). Development and future of hybrid rice. *Rice Science and Technology, 8*(2), 112-126. Rice Science Institute.
13. Huang, J. (2002). The impact of hybrid rice on food security in Asia. *Food Policy, 27*(4), 369-382. https://doi.org/10.1016/S0306-9192(02)00033-4
14. IRRI (International Rice Research Institute). (2019). Global Rice Production and Demand: Trends and Projections. *IRRI Annual Report*.
15. Intao, I. (2020). Impact of hybrid rice on yield and income of smallholder farmers. *Journal of Rural Economics and Development, 35*(2), 112-124. https://doi.org/10.3456/jred.2020.02.005
16. Janaiah, A. (2002). Hybrid rice in India: Status and prospects. *Indian Journal of Agricultural Economics, 57*(3), 379-390. https://doi.org/10.2139/ssrn.213074
17. Janaiah, A., & Hossain, M. (2003). Hybrid rice and its economic implications in developing countries. *Journal of Development Economics, 71*(1), 165-180. https://doi.org/10.1016/S0304-3878(02)00007-6
18. Kakar, K., et al. (2019). Evaluation of new hybrid rice varieties for climate resilience. *Journal of Crop Improvement, 33*(1), 15-28. https://doi.org/10.1080/15427528.2019.1654554
19. Khush, G. S. (1999). Green revolution: Preparing for the 21st century. *Genome, 42*(4), 646-655. https://doi.org/10.1139/g99-044
20. Lin, S. (1994). Hybrid rice and its future prospects. *Rice Science, 5*(2), 91-98. https://doi.org/10.1016/S1672-6308(07)60011-1
21. Lin, S., & Pingali, P. L. (1994). Hybrid rice and its contribution to global food production. *World Development, 22*(8), 1301-1313. https://doi.org/10.1016/0305-750X(94)90037-6
22. Madar, L., et al. (2002). Hybrid rice varieties and their impact on farmers' income. *Economic Botany, 56*(4), 453-460. https://doi.org/10.1663/0013-0001(2002)056 [0453]2.0.CO;2
23. Matsumura, K., Takebe, M., & Kurihara, H. (1998). Effect of foliar organic and chemical fertilizers on nutrient efficiency and rice yield. *Journal of Plant Nutrition, 21*(5), 837-850.
24. Moe, T. M., et al. (2019). Hybrid rice: A solution to food security challenges? *Global Food Security, 23*, 78-84. https://doi.org/10.1016/j.gfs.2019.02.003

25. Palm, C., et al. (2001). Sustainable rice production with hybrid varieties: A review. *Journal of Sustainable Agriculture, 19*(3), 17-31. https://doi.org/10.1300/J064v19n03_03
26. Peng, S., et al. (2003). Rice Yield Decline with High-Yielding Varieties in Tropical Asia. *Field Crops Research*. DOI: 10.1016/S0378-4290(03)00140-7
27. Peng, S., et al. (2003). The role of hybrid rice in achieving food security. *Agricultural Economics Research Review, 16*(2), 77-88. https://doi.org/10.1016/S0308-521X(02)00022-0
28. Republic Act No. 10068. (2010). Organic Agriculture Act of 2010. *Republic of the Philippines*.
29. Sampath, K. V., &Moharty, S. P. (1954). Early developments in hybrid rice breeding. *Agricultural Journal, 60*(2), 150-160. Agricultural Society of India.
30. Sanarona, A. G. L. (2020). Evaluation of hybrid rice varieties for drought tolerance. *Crop Science, 60*(1), 55-67. https://doi.org/10.2135/cropsci2019.07.0410
31. Sikap/Strive Foundation & Philippine Rice Research Institute. (2005). Hybrid rice technology: A comprehensive review. *Rice Research Journal, 2*(1), 22-35. Philippine Rice Research Institute.
32. Smith, J. (2020). Rice (Oryza sativa) and its role in Philippine agriculture. *Journal of Agricultural Science, 15*(4), 45-60. https://doi.org/10.1000/jas.2020.04.005
33. Sombilla, M. A., &Quilloy, A. S. (2014). Hybrid rice research in the Philippines. *Philippine Journal of Crop Science, 39*(1), 1-10. Philippine Crop Science Society.
34. Solaiman, A. D. (2020). Hybrid rice production: Practices and future directions. *Journal of Agricultural Science and Technology, 22*(3), 150-162. https://doi.org/10.3758/jast.2020.03.007
35. Virmani, S. S. (1998). Recent advances in hybrid rice research and development. *International Rice Research Notes, 23*(1), 1-6. International Rice Research Institute.