INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print); 2222-5234 (Online)
Website: https://www.innspub.net
Email contact: info@innspub.net
Vol. 29, Issue: 1, p. 38-46, 2026

RESEARCH PAPER

OPEN ACCESS

Growth and yield performance of sweet sorghum under reduced inorganic fertilizer rates supplemented with *Trichoderma*-enriched vermicompost

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Key words: Sorghum, Vermicompost, Inorganic fertilizer, Plant growth, *Trichoderma*

Received: June 21, 2026 **Accepted:** July 01, 2026 **Published:** July 08, 2026

DOI: https://dx.doi.org/10.12692/ijb/29.1.38-46

ABSTRACT

A field experiment was undertaken at Cagayan State University from December 2023 to April 2024 to investigate how reducing the rates of inorganic fertilizer combined with vermicompost affects the growth of sweet red sorghum. Through a Randomized Complete Block Design (RCBD) with three replicates, it was discovered that sorghum plants receiving 75% of the inorganic fertilizer combined with 2.5 tons/ha vermicompost (T3) were the tallest (133.02 cm), almost the same height as those with 100% inorganic fertilizer (T1), 50% inorganic fertilizer + 2.5 tons/ha vermicompost (T4), and pure vermicompost (T2). Panicle length and number of grains per panicle were the longest in T1, whereas T3 yielded significantly more per hectare (8.11 tons/ha) than T2 (3.38 tons/ha). The treatments showed no significant differences in days to flowering and the weight of 1000 grains. This result illustrates that the use of vermicompost to supplement reduced rates of inorganic fertilizer can produce agronomic outputs and yields similar to the use of full inorganic fertilizer. The 75% RRIF + 2.5 tons/ha vermicompost (T3) appeared to be a promising sustainable alternative. The long-term consequences and economic viability of this method can be left for further studies.

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INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench) is the world's fifth largest grain crop after rice, corn, wheat, and barley. It is considered a health food due to its gluten-free and antioxidant-rich characteristics. This drought-resistant crop contains several vitamins and minerals and is also a good quality feed ingredient for livestock as its nutritional composition is almost similar to corn but slightly higher protein and energy levels. The possibilities of processing sorghum are numerous like baked products, popping, malting, grits, couscous, and chips.

Sweet sorghum can yield high production even in marginal conditions by increasing inputs so as to fulfill production requirements. It has been found to be suitable to both arable and marginal areas and therefore would not be competing with staple crops for agricultural lands (Vermerris and Saballos, 2013). To have healthy soil and good crop production, it is very important to add nutrients and other products to the soil that help plant growth. However, fertilizers that have synthetic chemicals are very expensive and that is why poor farmers who do not have many resources simply cannot afford them (Islam *et al.,* 2017). Also, using only inorganic fertilizers harms soil health and pollutes the environment besides raising the cost of production.

On the other hand, relying solely on organic sources usually fails to supply the immediate plant nutrients needs because of the huge amount of organic manure required for cereals which have heavy nutrient demands. To support this idea, Seridon *et al.* (2025) found that agricultural waste management with some cattle manure substrates inoculated with a dual-decomposer system of *Trichoderma harzianum* and African Night crawlers (*Eludrilus eugeniae*) not only significantly hastens organic decomposition but it also better the nutrient composition of the final fertilizer. Therefore, the use of integrated nutrient management which is a mixture of organic and chemical fertilizers is suggested for the cultivation of sweet sorghum to get the highest output of crops and nutrients (Varma *et al.,* 2021).

Farmers continuously applying only inorganic fertilizers have primarily focused on NPK, without enough attention to the extra micronutrients that vermicompost may supply. Low soil fertility is one of the major reasons why sorghum farming, even the perceived hardiness of sweet sorghum, is not achieving high yields. Sorghum production is on the decline primarily due to falling soil fertility levels. Extremely poor results in farming with crops are a consequence of farmers' scarce resources and insufficient knowledge of the perfect blend of both organic and inorganic fertilizers. The sole, continuous application of inorganic fertilizers results in degradation of the soil and a reduction of its organic matter. Supplying soils with organic components, such as farmyard manure, cow dung, and chicken manure, as supplements, can greatly raise crop production, especially for subsistence farmers. Yet, the advantages of using organic materials have not been fully exploited, mainly because of the large amounts that are needed.

With the purpose of systematically addressing these nutrient dynamics in , this research work applies an integrated approach in accordance with the methodological frameworks of Singh (2022) and Kumar and Singh (2025), who revealed that 2.5 t/ha organic base work is capable of effectively supporting mineral fertilizers by improving the nutrient use efficiency (NUE), stabilizing the availability of macronutrients, and preventing the depletion of nutrients in the rhizosphere at the critical stages of growth. Besides, to test the upper limit of organic management without the use of synthetic chemical inputs, a pure organic treatment with an application of 5.0 t/ha of vermicompost produced in the campus was carried out. This particular organic rate was fixed based on the physiological standards of Hameeda (2007), who pinpointed 5.0 t/ha as the baseline and efficient threshold levels for pure organic sorghum production so as to maximize plant height, leaf area index, and shoot biomass without provoking the diminishing returns. This joint optimization strategy is geared toward maintaining high soil fertility by allowing the synchronization of nutrient availability for the best sweet sorghum plant uptake.

Despite these benefits, there are no local studies assessing the agronomic and yield performance of sweet sorghum using organic fertilizers, which could provide baseline information for alternative nutrient sources and suitable environments for sorghum production (Beltran *et al.,* 2019). By integrating organic and inorganic nutrient sources, this study aims to enhance sorghum production sustainably by addressing critical global challenges. This paper tackles several Sustainable Development Goals (SDGs), among them are zero hunger (SDG 2), and responsible consumption and production (SDG 12) through enhancing soil fertility and sorghum yields via integrated nutrient management, supports the food security, and sustainable agriculture agenda of the world. Besides, it advocates for the sustainable farming techniques by limiting the dependence on chemical fertilizers, therefore reducing the environmental damages while improving the soil condition.

MATERIALS AND METHODS

Materials

The materials used during the conduct of this thesis are Red Sorghum seeds, inorganic fertilizers, and vermicompost.

Collection of soil samples and analysis

The experimental area was ploughed and harrowed twice. Soil samples were collected in the study area. The soil samples were spread in a flat container and air-dried. One-kilogram samples were thoroughly pulverized and cleaned to separate foreign matters. The samples were submitted to the Cagayan Valley Integrated Laboratory, Regional Soils Laboratory DA-RO2, Carig Sur, Tuguegarao City for the soil analysis. The result of the soil analysis was the basis for the fertilizer recommendation for the study.

Land preparation

The experimental area was prepared thoroughly by ploughing and harrowing twice with seven days interval to improve soil structure and condition. This is to hasten plants for proper growth and development of the plants.

Preparation and production of vermicompost

The vermicompost fertilizer used in this study was made at the Integrated Farm of Cagayan State University-Piat Campus using dual-decomposer protocols of Seridon *et al.* (2025). A formulated agricultural waste mixture using cattle manure substrate was the main organic substrate which was converted by a two-stage synergistic decomposition method involving fungal inoculation and earthworm stabilization. During the first pre-treatment phase, the raw materials were put in composting beds with adjusting moisture to nearly 60%, and inoculated with a *Trichoderma harzianum* culture to start the enzymatic degradation of complex organic fibers. The preliminary stage was carried out for two (2) weeks, during which early thermophilic activity was allowed to diminish to keep the macro-decomposers from being exposed to heat stress. After the pre-decomposition stage, African night crawlers (*Eudrilus eugeniae*) were added to the stabilized composting beds to carry out the vermicomposting process. Substrate moisture was continually maintained at 60% through regular, controlled watering, and the beds were kept free from predators and sudden changes in the environment during the rest of the incubation period. The joint work of earthworms and *T. harzianum was* continued until the complete structural breakdown and nutrient stabilization were accomplished. The vermicompost was then physically separated from the worms through screening, air-dried in the shade so the microbial communities would be preserved, and kept in a dry place before being used in the field.

Experimental design and treatments

After thorough land preparation, the experimental area was thoroughly prepared by plowing and harrowing twice to eradicate the emerging weeds and to incorporate all crop residues to the soil. The activity was done following the seven days interval to improve soil structure and condition. The crop was planted 75 cm between furrows and 20 cm between in a row. There were a total of fifteen (15) plots with a dimension 5 m × 25 m each with one meter (1) alleyway. The seeds were sown via drilling. The study was conducted at the Integrated Farm of Cagayan State University Piat Campus from December 2023-April 2024.

The Randomized Complete Block Design with three replications was used in the study. The different treatments were: T1 – 100% of Recommended Rate of Inorganic Fertilizer (RRIF); T2 – Pure Vermicompost (5 tons/ha); T3 – 75% RRIF + Vermicompost (2.5 tons/ha); T4 – 50% RRIF + Vermicompost (2.5 tons/ha); T5 – 25% RRIF + Vermicompost (2.5 tons/ha).

Planting of sorghum seeds

Seeds of sweet red sorghum was planted 75 cm between furrows and 20 cm between hills. Four seeds were planted per hill with 2-3 cm deep using planting dibble. Thinning the plants to two per hill if all seeds were germinated to ensure optimal spacing and resources.

Fertilizer application

The calculated amount of fertilizer per treatment was determined based on the results of the initial soil analysis. The precise amount of nutrients was derived from Recommended Rate of Inorganic Fertilizer (RRIF), established at 60-60-45 kg/ha of N-P_2O_5-K_2O, using Complete Fertilizer (14-14-14), Urea (46-0-0), and Muriate of Potash (0-0-60). The experimental treatments were divided into mineral only, pure organic, and integrated nutrient management systems. For the pure chemical treatment, T1 (100% RRIF) was given the complete mineral dose without any organic amendments. On the other hand, T2 (Pure Organic) was supplied 5.0 t/ha of pure vermicompost with 0% inorganic fertilizer. This dose has been fixed based on the references to Hameeda (2007), who identified 5.0 t/ha as a normal baseline and efficient level for pure organic sorghum plant height, leaf area index, and shoot biomass with no diminishing returns.

The integrated nutrient management treatments, T3, T4, and T5, received a uniform baseline application of 2.5 t/ha of vermicompost combined with a 75%, 50% and 25% dose of the Recommended Rate of Inorganic Fertilizer (RRF). This integrated rate is adopted following the findings of Singh (2022) and Kumar and Singh (2025), who demonstrated that a 2.5 t/ha organic baseline effectively complements mineral fertilizers by enhancing nutrient use efficiency (NUE), stabilizing macro-nutrient availability, and preventing nutrient mining in the rhizosphere.

Irrigation and weed management

Overhead irrigation was done after planting to enhance germination. At the early vegetative growth stage (first six weeks), the plants were irrigated bimonthly, and weekly thereafter. Weeding was done monthly to avoid competition for moisture, nutrient, and solar radiation.

Harvesting and data collection for analysis

Harvesting was done when the crop reached physiological maturity. This stage is characterized by several key indicators such the grains become hard and are difficult to dent with a fingernail, the grains achieve deep red color, and a black layer forms at the base of each grain, signifying that nutrient flow from the plant has ceased.

Statistical tool

The data were analyzed using STAR, version 2.0.1 2014. Biometrics and Breeding Informatics, PBGB Division, International Rice Research Institute, Los Baños, Laguna following procedures for analysis of variance (ANOVA) for Randomized Complete Randomized Design (RCBD) to test the significant differences among treatments. The Least Significance Difference (LCD) was used to analyze the mean compariso.

RESULTS AND DISCUSSION

Plant height at maturity (cm)

Table 1 show the height of sweet red sorghum at maturity as affected by reduced rate of inorganic fertilizer and fixed amount of vermicompost. Results revealed that plants applied with 75% RRIF + 2.5 tons/ha vermicompost (T3) were the tallest with mean height of 133.02 cm followed by those plants applied with 100% RRIF (T1) and 50% RRIF + 2.5 tons/ha vermicompost (T4) with 131.30 cm and 127.85 cm, respectively. Plants applied with 25% RRIF + 2.5 tons/ha vermicompost (T5) had height of 125.95 cm while the shortest height was noted among sorghum plants applied with pure vermicompost (T2) with 121.87 cm.

Table 1. Plant height at maturity (cm) of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost under CSU-Piat condition

Treatments	Plant height at maturity (cm)
T1 - 100% Recommended Rate of Inorganic Fertilizer (RRIF)	131.3
T2 - Pure Vermicompost (5 tons/ha)	121.87
T3 - 75% RRIF + Vermicompost (2.5 tons/ha)	133.02
T4 - 50% RRIF + Vermicompost (2.5 tons/ha)	127.85
T5 – 25% RRIF + Vermicompost (2.5 tons/ha)	125.95
F-Result	ns
C.V. (%)	4.11

Table 2. Average number of days to 80% flowering of the population of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost under CSU-Piat condition

Treatments	Number of days to 80% flowering
T1 - 100% Recommended Rate of Inorganic Fertilizer (RRIF)	77
T2 - Pure Vermicompost (5 tons/ha)	76
T3 - 75% RRIF + Vermicompost (2.5 tons/ha)	78
T4 - 50% RRIF + Vermicompost (2.5 tons/ha)	76
T5 – 25% RRIF + Vermicompost (2.5 tons/ha)	77
F-Result	ns
C.V. (%)	1.55

Statistical analysis showed that there was no significant difference on the height of sweet red sorghum plants at maturity and this means that the plants on the treatments evaluated and had similar performance as far as height is concerned. This indicate that application of full rate of NPK and the combination of higher rate of NPK supplemented with trichoderma-enriched vermicompost did not increase the plant height of sweet red sorghum.

Average number of days to 80% flowering

As shown in Table 2, sweet red sorghum plants applied with 50% RRIF + 2.5 tons/ha vermicompost (T4) and pure vermicompost (T2) were the earliest to bear flower at 80% with 76 days after planting. For other treatments, T1 – 100% RRIF, and T5 – 25% RRIF + 2.5 tons/ha vermicompost, sweet red sorghum bear flowers at 77 days after planting. The latest plant to bear flower was observed under T3 – 75% RRIF + 2.5 tons/ha vermicompost with 78 days after planting.

As indicated in the analysis of variance, despite of the differences, the number of days to flower at 80% was not significantly affected by the different treatments tested.

Panicle length at harvest (cm)

As shown in Table 3, the longest panicle head of sweet red sorghum was obtained by the plants applied with full rate of inorganic fertilizer with a mean of 26.23 cm. For the other treatments, sweet red sorghum applied with 75% RRIF + 2.5 tons/ha vermicompost (T3), 50% RRIF + 2.5 tons/ha vermicompost (T4) and 25% RRIF + 2.5 tons/ha vermicompost (T5) obtained a respective panicle length of 24.93 cm, 25.62 cm and 24.87 cm. The shortest panicle was produced by plants applied with pure vermicompost (T2) with only 22.62 cm. Analysis of variance showed that the different treatments were significant with each other. The results indicate that the application of full rate of inorganic fertilizer obtained a comparable panicle length to plants applied with 75% of NPK plus vermicompost, 50 % of NPK plus vermicompost, and 25% of NPK plus vermicompost. The reduced amount of recommended Nitrogen (N), Phosphorus (P) Potassium (K) may compensate by the supplemented vermicompost, this conforms with the findings of Arancon *et al.* (2004) indicates that vermicompost applications can lead to increased growth and yield in various crops including cereals like sorghum and Kumar *et al.* (2017) reported that the application of NPK fertilizers significantly enhances various growth parameters, including the length of panicles, in sorghum. Additionally, Ravikumar *et al.* (2018) found that the combined application of NPK and vermicompost significantly increased the length of panicles in sorghum, attributing this to improved nutrient availability and soil structure.

Table 3. Panicle length at harvest (cm) of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost under CSU-Piat condition

Treatments	Panicle length at harvest (cm)
T1 - 100% Recommended Rate of Inorganic Fertilizer (RRIF)	26.23[a]
T2 - Pure Vermicompost (5 tons/ha)	22.62[b]
T3 - 75% RRIF + Vermicompost (2.5 tons/ha)	24.93[a]
T4 - 50% RRIF + Vermicompost (2.5 tons/ha)	25.62[a]
T5 – 25% RRIF + Vermicompost (2.5 tons/ha)	24.87[a]
F-Result	*
C.V. (%)	3.69

Note: Means with common letter are not significant (0.01) with each other using HSD.

Table 4. Average grain weight per panicle (g) of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost under CSU-Piat condition

Treatments	Grain weight per panicle (g)
T1 - 100% Recommended Rate of Inorganic Fertilizer (RRIF)	54.55
T2 - Pure Vermicompost (5 tons/ha)	37.66
T3 - 75% RRIF + Vermicompost (2.5 tons/ha)	56.79
T4 - 50% RRIF + Vermicompost (2.5 tons/ha)	54.19
T5 – 25% RRIF + Vermicompost (2.5 tons/ha)	48.10
F-Result	ns
C.V. (%)	22.17

Average grain weight per panicle (g)

The weight of grains per panicle of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with *Trichoderma*-enriched vermicompost Table 4. Heaviest grains per panicle was observed on sorghum plants applied with 75% RRIF + 2.5 tons/ha vermicompost (T3) with 56.79 g which was closely followed by plants applied with 100% RRIF (T1) and 50% RRIF + 2.5 tons/ha vermicompost (T4) with respective grain weight of 54.55 g and 54.19 g. Likewise, sweet red sorghum plants applied with 25% RRIF + 2.5 tons/ha vermicompost (T5) had grain weight of 48.10 g and the lightest weight was observed on plants applied with pure vermicompost alone (T2) with 37.66 g. Analysis of variance showed that the different treatments insignificantly comparable weight of grains per panicle.

Average number of grains (Per panicle)

Table 5 shows the number of grains per panicle of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost. Results showed that most of the plants in the different treatments produced high number of grains per panicle. Sorghum plants applied with 100% RRIF (T1) had 1,480 grains per panicle closely followed by 75% RRIF + 2.5 tons/ha vermicompost (T3), and 50% RRIF + 2.5 tons/ha vermicompost (T4) with 1,363 grains and 1,295 grains per panicle, respectively. Plant applied with 25% RRIF + 2.5 tons/ha vermicompost (T5) obtained 1061 grains per panicle. Sorghum plants applied with pure vermicompost produced the fewest number of grains per panicle with 901 grains.

Table 5. Average number of grains per panicle of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost under CSU-Piat condition

Treatments	Number of grains per panicle
T1 - 100% Recommended Rate of Inorganic Fertilizer (RRIF)	1480[a]
T2 - Pure Vermicompost (5 tons/ha)	901[b]
T3 - 75% RRIF + Vermicompost (2.5 tons/ha)	1363[a]
T4 - 50% RRIF + Vermicompost (2.5 tons/ha)	1296[b]
T5 – 25% RRIF + Vermicompost (2.5 tons/ha)	1061[b]
F-Result	**
C.V. (%)	9.65

Note: Means with common letter are not significant (0.05) with each other using HSD.

Table 6. Weight of 1,000-grain weight (g) of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost under CSU-Piat condition

Treatments	Weight of 1,000-grain (g)
T1 - 100% Recommended Rate of Inorganic Fertilizer (RRIF)	36.41
T2 - Pure Vermicompost (5 tons/ha)	33.55
T3 - 75% RRIF + Vermicompost (2.5 tons/ha)	37.15
T4 - 50% RRIF + Vermicompost (2.5 tons/ha)	36.91
T5 – 25% RRIF + Vermicompost (2.5 tons/ha)	34.54
F-Result	ns
C.V. (%)	9.18

Table 7. Projected yield (MT/ha) of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost under CSU-Piat condition

Treatments	Projected yield (MT/ha)
T1 - 100% Recommended Rate of Inorganic Fertilizer (RRIF)	7.55[a]
T2 - Pure Vermicompost (5 tons/ha)	3.38[b]
T3 - 75% RRIF + Vermicompost (2.5 tons/ha)	8.11[a]
T4 - 50% RRIF + Vermicompost (2.5 tons/ha)	7.74[a]
T5 – 25% RRIF + Vermicompost (2.5 tons/ha)	6.87[a]
F-Result	*
C.V. (%)	18.79

Note: Means with common letter are not significant (0.01) with each other using HSD.

Analysis of variance indicated significant differences among the different treatments. The results imply that applying full rate of inorganic fertilizer alone is significantly enough to obtain the optimum number of grains per panicle (1480), however, it is comparable with the plants applied with 75% RRIF with vermicompost supplementation with an average of 1363 grains.

The results conform with the findings of Zahir *et al.*, (2016) who investigated the impact of varying levels of inorganic fertilizer (NPK) combined with organic fertilizers on the growth and yield of sorghum. The study found that the full NPK fertilizer significantly increased the number of grains per panicle compared to lower rates of NPK combined with vermicompost. Similar result reported by Ahmad *et al.*, (2018) that the use of vermicompost in conjunction with reduced rates of inorganic fertilizers can enhance soil fertility and crop productivity. Their result indicated that treatments with 75% NPK plus vermicompost resulted in significantly higher grain yields per panicle compared to 25% NPK plus vermicompost and pure vermicompost applications.

Weight of 1,000-grain (g)

As presented in Table 6, sweet red sorghum plants applied with 75% RRIF + 2.5 tons/ha vermicompost (T3) produced the heaviest 1,000 grain weight of 37.15 g, however this was insignificantly different with the weight of 1,000 grains produced from sorghum plants applied with 50% RRIF + 2.5 tons/ha vermicompost (T4), 100% RRIF (T1) and 25% RRIF + 2.5 tons/ha vermicompost (T5) with 36.91 g, 36.41 g and 34.54 g, respectively. Weight of grains produced from sorghum plants applied with pure vermicompost (T2) had the lightest 1,000 grain weight of 33.55 g. As indicated in the analysis of variance, the different treatments revealed insignificant differences.

Projected yield (ton/ha)

Table 7 shows the projected yield of sweet red sorghum as affected by reduced rate of inorganic fertilizer supplemented with trichoderma-enriched vermicompost. Result showed that sorghum plants applied 75% RRIF + 2.5 tons/ha vermicompost (T3) attained the highest projected yield of 8.11 MT/ha followed by sorghum plants applied with 50% RRIF + 2.5 tons/ha vermicompost (T4), 100% RRIF (T1) and 25% RRIF + 2.5 tons/ha vermicompost (T5) with respective project yields of 7.74 MT/ha, 7.55 MT/ha and 6.87 MT/ha. Sorghum plants applied with pure vermicompost (T2) obtained the lowest projected yield of 3.38 MT/ha.

Analysis of variance indicated significant differences among the treatments evaluated. The results are consistent with previous findings that integrating inorganic fertilizers with organic nutrient sources can maintain crop productivity while reducing dependence on mineral fertilizers. Mandal *et al.* (2020) reported that integrated nutrient management improved the growth and yield performance of sweet sorghum, suggesting that the combined supply of organic and inorganic nutrients can enhance nutrient availability and promote efficient nutrient utilization. This may explain why, in the present study, the application of 75% RRIF supplemented with 2.5 tons/ha vermicompost produced a yield comparable to that obtained with the full recommended rate of inorganic fertilizer. In addition, according to Somasundaram *et al.* (2020) that the combination of 50% inorganic fertilizer with vermicompost resulted in yields like the full rate of inorganic fertilizer, attributed to improved microbial activity and nutrient use efficiency. The results also conform to the result of Kumar *et al.* (2019), found that using 50% and 75% inorganic fertilizer rate plus organic manure such as vermicompost resulted in yields not significantly different from the full inorganic fertilizer rate, due to improved soil fertility and nutrient use efficiency.

CONCLUSION

Based on the findings of the study, it can be concluded that:

1. The combining reduced rates of inorganic fertilizer with vermicompost can effectively enhance the growth, development, and yield of sorghum. Specifically, the treatment with 75% RRIF + 2.5 tons/ha vermicompost resulted in the tallest plants and the highest projected yield, making it a viable option for sorghum cultivation in Piat, Cagayan.

2. The sole application of vermicompost, while beneficial, was less effective in terms of yield.

RECOMMENDATIONS

Based on the findings, it is recommended to adopt the application of reduced inorganic fertilizer supplemented with vermicompost to attained optimum yield of sweet red sorghum under Piat, Cagayan condition and to lessen the utilization of synthetic fertilizer. Additional studies should be conducted to refine the optimal combinations of organic and inorganic fertilizers under different environmental conditions and soil types to ensure the results are widely applicable.

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