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Research article

Performance of Hybrid and Inbred Rice Varieties under Vermicast Application

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Abstract: This study aimed to evaluate the performance of hybrid and inbred rice varieties using vermicast as fertilizer. Soil chemical properties, plant growth, and yield performance were observed and tested for significant differences. The experiment employed a Randomized, Completely Design-Factorial layout with three replications of 30 plots. Six check plots were also prepared as farmers fertilization practices for rice production. The total experimental area is 468 m², with a planting distance of 20m x 20m and a total plant population of 5,376. Factor A involved six rice varieties, and Factor B included varying vermicast levels. Growth parameters and yield components were assessed, and data were analyzed using two-factor ANOVA and LSD test. Results indicated significant differences among rice varieties in days to flowering, days to maturity, plant height, and grain yield per hectare. However, no significant differences were observed in productive tillers, filled grains, and thousand-grain weight. No interactions were observed between rice varieties and vermicast levels. Soil analysis revealed an increase in available phosphorus but a decrease in total nitrogen and potassium content in the soil after the experimental study. Based on the observed results, the study recommends utilizing the NSIC Rc314H variety in rice production with a vermicast application rate of 5 tons per hectare for better crop yield. Future research on vermicast application in lowland rice is highly recommended for more conclusive findings and valuable insights into optimizing rice cultivation with specific varieties and application for improved yield and sustainable agricultural practices.

Keywords: Rice; Vermicast; Performance

1. Introduction

Rice is the staple food for nearly half of Asia's world population, as it plays a more significant role in the world's present and future food security [1]. In the Philippines, rice is an important food staple for millions of Filipinos, with almost eighty percent spending one-fourth of their income on rice alone [2]. According to Tallada [3], the medium and high rice per capita consumption for the Philippine population in 2030 will be 128 million and 131 million, respectively, based on the 2020 census. Likewise, Filipinos consume an average of 110kg per capita of rice. On the production side, 48 million ha in Asia are used for rice production, equating to almost 30% of the world's rice harvest. The Philippines alone recorded 4.81 million hectares of area harvested for rice and a total production of 19.96 million metric tons, with a value of Php 403.89 billion [5]. However, even with this level of rice production in the Philippines, rice is still the country's third most imported agricultural item [6].

Future food security would depend on an improved yield per unit area planted. In general, success in crop production depends on many factors, such as varietal improvement, which will effectively improve yield stability when other factors of production are sufficiently available [7]. Accordingly, more than 400 inbred and hybrid rice varieties were released from the mid-1960s to 2023 [8]. These varieties were developed to adapt to environmental factors with promising yields to boost farmers' rice production. However, despite the development of new and improved varieties, local rice production is not enough to meet growing demand due to challenges brought about by climate change, a growing population, declining soil fertility, the high cost of chemical fertilizers, poor drainage, and irrigation facilities that lead to rice self-sufficiency in the country, an elusive goal [9].

Essential nutrients are a significant limiting factor for rice crop production and tend to inhibit rice growth if their absorption is significantly reduced. Synthetic fertilizers are a costly input, such that their use limits the probability of rice farming for high- or low-input systems, and the use of fertilizers alone is sometimes exceptionally inefficient [10] as the losses of the primary nutrients are greater when not correctly applied. Using commercial fertilizers N, P, and K contributed to a massive crop yield increase that nourishes the world's population. However, the excessive use of these fertilizers has been cited as a source of pollution of surfaces, groundwater, and even soil acidity problems in rice fields [11]. Accordingly, modern rice production relies heavily on applying chemical fertilizers, and excess application increases production costs and causes severe environmental problems [12]. Ameliorating soil acidity in rice soils is now seriously considered to enhance soil fertility and productivity [13].

The increasing demand for healthy and sustainable food production practices leads farmers to use organic fertilizers [14]. Organic fertilization positively affects agroecosystems by stimulating plant growth, enhancing crop productivity and grain quality, and improving soil fertility [15]. Vermicast, or vermicompost, is an organic fertilizer and soil enhancer produced from biodegradable materials introduced to earthworms. Compared to chemical fertilizers and conventional compost used by farmers, vermicast restores and enhances natural soil fertility by increasing the physical, chemical, and biological properties without degrading the soil in the long run due to harmful chemical effects [16]. Vermicasts generally have a higher pH and moisture content than soil, along with more significant enrichment by carbon, nitrogen, phosphorus, ammonium, polysaccharides, exchangeable cations (Ca^{2+}, Mg^{2+}, and K^{+}), and humus. Higher nutrient content in vermicasts is associated with partial organic matter decomposition during gut passage, converting these nutrients into available forms [17].

In the study conducted by Ruan et al. [18], the application of vermicast exhibited better growth in terms of higher plant height, bigger stem diameter, and increased biomass of rice crops. Moreover, the multiple nutrients present in vermicompost enhance the uptake of nutrients such as nitrogen, phosphorus, potassium, iron, manganese, copper, and magnesium from vermicast, consequently enhancing the photosynthesis activity and increasing rice yield. Furthermore, Rahman and Barmon [19] also revealed that the application of vermicast to rice productivity is significantly higher than chemical fertilizer. Kheyri [20] also concluded that increasing the application of vermicast and vermicompost in three splits over the plant growth stages led to an increase in yield and yield components in rice. The application of vermicast is gaining interest as an alternative fertilizer input in rice production due to the increasing price of chemical fertilizer on the market.

Hence, this study on the performance of hybrid and inbred rice varieties under vermicast fertilizer application was conducted to evaluate which fertilizer application would give better growth and yield components. This study will also serve as an alternative fertilizer source for rice farmers, utilizing organic fertilizer in rice-based agricultural production to reduce the cost of fertilizer inputs.

2. Methodology

The study was performed using a two-factorial Randomized Complete Block Design (2 Factor-RCBD) with six promising high-yielding rice varieties, four of which were inbred rice varieties (NSIC Rc300, NSIC

Rc222, NSIC Rc238, and NSIC Rc216) and two hybrid rice varieties including NSIC Rc492H and NSIC Rc314H as Factor A and with five levels of vermicast fertilizer application (VL1 3 tons/ha, VL2 4 tons/ha, VL3 5 tons/ha, VL4 6 tons/ha, VL5 7 tons/ha) and inorganic fertilizer application as check plots locally known as farmers practiced (90- 60-60 kg/ha) as Factor B. Ninety-six experimental plots were prepared with a plot size of 1.5 m x 1.5 m. The rate of vermicast applied per plot and the time of application are indicated in Table 1. During the first basal application, vermicast was incorporated into the soil in each plot after the final land preparation. The second and third applications of vermicast were done by top dressing. Data were recorded on various parameters such as plant height at maturity, average days to flowering, days to maturity, average number of productive tillers per hill, weight of thousand grains, filled grains, and yield per hectare in tons. The recorded data was subjected to statistical analysis using the analysis of variance, and mean significant differences were subsequently analyzed using LSD [4].

Table 1. Fertilizer application guide for hybrid and inbred rice experiment

Level of Vermicast Fertilizer	Amount to be applied per plot	Time of Application		
		1st Basal	2nd PI	3rd Flowering
3 tons/ ha	0.70 kg	50%(0.35 kg)	25%(0.175 kg)	25%(0.175 kg)
4 tons/ ha	0.90 kg	50%(0.45 kg)	25%(0.225 kg)	25%(0.225 kg)
5 tons/ ha	1.13 kg	50%(0.57 kg)	25%(0.28 kg)	25%(0.28 kg)
6 tons/ ha	1.40 kg	50%(0.70 kg)	25%(0.35 kg)	25%(0.35 kg)
7 tons/ ha	1.60 kg	50%(0.80 kg)	25%(0.40 kg)	25%(0.40 kg)

3. Results and Discussion

3.1 Soil Characteristics of the Experimental Area

The analysis of soil chemical properties before and after the study is presented in Table 2. The soil chemical analysis before the conduct of the study indicated the following characteristics: pH value: 5.51; available nitrogen: 0.21 percent; total phosphorus: 5.51 ppm; exchangeable potassium: 0.22 meq/100 g; organic matter content of the soil: 11.44 percent; CEC: 16.40 Moreover, the texture is clay-loam soil.

The data shows that after the experimental study, the soil chemical analysis result shows that the nitrogen, phosphorus, and potassium experiments changed the numerical value. The amount of nitrogen after the experiment decreased from 0.21% to .12%, while there was an unprecedented increase in the total phosphorus content after applying fertilizer, from 5.51 ppm to 49.40 ppm. However, the exchangeable potassium decreased from 0.22 to 0.034 meq/100 g. Likewise, the organic content of the soil and Cations Exchange Capacity (CEC) also increases. Also, the data noted that the application of vermicast improved the pH value of the soil. The soil analysis result was supported by the study of Elissen et al. [21], which found that vermicomposting increases the breakdown of organic matter, increases plant-available phosphorus nutrient concentrations in the soils, and increases stable humic and fulvic acid content.

Table 2. Soil chemical Analysis before and after the study

Characteristics	Critical Level Range	Before Experiment	After Experiment
		Value	Value
Ph	5.5 – 8-5	5.51	5.6
Available N (%)	0.3-0.6	0.21	0.122
Available P (ppm)	20-30	5.52	49.40
Available K (meq/100g)	0.3-0.6	0.22	0.034
Organic Matter (%)	2-3	11.44	12.15
CEC	15-25	16.40	16.80
Soil Textural Class		Clay loam	Clay loam

** Source: Analytical Service Laboratory, Bureau of Soils and Management*

3.2 Average plant height at maturity

The average plant height at maturity of rice varieties applied with different levels of vermicast is presented in Table 3. The plant height of four inbred and two hybrid varieties was determined at maturity. The plant height of inbred varieties ranges from 77.27 cm to 81.87 cm. Among the four inbred varieties, NSIC Rc300 and NSIC Rc238 grew as high as 81.87 cm and 80.05 cm, respectively. At the same time, NSIC Rc222 and NSIC Rc216 registered the shortest plant height and grew only to a mean height of 79.00 cm and 77.27 cm, respectively. Across hybrid varieties, the plant height ranged from 85.80 cm to 88.27 cm. NSIC 492H obtained an average height of 88.27 cm compared to NSIC Rc314H, which registered a slightly shorter plant height with a mean of 85.80 cm, respectively. Regarding vermicast application, the plant heights of all treated inbred varieties were comparable, ranging from 80.78 cm to 83.45 cm. However, the plant height of hybrid varieties in the check plot was higher than that of the treated inbred varieties.

Statistical analysis showed that the plant height of inbred and hybrid rice varieties was statistically significant. However, the vermicast application rate did not significantly affect the plant height of all varieties tested. Furthermore, treatment means comparison revealed no significant differences between hybrid Rc492 and Rc314 and inbred Rc300, Rc222, Rc238, and Rc216, but significant differences were observed in hybrid variety Rc492 over inbred Rc216. In addition, the plant of height, both inbred and hybrid varieties, did not show significant interaction among the rates of vermicast applied to different rice varieties tested.

The result of the study emphasized that the height characteristics of both hybrid and inbred rice varieties were not affected by levels of vermicast application. It further explains that the significant difference was only observed in the different varieties tested. In addition, among the varieties tested, the hybrid rice varieties outgrew the inbred varieties in growth performance, and this is expected due to the inherent uniform growth characteristics of the hybrid rice, which are superior to those of the inbred rice varieties [22].

Table 3. Average plant height at maturity (cm) of rice varieties applied with different levels of vermicast

Rice Varieties	Check Plot	Vermicast levels (tons/ha)					Mean* (A)
		3 tons	4 tons	5 tons	6 tons	7 tons	
NSIC Rc300 (Inbred)	87.00	81.33	80.00	85.00	82.33	80.67	**81.87^{ab}**
NSIC Rc222 (Inbred)	85.00	81.33	78.67	79.33	81.67	74.00	**79.00^{ab}**
NSIC Rc238 (Inbred)	92.00	83.00	81.67	79.67	79.00	77.00	**80.05^{ab}**
NSIC Rc216 (Inbred)	84.00	75.67	82.67	75.67	75.67	76.67	**77.27^{b}**
NSIC Rc492H	91.00	85.33	91.33	82.67	89.33	92.67	**88.27^{a}**
NSIC2 Rc314H	95.00	88.67	86.33	85.67	84.67	83.67	**85.80^{ab}**
Mean* (B)	**89.00**	**82.56**	**83.45**	**81.34**	**82.11**	**80.78**	

**-Means followed by the same letter were not significantly different from each other using the LSD test.*

3.3 Days to flowering

The study examined the effect of different levels of vermicast on the flowering times of four inbred and two hybrid rice varieties. The inbred varieties, particularly NSIC Rc216 and NSIC Rc238, displayed variations in flowering time, with NSIC Rc216 flowering earliest at 79.47 days, followed by NSIC Rc238 at 81.07 days. The other two inbred varieties took longer to flower, averaging 83.07 and 87.07 days. Among the hybrid varieties, NSIC Rc314H flowered earlier at 85.87 days compared to NSIC R492H at 87.67 days. The check plot consistently showed delayed flowering compared to the experimental plot.

However, the application of vermicast did not significantly affect the flowering time across inbred and hybrid varieties, as the average days to flowering ranged from 83.17 to 84.67 days, regardless of the vermicast application rate. Treatment comparison among rice varieties revealed that NSIC Rc314, NSIC Rc300, NSIC Rc492, and NSIC Rc222 did not differ significantly among themselves but were significantly different in terms of days to flowering compared to NSIC Rc238 and Rc216. Likewise, the study indicated that varietal differences significantly influenced flowering time, and the nutrients present and the slow release of nutrients from vermicast did not significantly affect both inbred and hybrid rice days to flowering. In general, there was no significant interaction between the two factors (varieties and vermicast levels) in determining the flowering time of rice varieties.

The variation in days to flowering among varieties tested was related to the different physiological characteristics of every variety. Hybrid varieties with late physiological maturity tend to have late days to produce flowers compared to inbred varieties with short physiological maturity. Likewise, the result shows that differences in days to flowering were due to physiological characteristics and were not affected by the levels of vermicast application.

Table 4. Average days to flowering of rice varieties applied with different levels of vermicast

Rice Varieties	Check Plot	Vermicast levels (tons/ha)					Mean* (A)
		3 tons	4 tons	5 tons	6 tons	7 tons	
NSIC Rc300 (Inbred)	89.00	89.00	88.67	84.33	85.33	88.00	87.07[a]
NSIC Rc222 (Inbred)	87.00	83.67	81.33	85.00	81.67	83.67	83.07[abc]
NSIC Rc238 (Inbred)	88.00	79.33	81.00	82.67	81.67	80.67	81.07[bc]
NSIC Rc216 (Inbred)	86.00	78.67	80.67	79.00	81.00	78.00	79.47[c]
NSIC Rc492H	93.00	87.00	89.33	89.67	87.33	85.00	87.67[a]
NSIC2 Rc314H	94.00	81.33	87.00	84.33	86.00	90.67	85.87[ab]
Mean* (B)	89.83	83.17	84.67	84.17	83.83	84.34	

**-Means followed by the same letter were not significantly different from each other using the LSD test.*

3.4 Number of days to maturity

The result of the study showed that the different varieties have different maturity periods, ranging from 104.20 to 111.93 days for the inbred varieties after planting. Among the inbred varieties, NSIC Rc216 matured early at 104.20 days, followed by NSIC Rc238 and NSIC Rc222 at 106.20 and 108.07 days, respectively. On the other hand, NSIC Rc300 matured later, with an average mean of 111.93 days after planting. For hybrid varieties, NSIC Rc314H matures within 110.87 days, while NSIC Rc492H has a delayed maturity period with an average of 112.67 days. The application of vermicast did not influence the maturity period of all inbred and hybrid varieties.

Statistical analysis showed that the maturity periods of inbred and hybrid varieties are significantly different, but the application of vermicast at different rates did not indicate a significant difference. Furthermore, no interaction was observed in the number of days to maturity of all inbred and hybrid varieties or in the application of different rates of vermicast. Differences in the maturity of different varieties could be attributed to the inherent physiological maturity dictated by the genotype of each variety and its interaction with the environment.

Table 5. Average days to maturity of rice varieties applied with different levels of vermicast

Rice Varieties	Check Plot	Vermicast levels (tons/ha)					Mean* (A)
		3 tons	4 tons	5 tons	6 tons	7 tons	
NSIC Rc300 (Inbred)	119.00	114.00	113.67	108.67	110.33	113.00	111.93[a]
NSIC Rc222 (Inbred)	117.00	108.67	106.33	110.00	106.67	108.67	108.07[abc]
NSIC Rc238 (Inbred)	118.00	104.33	106.67	107.67	106.67	105.67	106.20[bc]
NSIC Rc216 (Inbred)	116.00	104.00	105.67	103.00	106.00	102.33	104.20[c]
NSIC Rc492H	123.00	112.00	114.33	114.67	112.33	110.00	112.67[a]
NSIC2 Rc314H	124.00	106.33	112.00	109.33	111.00	115.67	110.87[ab]
Mean* (B)	119.50	108.22	109.78	108.89	108.33	109.22	

**-Means followed with the same letter/superscript were not significantly different from each other using the LSD test.*

3.5 Number of productive tillers

Results showed that the number of productive tillers was comparable among the inbred and hybrid varieties tested. On average, NSIC Rc216 had a mean of 12.13 productive tillers per hill, followed by NSIC Rc300 with 12.47 productive tillers per hill. The two other inbred varieties (NSIC Rc222 and NSIC Rc238) obtained an average number of 13.13 tillers and 13.47 productive tillers per hill, respectively. The two hybrid varieties also produce productive tillers comparable to those of inbred varieties. Likewise, the application of vermicast, at any rate, did not influence the tillering ability of different inbred and hybrid varieties except in the check plot. In comparison, the check plot attained the highest number of productive tillers, with an average mean of 15.66 per hill. Furthermore, no interaction effect was noted between the different varieties and the rate of vermicast applied to the different rice varieties. The result clearly shows that hybrid and inbred varieties had comparable productive tillers despite the advantage of hybrid varieties in terms of growth and yield characteristics. Furthermore, the tillering ability of each variety was not affected by the different rates of vermicast and check plots or the application of inorganic fertilizer.

Table 6. The average number of productive tillers of rice varieties applied with different levels of vermicast

Rice Varieties	Check Plot	Vermicast levels (tons/ha)					Mean* (A)
		3 tons	4 tons	5 tons	6 tons	7 tons	
NSIC Rc300 (Inbred)	11.00	12.67	11.67	12.67	13.00	12.33	12.47
NSIC Rc222 (Inbred)	17.00	15.33	11.33	13.33	14.00	11.67	13.13
NSIC Rc238 (Inbred)	15.00	13.67	13.33	14.00	13.33	13.00	13.47
NSIC Rc216 (Inbred)	13.00	11.67	12.33	12.00	12.00	12.67	12.13
NSIC Rc492H	15.00	13.00	14.67	12.67	13.33	16.67	14.07
NSIC2 Rc314H	23.00	14.00	14.00	14.33	14.33	12.33	13.80
Mean* (B)	15.66	13.39	12.89	13.17	13.33	13.11	

**-Means followed by the same letter were not significantly different from each other using the LSD test.*

3.6 Average Weight of Thousand Grains

Table 7 presents the average weight of a thousand grains of rice varieties applied with different levels of vermicast. Statistical analysis showed that the weight of a thousand grains in grams of inbred and hybrid varieties was not significantly different. On average, NSIC Rc300 had a mean of 27.60 grams, followed by NSIC Rc238 with a mean of 27.93 grams, and the other two inbred, NSIC Rc222 and NSIC Rc216, obtained an average mean of 30.93 and 31.13 grams, respectively. The two hybrid varieties weigh a thousand grains more than the inbred varieties. NSIC Rc314H had an average mean of 34.20 g, and NSIC Rc492H had an average mean of 35.60 g, respectively. Meanwhile, applying vermicast at different rates did not significantly affect the grain weight in grams of the different hybrid and inbred varieties in both the treated and the check plots. Likewise, statistical analysis has shown no interaction effect between inbred and hybrid varieties and the rate of vermicast applied as fertilizer in the different rice varieties.

The result on the weight of a thousand grains shows that all the tested varieties, the hybrid and inbred varieties, had comparable weights. Inbred rice varieties had similar performances despite the inherent advantage of hybrid rice varieties.

Table 7. The average weight of a thousand grains of rice varieties applied with different levels of vermicast

Rice Varieties	Check Plot	Vermicast levels (tons/ha)					Mean* (A)
		3 tons	4 tons	5 tons	6 tons	7 tons	
NSIC Rc300 (Inbred)	28.10	26.67	29.00	28.33	27.33	26.67	27.60
NSIC Rc222 (Inbred)	31.00	25.33	29.00	33.33	30.00	37.00	30.93
NSIC Rc238 (Inbred)	28.95	35.00	24.33	26.00	24.33	30.00	27.93
NSIC Rc216 (Inbred)	31.20	35.00	32.00	32.33	32.00	24.33	31.13
NSIC Rc492H	38.00	36.00	41.33	35.00	31.33	34.33	35.60
NSIC2 Rc314H	37.00	28.33	33.33	36.33	33.00	40.00	34.20
Mean* (B)	32.38	31.06	31.50	31.89	29.67	32.06	

**-Means followed by the same letter were not significantly different.*

3.7 Percentage of filled grains

Results of the study of different inbred and hybrid rice varieties showed that the percentage of filled grains ranged from 93.20 to 95.73 percent for the inbred varieties. However, non-significant results were obtained between varieties and levels of vermicast application. Among the inbred varieties, NSIC Rc300 and NSIC Rc222 obtained the highest mean percentage of filled grains. Likewise, hybrid varieties, NSIC Rc429H, obtained the highest percentage of filled grains than NSIC Rc314H, with a mean percentage of 95.94%. However, varieties in the check plot applied with inorganic fertilizer have similar percentages of filled grains, with an average mean of 94.74 % filled grains. Statistical analysis showed that the percentage of filled grains in both inbred and hybrid varieties is not significantly different. The application of vermicast did not show significant differences in filled grains. Furthermore, no interaction was observed in the number of days for all inbred and hybrid varieties applied with different levels of vermicast. The study results imply that the hybrid and inbred rice varieties, at any rate of vermicast application, will produce a comparable percentage of filled grain. In addition, the filled grains performance of each rice variety is higher among varieties, and it was a good indicator that the varieties responded uniformly to factors outside their genetic control.

Table 8. Percentage of filled grains of rice varieties applied with different levels of vermicast

Rice Varieties	Check Plot	Vermicast levels (tons/ha)					Mean* (A)
		3 tons	4 tons	5 tons	6 tons	7 tons	
NSIC Rc300 (Inbred)	98.36	94.88	96.27	97.01	95.63	94.86	**95.73**
NSIC Rc222 (Inbred)	87.50	96.63	95.13	97.09	95.23	94.27	**95.67**
NSIC Rc238 (Inbred)	99.00	94.76	95.24	95.91	93.54	94.93	**94.88**
NSIC Rc216 (Inbred)	90.91	91.57	95.23	91.78	95.09	92.34	**93.20**
NSIC Rc492H	99.00	95.62	96.57	96.03	96.57	96.92	**96.34**
NSIC2 Rc314H	93.67	94.76	95.44	95.70	97.11	96.68	**95.94**
Mean* (B)	**94.74**	**94.70**	**95.65**	**95.59**	**95.53**	**95.00**	

**-Means followed by the same letter were not significantly different from each other using the LSD test.*

3.8 Yield per hectare in tons

Table 9 presents the computed yield per hectare in tons of rice varieties applied with different levels of vermicast. As shown in the table, the data on the grain yield of the four inbred and two hybrid varieties ranged from 3.63 to 4.26 tons per hectare for the inbred varieties. Grain yield ranges from 4.75 to 4.83 tons per hectare for hybrid varieties. Among the inbred varieties, NSIC Rc216 had an average yield of 3.63 tons/ha, significantly different among inbred varieties. On the other hand, the hybrid varieties obtained slightly higher grain yields than the inbred varieties. NSIC Rc314H had an average grain yield of 4.83 tons per hectare. Statistical analysis showed that grain yield in tons of inbred and hybrid varieties differed significantly. However, the vermicast application rate did not significantly affect the grain yields of all varieties tested. Moreover, the treatment mean comparison result disclosed that hybrid varieties NSIC Rc492H, NSIC Rc314, and Inbred NSIC Rc300, NSIC Rc222, and NSIC Rc238 did not show significant differences. Still, significant results were observed between hybrid NSIC Rc314 and inbred NSIC Rc216. Likewise, both inbred and hybrid grain yields did not show a significant interaction between the rate of vermicast applied. The result of the study shows that the yield performance of the different varieties of inbred and hybrid rice had a lower yield performance based on its physiological yield potential. However, the varieties surpassed the country's average yield of 3 tons per hectare. Likewise, differences in yield performance were attributed to their genetic differences that affect their performance when interacting with the environment.

Table 9. Yield per hectare in tons of rice varieties applied with different levels of vermicast

Rice Varieties	Check Plot	Vermicast levels (tons/ha)					Mean* (A)
		3 tons	4 tons	5 tons	6 tons	7 tons	
NSIC Rc300 (Inbred)	4.44	4.18	4.19	3.96	4.04	3.91	4.06[ab]
NSIC Rc222 (Inbred)	4.44	4.96	3.54	4.37	4.54	3.91	4.26[ab]
NSIC Rc238 (Inbred)	4.46	4.74	3.90	4.56	3.67	3.78	4.13[ab]
NSIC Rc216 (Inbred)	4.0	3.42	4.22	3.38	3.61	3.50	3.63[b]
NSIC Rc492H	6.22	4.46	4.83	4.28	4.71	5.48	4.75[ab]
NSIC2 Rc314H	8.0	4.44	4.65	5.64	5.07	4.33	4.83[a]
Mean* (B)	5.26	3.67	4.22	4.37	4.27	4.15	

**-Means followed by the same letter were not significantly different from each other using the LSD test.*

4. Conclusions

The study evaluates the agronomic parameters of inbred and hybrid varieties, including significant variations in plant height at maturity, average number of days to flowering, average days to maturity, and grain yield per hectare in tons. Notably, inbred and hybrid varieties were the same concerning the average number of productive tillers, the average percentage of filled grains, and the computed weight of a thousand grains in grams. Additionally, applying different levels of vermicast did not influence the parameters of both inbred and hybrid varieties. Likewise, no interaction was observed between the inbred and hybrid varieties and the levels of vermicast across all observations. Interestingly, findings included the higher grain yield in tons per hectare of the hybrid varieties (NSIC Rc314 and NSIC Rc492H) and inbred varieties (NSIC Rc238, NSIC Rc216, and NSIC Rc300) compared to NSIC Rc216. Furthermore, the study observed changes in soil chemical components, with a significant increase in exchangeable phosphorus and a decline in nitrogen and potassium. The plants consumed these nutrients in large amounts. These findings contribute valuable insights to understanding crop performance and soil dynamics, offering implications for future agricultural practices and research endeavors.

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