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ORIGINAL RESEARCH

Influence of GIDI organic fertilizer on the yield of corn

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Abstract

Purpose: GIDI organic fertilizer or water hyacinth is an aquatic plant, an excellent depollutant, and is helpful for food production as compost and regeneration of degraded soil. Maintaining its fertility and maintaining the ecological balance of the environment. The study aimed to evaluate the influence of different rates of GIDI organic fertilizer on the yield response of corn under Rebuken, Sultan Kudarat, and Maguindanao conditions from October 2017 to January 2018.

Method: Randomized Complete Block Design (RCBD) was used in this study, with five treatments that were replicated three times. The treatments used were as follows: T1- Control or no application of fertilizer, T2-1,000 kg/ha of GIDI, T3- 2,000 kg/ha GIDI, T4- 3,000 kg/ha of GIDI, and T5- complete and recommended fertilizer in the locale.

Results: Based on the findings, the application of different rates of GIDI organic fertilizer significantly influenced the plant height, ear diameter, ear length, thousand seed weight, and grain yield of corn except for ear height in centimeters. Moreover, treatments applied with higher rates of GIDI organic fertilizer obtained the tallest plant height, heaviest seed weight, and grain yield.

Conclusion: Results attributed that the GIDI organic fertilizer gives nourishment to plants, enhanced with beneficial microbes capable of supplying complete nutrients needed by the corn plants making the soil fertile and yield better. The GIDI organic fertilizer is an environment-friendly, aquatic plant numerously growing in Liguasan Marsh, Rio Grande de Mindanao, Philippines.

Keywords: GIDI organic fertilizer, Excellent depollutant, Environment-friendly, Liguasan marsh, Maguindanao,

Introduction

Organic agriculture is an alternative to the conventional farming system which overuses and applies synthetic or chemical fertilizers often leading to soil degradation. This farming practice benefits mostly from organic fertilizer for its nutrient availability. A number of researchers and authors have reported that the use of organic fertilizer has enhanced soil quality. However, the benefit of organic fertilizer is highly dependent on its sources. Lim et al. (2010) concluded that different sources of compost had to be taken into consideration in its application guidelines. Hosseinpur et al. (2012) also reported that farmyard compost had 26% organic content, 8,667 mg kg Nitrogen (N), 2,033 mg kg Phosphorus (P), 4,900 mg kg Potassium (K), and a C/N ratio of 16.6. Another study also pointed out that local waste compost has 32.9%, 7,900 mg kg P, 1,600 mg kg K, and 9,500 mg kg Calcium (Ca) (De Varennes et al. 2010). Compost from weeds is also reported to bring about enhancement of soil quality and plant growth. A previous study carried out by Wahyudi et al. (2010) exhibited that the application of *tithonia* and *gliricidia* composts provided a significant increase in soil pH and reduction of exchangeable Aluminum (Al). The improvement of soil quality after application of weed compost often leads to increased growth and yield of the crop (Suntoro et al. 2001).

Water hyacinth is another alternative for composting material. Such weed dry matter contains 22.99% protein, 0.14% Calcium, 0.6% Phosphorus, 2.3% Nitrogen and 4.2% ash (Suntoro et al. 2001). Another researcher pointed out that water hyacinth dry matter has 1.5% Nitrogen, 0.74% Phosphorus, and 5.7% Potassium (Vidyah and Girish 2014). Water hyacinth compost application is reported to enhance the growth and yield of tomatoes (Mashavira et al. 2015). The application of compost of water hyacinth does not affect yield on corn even though it improves its growth (Osoro et al. 2014). Water hyacinth *(Eichhornia crassipes)* is a free-floating perennial aquatic plant belonging to the family *Pontederiaceae*. It is found in freshwater ecosystems and spread on the surface of rivers, lakes, canals, and ponds and may root in the mud of shallow waters (Rajan et al. 2022). Corn (Zea mays L.), also known as "maize," is one of the most important crops in the world, and almost 700 million metric tons of these nutritious and valuable crops are harvested annually worldwide. Maize is widely used as feed for livestock, particularly cattle, especially in the United States and Canada. In the Philippines, corn is the second major staple food for Filipinos, next to rice.

Organic matter is one of the major sources of nutrient elements for plants in improving soil physical and biological conditions such as better soil aggregation, soil aeration, and water-holding capacity. It is rich in essential nu-

trient elements that crops need for healthy growth, including nitrogen, phosphorus, and potassium. These nutrients are gradually released into the soil as the organic matter decomposes, providing a stable and longer source of nutrition for plants. It also increases the activity of micro and macro elements. Soil organic matter (SOM) is the organic fraction of the soil that is made up of decomposed plant and animal materials as well as microbial organisms. SOM is generally derived from residual plant and animal materials such as uneaten feeds, feces, dead algae and manure (Reyes and Santos 2019). GIDI natural organic fertilizer is a high-grade fertilizer made up of quality water hyacinth compost from the marshes specifically in Liguasan Marsh in Rio Grande de Mindanao. It is a pure natural fertilizer enhanced with beneficial microbes and enzymes. Water hyacinth is an aquatic plant, an excellent water de-pollutant for domestic water waste, and is very helpful in meeting some of the most urgent needs in tropical countries for food production as compost. Thus, it makes the soil more fertile which yields better for most crops. It is also environment-friendly which maintains the ecological balance of the environment.

This study aimed to evaluate the influence of different rates of GIDI organic fertilizer on the yield response of corn under Sultan Kudarat, Maguindanao conditions. Specifically, it aimed to determine which among the different rates of GIDI organic fertilizer would give an optimum yield in terms of plant height, ear length, ear height, ear diameter, thousand seed weight, and grain yield in kilograms per plot.

Material and methods

Experimental design

The study was conducted at Cotabato City State Polytechnic College experimental area at Rebuken, Sultan Kudarat, Maguindanao, Philippines. The experiment was laid out in a Randomized Complete Block Design (RCBD) with five treatments and replicated three times. The treatments are as follows:

T1- Control (no application of fertilizer)

T2- 1,000 kg/ha water hyacinth

T3- 2,000 kg/ha water hyacinth

T4- 3,000 kg/ha water hyacinth

T5- complete fertilizer (recommended from the locale)

Soil collection and treatment preparation

Soil samples were collected from the three different sites, representing the different altitudes. The soil in the experimental area at Rebuken Sultan Kudarat, Maguindanao was continuously planted with vegetables, leguminous crops such as mung bean and peanuts on sloping sites and fruit trees. The lower sites were planted with rain-fed upland rice production. After a week of soil and water hyacinth compost incorporation, two (2) corn seeds were planted per hill to each plot.

Land preparation

The experimental area was prepared thoroughly through a process of double plowing and alternate harrowing using the Carabao-drawn implement. This was done in order to pulverize the soil and to create optimal conditions

for seed germination. Removing unnecessary weeds and materials was done to ensure the area was clear and clean, both before and after the corn seeds were sown.

Fertilizer application

The GIDI organic fertilizer, derived from water hyacinth, was mixed into the soil in accordance with the study's treatment protocols three weeks prior to planting to ensure adequate decomposition of organic matter in corn plants. At the time of planting, half of the recommended fertilizer was applied directly to the soil, while the remaining half was side-dressed a month after the corn seeds were sown. The composted water hyacinth used in this process was sourced from the Saljay Farm, Pigcawayan, North Cotabato, Mindanao, Philippines.

Preparation of Water Hyacinth as compost (From Saljay Farm, Pigcawayan, North Cotabato, Mindanao)

Water hyacinth compost was prepared using its leaves, mixed with effective microorganisms (EM). The microorganism solution was a mixture of 50 mL and 10 grams, sugar in 2000 mL aquadest. Approximately 100 kilograms of water hyacinth leaves were sliced and chopped into fine pieces, then placed into wooden boxes. This leaf pile was sprayed with the microorganism solution, following which the container was covered with plastic and left to incubate for approximately 70 days, or around two to three months. Post incubation, the water hyacinth compost was passed through a 2 mm screen sieve for refinement. Upon this process completion, the water hyacinth compost is deemed ready for utilization as an organic fertilizer.

Planting, thinning, and spacing

The seeds were planted using the hill method, placing them at 25 cm apart within rows and 75 cm between rows, with each hill receiving two seeds. This arrangement was later thinned down to one plant per hill two weeks after the corn seeds had sprouted. This strategy was designed to optimize the growth conditions for the corn plants.

Care

Cleanliness was maintained for the whole duration of the study. Hand weeding and shallow cultivation were done to control weeds and avoid competition and absorption of nutrients available in the soil. This was also done in order for the corn plants to be free from pests and disease infestations and to obtain their desired growth and development.

Harvesting

The corn ears were harvested manually when the corn leaves and husks turned brown, and kernels were generally grazed at about 90-120 days after planting. Harvesting was done by plots with identification in the bags for every treatment in order to have an easy collection of data.

Data gathered

Plant height (cm)

The relevant data was collected by measuring the height of the corn plants at three specific stages - 30, 60, and 90 Days After Planting (DAP). Measurements were taken from the base of each plant to the tip of its highest leaf,

and were recorded in centimeters. Ten plants from each plot were randomly chosen for this purpose. Following data collection, the figures were properly recorded, and the average plant height was subsequently calculated.

Ear height (cm)

The ear height of corn was measured from the base of the plants up to the nodes which bear the ear using a meter stick in centimeters. This data was taken ten (10) days before harvesting time.

Ear length (cm)

The ear length of corn was measured in centimeters at harvesting time. This was done by measuring the length of corn ears from the two middle rows of the plots per treatment as a representative sample. Ten sample plants per plot were randomly picked per treatment and measured.

Ear diameter (cm)

Ear diameter was taken from the two middle rows by measuring the diameter of the ear per treatment using a tape measure in centimeters. This was done at harvesting time.

Number of ears per plant

This data was gathered one week before harvesting of corn plants by counting the number of ears per plant. Ten (10) sample plants were randomly counted per treatment.

Number of kernels per ear

The data was gathered at harvesting time by counting the number of kernels per ear which started from the base of the corn ears up to its tip. The first kernels found at the base of the corn ear were not included in counting as well as the very small kernels found at the tip of the ear. This was recorded and placed on its individual bags with tag per plot.

Thousand seed weight (g)

The thousand seed weight was done by weighing after counting one thousand seeds of the corn plants from the two middle rows per plot of the different treatments at harvesting time. These were placed in individual bags with tags for proper identification.

Grain yield (t/ha)

The grain yield per plot was taken after drying the corn plants for three consecutive days under the heat of the sun and these were weighed in kg/plot using the following formula:

Yield (tons/ha) = yield kg/plot (10,000-meter square)

Sampling area in meter square (1,000 kg/ton)

Statistical analysis

All the data taken from this research study were subjected to Analysis of Variance (ANOVA) and significant results were analyzed through the Duncan's Multiple Range Test (DMRT).

Results and discussion

Table 1 shows the different data gathered during the conduct of the study as follows : Plant Height (cm), Ear height in (cm), Ear Length in (cm), Ear Diameter in (cm), Number of Ears per Plant, Number of Kernels per Corn Ear, Thousand Seed Weight in (g/plot) and Grain Yield in (tons/ha). The influence of agro climatic conditions to agricultural practices and crops' growth and productivity are also considered in the conduct of this study. These climatic factors include rainfall, temperature, sunlight, wind, humidity, and the length of the growing season. These conditions vary from one region to another and greatly affect the type of crops that can be successfully cultivated, the timing of planting and harvesting, pest and disease prevalence, and the choice of farming techniques. Understanding the agro climatic conditions of the specific area chosen for this study is crucial in analyzing the appropriate crops and farming practices that will optimize yield while minimizing environmental impacts.

The impact of different quantities of GIDI organic fertilizer, or water hyacinth on the height of corn plants is detailed in Table 2. Measurements were made at three critical growth stages: 30, 60, and 90 Days after Planting (DAP). The tallest corn plants were observed in treatment 4, which received 3,000 kg/ha of water hyacinth, with an average height of 148.11 cm. This was followed by treatments 5, 2, and 3, which yielded average heights of 147.68 cm, 145.68 cm, and 140.05 cm, respectively. The shortest plants were observed in treatment 1, where no fertilizer was applied, resulting in an average height of 124.37 cm.

ANOVA revealed a significant result at a 5% level which implied that the application of water hyacinth organic fertilizer greatly influenced the plant height of corn plants in centimeters. In the study of Gunnarson and Peterson (2007), it was found out that water hyacinth can be used as a substrate for compost or biogas production. Furthermore, the authors stated that the sludge from the biogas process contains almost all of the nutrients of the substrate and can be used as a fertilizer, and that the use of water hyacinth compost on different crops has resulted in improved yields. Water hyacinth, due to its abundant growth and high concentrations of nutrients, has a great potential as fertilizer for the nutrient-deficient soils. It was stated further that applying the water hyacinths directly without any other processing than sun drying, seems to be the best alternative in small-scale use due to the relatively small losses of nutrients and workload required Gunnarsson and Peterson (2007).

Table 1. The data collected for treatments during the study (Plant height, Ear height, Ear length, Ear diameter,…).

Treatment	Plant Height (cm)	Ear Height (cm)	Ear Length (cm)	Ear Diameter (cm)	Number of Ears per plant	Number of Kernels per Corn Ear	Thousand Seed Weight (g/plot)	Grain Yield (tons/ha)
T1 (Untreated)	124.37^{bc}	53.67	9.05^{b}	3.50^{b}	1.1	448	248.33^{c}	1.8^{b}

T2 - 1000 kg/ha	145.67[ab]	64.26	15.66[a]	4.21[b]	1.6	480	280.00[bc]	3.20[ab]
T3 - 2000 kg/ha	140.05[b]	59.64	14.90[ab]	4.25[a]	1.4	600	285.00[b]	3.70[a]
T4 - 3000 kg/ha	48.11[a]	69.36	15.39[a]	4.18[a]	2.2	650	301.67[a]	4.07[a]
T5 - 90-60-30 NPK	147.68[a]	67.19	15.55[a]	4.19[a]	2.0	625	293.33[a]	3.93[a]

Increasing the rates of application of water hyacinth also increased the plant height of corn plants as observed in the different treatments. The observation was especially noted on its 30 days after planting and on the 90 days after planting of corn plants. The result conforms with the findings that water hyacinth is high in organic matter content which is capable of supplying complete nutrients needed by the plants and gives long-lasting nourishment to plants. (GIDI, Pigcawayan, North Cotabato, 2012). Further, according to (Osoro et al. 2014), improvement of soil quality after application of weed compost often leads to increase of growth and yield of crops and that the application of water hyacinth as compost also improves the growth of the corn plants. (Suntoro et al. 2001) further stressed out that water hyacinth as another alternative for compost material and such dry matter weed contains 2.3% nitrogen which supplies and improves the growth of plants.

Ear height of corn (cm)

Ear height of corn as influenced by the different rates of water hyacinth organic fertilizer was presented in Table 2. Results show that treatment 4 got the highest mean of 69.36 cm, with 3,000 kg/ha application of water hyacinth followed by treatments 5 (Complete fertilizer application of 90-60-30), treatment 2 (1,000 kg/ha of water hyacinth), treatment 3 (2,000 kg/ha of water hyacinth), and treatment 1 (control or no application of fertilizer) with a means of 67.19 cm, 64.26 cm, 59.64 cm, and 53.67 cm, respectively. Corn ear height is the key that the corn breeder relies on until now, it's been extremely labor-intensive to collect properly.

An ANOVA showed no significant differences among the treatment means. This suggests that the use of GIDI organic fertilizer had no substantial effect on the ear height of corn in Rebuken, Sultan Kudarat, and Maguindanao, Philippines. This corroborates the findings of (Damtie et al. 2022), who reported in their study on the influence of water hyacinth on rural livelihoods that water hyacinth significantly reduced crop and livestock production among the affected households.

Table 2. Plant height (cm) of corn plants gathered during the different growth stages of the plants.

Treatment	30 DAP	60 DAP	90 DAP	Total	Mean
T1 (Control no application	120.00	122.50	130.61	373.11	124.37

of fertilizer)					
T2 (1000 kg/ha of water hyacinth)	139.68	148.80	153.53	437.01	145.67
T3 (2000 kg/ha of water hyacinth)	127.25	140.70	152.20	420.15	140.05
T4 (3000 kg/ha of water hyacinth)	141.76	146.92	155.65	420.33	148.11
T2 (Complete fertilizer 90-60-30)	142.34	145.50	155.20	443.04	147.68

Ear length (cm)

"Ear length" column under Table 1 presents the ear length of corn as affected by the application of GIDI organic fertilizer. Results showed that the longest ear length observed in treatment 2 with the application of 1,000 kg/ha of water hyacinth, with a mean of 15.66 cm. This was followed by treatments 5 (application of complete fertilizer) treatment 4 (with 3,000 kg/ha of water hyacinth), and treatment 3 (2,000 kg/ha of water hyacinth) with a mean values of 15.55 cm, 15.39 cm, and 14.90 cm respectively. The shortest ear length was noted in treatment one (1) untreated plots or plots with no application of fertilizer with a mean of 9.05 cm.

The ANOVA demonstrated highly significant differences among the treatment means. This suggests that the application of GIDI organic fertilizer or water hyacinth substantially impacts the ear length of corn. However, the results also further imply that lesser rates of GIDI or water hyacinth are still comparable with the plots applied with higher rates of GIDI organic fertilizer. The results confirmed the findings of Sahu (2012), who stated that water hyacinth is rich in macroelements that are beneficial for plant growth and development. In another study conducted by (Mashavira et al. 2015), they explored the effects of various application rates of water hyacinth compost on the growth attributes, yield, and heavy metal (lead, copper, nickel, and zinc) accumulation in tomatoes. They found a significant impact of water hyacinth compost on plant height, time to maturity, and yield. Furthermore, they suggested that using water hyacinth compost at a rate of 7 tons/ha could lead to an increased yield without subjecting consumers to the risk of heavy metal toxicity.

The results also suggest that utilizing water hyacinth as an organic fertilizer for corn provides crucial macronutrients such as Phosphorus, Nitrogen, and Potassium, all of which are essential elements for plant nutrition (Gunnarsson and Petersen 2007). This supports the research of (Begum et al. 2021), who in their study on the potential of water hyacinth compost, concluded that as an organic source, water hyacinth contributes significantly to the build-up of soil organic matter, which subsequently enriches the soil's physical, chemical, and biological proper-

ties. They further emphasized that water hyacinth compost appears to be far better than animal manures in improving soil characteristics. In terms of plant growth parameters like germination percentage, leaf count, leaf area index, plant height, and shoot and root length, among others, water hyacinth compost demonstrated remarkable effects. They also suggested that with proper management, water hyacinth compost could be an alternative to inorganic nutrient sources in the future.

Ear diameter (cm)

"Ear diameter" column under Table 1 shows the ear diameter of corn taken at harvest time in centimeters as influenced by the application of different rates of GIDI organic fertilizer at Rebuken, Sultan Kudarat, Maguindanao, Philippines. Treatment 3 with the application of 2,000 kg/ha of water hyacinth got the highest mean of 4.25 cm followed by treatment 2 (with 1,000 kg/ha) of water hyacinth, treatment 5 (with the application of complete fertilizer) or the recommended from the locale and treatment 4 (3,000 kg/ha of water hyacinth) with a mean value of 4.21 cm, 4. 19 cm, and 4.18 cm respectively. The smallest diameter was observed from the untreated plots or with no application of fertilizer. Furthermore, water hyacinth compost appears to be far superior to animal manures in terms of improving soil properties. As a result, water hyacinth compost has a spectacular effect on plant agronomic growth parameters like germination percentage, number of leaves, leaf area index, plant height, length of shoot and root, root: shoot ratio, biomass content, and yield parameters.

The ANOVA revealed a highly significant result on corn ear diameter as influenced by the application of different rates of water hyacinth at Sultan Kudarat, Maguindanao condition, Philippines. The result implied that the application of GIDI organic fertilizer or water hyacinth greatly influenced the ear diameter of corn at 1 % level of significance. Water hyacinth is an organic fertilizer composed of various minerals and nutrients which were well absorbed by the plants GIDI, 2012, Pigcawayan, North Cotabato.

Number of ears per corn plant

Observations regarding the number of ears per corn plant are detailed in Table 1. The study's findings show that treatment 1, which involved no application of fertilizer, yielded the fewest number of corn ears per plant, with an average of 1.1 ears. This was followed by treatment 3, which applied 2,000 kg/ha of water hyacinth, resulting in an average of 1.4 ears. Treatment 2, using 1,000 kg/ha of water hyacinth, produced an average of 1.6 ears, and treatment 5, with the application of NPK complete fertilizer, yielded 2.0 ears on average. The highest number of corn ears per plant was observed in treatment 4, which applied 3,000 kg/ha of water hyacinth, resulting in an average of 2.2 corn ears.

The ANOVA analysis indicated no significant impact on the count of corn ears per plant due to varying applications of water hyacinth. Irrespective of the water hyacinth rates used, the number of corn ears, collected a week before harvest, remained unaffected. According to a study by Liliane and Mutengwa (2020) crop yield is influenced by several factors that are grouped in three basic categories known as technological (agricultural practices, managerial decision, etc.), biological (diseases, insects, pests, weeds) and environmental (climatic condition, soil fertility, topography, water quality, etc.). Liliane and Mutengwa (2020) also added that organic crop production is one of the alternative agricultural practices promoted for the reduction of environmental pollution. Maintenance of soil organic matter (SOM) has received considerable attention, but its relationship with yield is contested be-

cause of local-scale differences in soils, climate, and farming systems. Thus, relationship between these factors should be properly quantified and proper soil management strategies should be ensured to yield sustainable crop production. The study's findings revealed that while treatments with higher rates of water hyacinth produced slightly more corn ears, they were still comparable to treatments with no application and treatments with inorganic fertilizer. And the treatments used 1,000 kg/ha water hyacinth.

Number of kernels per ear

Corn kernels are, in fact, the fruits of the corn plant. As presented under the column "Number of Ears per plant" in Table 2, the count of kernels per ear varies with different treatments. The treatment with no water hyacinth application resulted in the least kernel count, averaging only 448 kernels per ear. The study further indicated that escalating the water hyacinth application rates to 1,000 kg/ha, 2,000 kg/ha, and 3,000 kg/ha also elevated the kernel count per corn ear. Specifically, the averages were 480 kernels, 600 kernels, and 650 kernels per ear, respectively. These findings suggest that the use of water hyacinth as compost enhances soil quality, which in turn promotes growth and yield in corn plants (Suntoro et al. 2001).

The ANOVA revealed a highly significant result at 1% levels of significance which means that the application of water hyacinth on corn plants really influenced the number of kernels per corn ear at harvesting time. Thus, water hyacinth as dry matter contains 22.99% protein, 0.14% Calcium, 0.6% Phosphorus, 2.3% Nitrogen and 4.2% ash 1.5% which adds nutrient to soil and improve the growth and performance of the crop (Suntoro et al. 2001).

Thousand seed weight (g/plot)

Table 1 outlines the weights of one thousand seeds from different treatments. The data revealed that the highest average seed weight of 301.67 grams was recorded from treatment 4, which used 3,000 kg/ha of water hyacinth. Following closely were treatments 5 (utilizing a complete or locale recommended fertilizer), 3 (using 2,000 kg/ha of water hyacinth), and 2 (employing 1,000 kg/ha of water hyacinth), which had mean weights of 293.33 grams, 285.00 grams, and 280.00 grams, respectively. However, it's worth noting that the heaviest weight, surprisingly, came from untreated plots (without any application of water hyacinth), but the mean was substantially lower at only 248.33 grams.

The ANOVA revealed a result at 5% levels of significance. The result implies that the application of different rates of GIDI organic fertilizer (water hyacinth) greatly influenced the thousand seed weight of corn plants planted at Rebuken, Sultan Kudarat, Maguindanao, Philippines. This corroborates the notion of Talkah (2015) in his study of the effect of organic fertilizer water hyacinth on the growth and production plant taro that organic fertilizer water hyacinths have very significant effect on the variable observation (plant height, number of leaves, leaf area) at the age of 30, 60, 90 days after planting, and on the average weight of fresh taro. Talkah (2015) even suspected that the water hyacinth fertilizer greatly affects soil fertility, and that the nutrient content in manure water hyacinth is very helpful in plant growth and development, so that plant growth is better and faster. Talkah (2015) also pointed out that the influence of macro and micro nutrients contained in fertilizer plants and water hyacinth showed better growth and fertility. According to Hadjowigeno as cited by Talkah (2015), organic fertilizer can increase the levels of nutrients N, P and K in the soil and it can also improve soil physical characteristics and present potential for microbial development in the soil.

Grain yield (tons/ha)

The data displayed in the tables show a significant result regarding the influence of varying amounts of GIDI organic fertilizer on corn's grain yield (refer to "Grain Yield (tons/ha)" in Table 2). It's notable that the highest grain yield was seen in treatment 4, using 3,000 kg/ha of water hyacinth, with an average yield of 4.07 tons/ha. This was followed by treatment 5 (using complete water hyacinth fertilizer), treatment 3 (using 2,000 kg/ha of water hyacinth), and treatment 2 (using 1,000 kg/ha of water hyacinth), with average yields of 3.93 tons/ha, 3.70 tons/ha, and 3.20 tons/ha, respectively. Conversely, the untreated plots, which did not apply any water hyacinth, resulted in the lowest yield with a mean of 1.8 tons/ha. It was noticeably evident that an increase in the application rates of water hyacinth correspondingly led to an increase in the grain yield of corn, measured in kg per plot.

Statistical ANOVA revealed a highly significant result. The results suggest that the application of varying amounts of GIDI organic fertilizer significantly influenced corn's grain yield at the 1% significance level in Rebuken, Sultan Kudarat, and Maguindanao. This corroborates Talkah's (2015) research, which revealed notable differences between non-organic and organic fertilization, with the latter showing a higher propensity to produce more taro fresh weight. This indicates that using water hyacinth manure as a fertilizer can boost the yield of taro. The explanation behind this could be that the composted organic fertilizer from water hyacinth is rich in organic materials and nutrients, thereby enhancing the soil's physical, chemical, and biological characteristics.

The findings further suggest that the use of water hyacinth on corn yield has a positive and significant impact on the yield attributes of corn (*Zea maize L.*,) as noted by Gunnarson et al. (2007). Rakotoarisoa et al. (2020) found out in their study of organic fertilizer and soil amendment from the invasive water hyacinth that water hyacinth compost is more beneficial for plant growth than commonly used fertilizers. They further concluded that water hyacinth compost is suitable for improving vegetable field soil structure and fertility and that it has the potential to substitute or complement NPK and cow dung in the Alaotra region. Lata and Dubey (2013) claimed that the incorporation of water hyacinth into the soil crop system increases the performance yield of the crop plant (*Coriandrum sativum*). They also claimed that water hyacinth manure is more effective for the growth and yield of the test plant in all combinations. The use of compost fertilizer offers benefits beyond enhancing soil structure and fertility; it also boosts crop yields.

The study further states that due to the characteristics of the corn plant's root system, the primary compost application should be around 7 tons/ha. The experiment involved lower rates of water hyacinth compost application to corn plants such as 1,000 kg/ha, 2,000 kg/ha, and 3,000 kg/ha, leading to the observed results. Compost is rich in organic nutrients that are readily absorbable by plants, fostering comprehensive nutrient uptake. It enhances the quality and structure of soil, thus ensuring that the corn's aerial root system can breathe effectively. Compost also aids in moisture retention by preventing excessive soil compaction during the growth season.

Conclusion

This study concludes that the application of different rates of GIDI organic fertilizer or water hyacinth significantly influenced the agronomic and yield parameters of corn at Rebuken, Sultan Kudarat, Maguindanao, Philippines. The study further concludes that escalating the usage rates of water hyacinth compost positively and significantly influences both the thousand seed weight and grain yield per plot in kilograms. Water hyacinth improves soil

quality, leading to enhanced growth of corn plants as seen in plant height, thousand seed weight, and grain yield per plot in kilograms. As shown in columns "Thousand Seed Weight (g/plot)" and "Grain Yield (tons/ha)" in Table 2, an increase in the application rates of water hyacinth as an organic fertilizer correlates with a linear increase in both the thousand seed weight and grain yield of corn plants. Water hyacinth, which is locally available in large quantities especially in Liguasan Marsh in Rio Grande de Mindanao, Philippines, can be composted in order to prepare an organic fertilizer and this is effectively used as an organic soil amendment which adds fertility to the soil and improves the growth of the plants. Further, it restores the soil and increases the corn production in terms of its grain yield in tons per hectare.

Water hyacinth is long-lasting nourishment to plants, enhanced with beneficial microbes and enzymes which are capable of supplying complete nutrients needed by the plants, thus making the soil fertile yielding better for crops. Moreover, the use of water hyacinth as an organic fertilizer is eco-friendly, easily accessible, and is a type of aquatic plant widely grown in the Liguasan marsh, Rio Grande de Mindanao. While water hyacinth can cause issues like blocking waterways and limiting boat traffic, recreation, flood control, and wildlife use, many local residents lack knowledge about its potential use and value as an organic fertilizer for various agricultural crops. This is especially significant considering the high costs associated with other farm inputs, such as synthetic or inorganic fertilizers, which can have substantial impacts on our crops, environment, and human health.

Hence, this study recommends conducting further research in different locations to validate and expand on these findings. Considering that water hyacinths are often seen as destructive weeds, blocking bridges and impeding water flow in some areas, their usefulness as a potent source of organic fertilizer is significant. They are rich in macro- and micro-nutrients necessary for plant growth and development, and they also enhance soil fertility. Moreover, the proponent of this study is also aware that water hyacinths could have further utility due to their nutritional value. The health benefits of water hyacinth may be derived from various parts of the plant, such as the stem, leaves, and beans. In the future, the use of water hyacinth as an organic fertilizer will be explored more thoroughly. Additionally, studies will also consider other parts of the water hyacinth plant, including the stem, beans, and roots, for their potential benefits.

Author Contributions: The study conceptualization and design, data collection, analysis and interpretation of results, and manuscript writing are all solely the responsibility of the author.

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