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Effectiveness of Quality Bird Manure and Rice Straw Mulch on Glutinous Corn Plants' Growth And Production

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ABSTRACT

The study aims to determine the effectiveness of the application of quail manure and rice straw mulch on glutinous corn (Zea mays var. ceratina) growth and production and the interaction between the effectiveness of quail manure and rice straw mulch. This study used a factorial randomized block design (RBD) consisting of 2 factors with 16 combinations and 32 treatment plots. The first factor was applying quail manure (L) which consisted of 4 levels, 0 kg/plot, 0.85 kg/plot, 1.70 kg/plot, and 2.55 kg/plot. The second factor was the provision of rice straw mulch (Z) which consisted of 4 levels, 0 kg/plot, 1 kg/plot, 2 kg/plot, and 3 kg/plot. Parameters observed were plant height (cm), total leaf (strands), cobs weight per sample (g), cobs weight per plot (g), cob length (cm), and the number of rows (rows). The results showed that the application of quail manure and rice straw mulch affected the parameters of plant height (cm), total leaf (strands), cob weight per sample (g), cob weight per plot (g), cob length (cm) and the number of rows (lines). The interaction of giving quail manure and rice straw mulch did not affect the parameters of plant height (cm), total leaf (strands), cob weight per sample (g), cob weight per plot (g), cob length (cm) and the number of lines (row). The best treatment was found in quail manure and rice straw mulch, 2.55 kg/plot and 3 kg/plot.

Keywords: *Design, Parameters, affect, Sample, Real*

1. INTRODUCTION

Glutinous corn (Zea mays var. ceratina) is a corn with the potential to be developed by farmers as a source of food diversification and industrial materials. Glutinous corn seeds contain protein, fat, fiber, and carbohydrates, which are adequate for development as food ingredients (Suarni, 2013). Glutinous corn has a special character; starch in the form of 100% amylopectin has a sweet, fluffier taste and an attractive appearance that other corn does not have (Maripadang, 2020). Glutinous corn is popular for consumption in fresh and processed products. So far, farmers use seeds from previous plantings that are non-certified, so the quality is low (Yusran and Maemunah, 2011).

Based on Badan Pusat Statistik (BPS) data in North Sumatra, in 2020, corn production in North Sumatra was 1,965 444,00 tons. Increased production began in 2018, with a yield of 1,710,784.96 tons. In 2019 corn production continued the increasing trend with a production achievement of 1,960,424.00 tons. At its peak in 2020, corn production reached 1,965, 444,00 tons (BPS Sumatera Utara, 2020).

Glutinous corn is a local corn with low yield potential, less than 2 tons/ha; cobs are small with a diameter of 10-11 mm and are very sensitive to downy mildew. The constraints faced in producing glutinous corn are the continuous planting of local varieties, inappropriate dosage fertilization, and nonoptimal cultivation techniques. Not to mention that the uncertain climate change conditions in Indonesia will severely disrupt seasonal crops, especially corn (Tengah *et al.*, 2016).

As one of the efforts to promote integrated agriculture, the utilization of quail manure is carried out. The protein or nitrogen content of quail manure is quite high, and quail manure can be used as organic fertilizer. (Wuryadi, 2011). Quail manure organic fertilizer has a high nutrient content, easy to decompose, and is easily absorbed, so it functions to stimulate plant growth. Quail droppings have an N content of 0.061 - 3.19%, a P content of 0.209 - 1.37%, and a K2O content of 3.133% (Agustin et al., 2017). Previous research conducted by Irianti et al. (2022) has not shown good results because organic fertilizer from quail droppings has not significantly affected the growth and yield of sweet corn plants. However, the application of 50 g/polybag of quail manure significantly affected the height, amount, width, and wet weight of lettuce plants at 35 DAP.

Applying mulch is an effort to suppress weed growth, modify the water balance, temperature, and humidity of the soil and create suitable conditions for plants so plants can develop properly (Damayanti et al., 2013). Organic mulch is a mulch that comes from plants or agricultural waste. Mulch derived from plant residues has many advantages, including improving fertility, structure, and groundwater reserves, and is available quite a lot because farmers don't use it. This affects aeration, and the soil's ability to absorb water will improve.

This rice straw has many functions, especially to maintain soil productivity and as a weed control,

reducing soil water evaporation. Thus, applying mulch to the land can indirectly improve land productivity (Prasetyo et al., 2014). Rice straw mulch with a thickness of 6 cm reduced the total dry weight of weeds from 16.73 g to 61.70 g (268.79%) (Nugraha et al., 2017). Limonu et al. (2021) stated that organic mulch of rice straw affected plant height 4 and 6 WAP, total leaf 4 and 6 WAP, cobs length, and cobs weight.

2. MATERIALS AND METHODS

This research was conducted at Km 19 Jalan Ikan Bandeng No. 160 Highland Village, East Binjai District, Binjai Municipality, North Sumatra. With an altitude of ± 28 meters above sea level, This research will be carried out from March to May 2022. The materials used in this research are sticky rice/Pulut corn seeds, quail manure fertilizer, and rice straw. The tools used in this glutinous corn plant research are hoes, machetes, water sprinklers, buckets, bamboo, tape measure, scales, plywood, markers, paper, pens, and wood.

The method used in this study was using a factorial randomized block design (RBD) consisting of 2 treatment factors, namely quail manure (0 kg/plot, 0.85 kg/plot, 1.70 kg/plot, and 2.55 kg/plot).) and rice straw mulch (0 kg/plot, 1 kg/plot, 2 kg/plot, and 3 kg/plot) with 16 treatment combinations and 2 replications to obtain a total of 32 treatment plots.

The research activities carried out included: land preparation, making plots, applying quail manure, applying rice straw mulch, planting, maintaining, determining sample plants, and harvesting (Figure 1). Parameters observed were plant height, number of leaves, the cobs weight per sample, the cobs weight per plot, length of cobs per sample, and number of lines per sample.

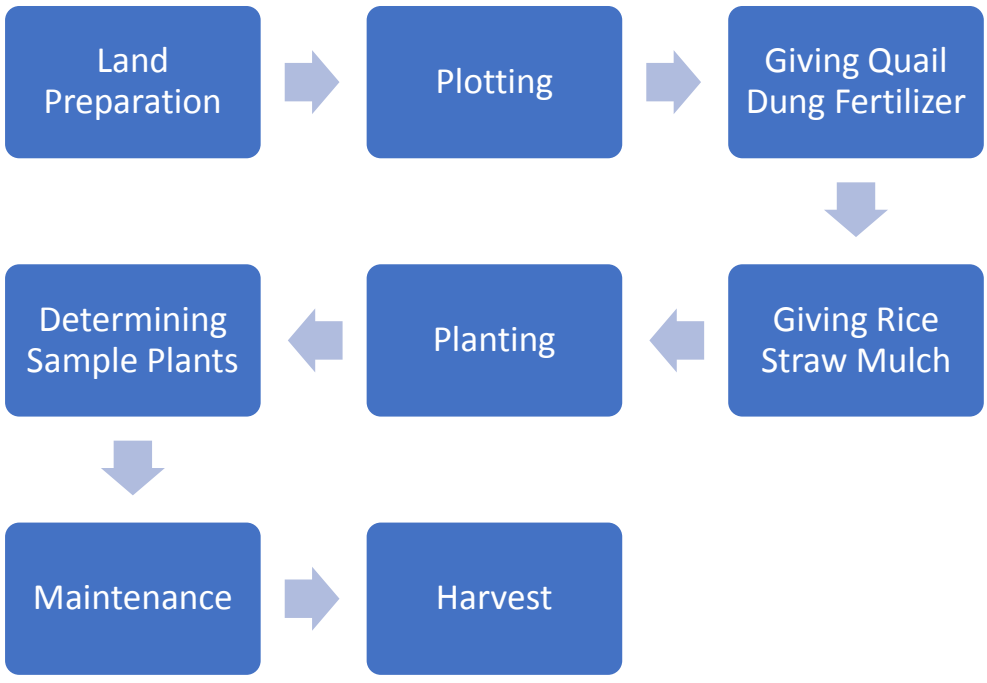

Figure 1. Research Implementation Flowchart

3. RESULT AND DISCUSSION

Plant Height (cm)

The analysis of variance showed that the application of quail manure and rice straw mulch had a very significant effect at the age of 5 MST, which can be seen in Table 1.

Table 1. Mean Plant Height (cm) of Glutinous Corn Due to the Application of Quail Manure and Rice Straw Mulch aged 3, 4, and 5 Weeks After Planting (MST).

Treatment	Plant Height (cm)		
	3 MST	4 MST	5 MST
Quail Manure			
00 kg/plot	27.19a	146.81a	177.00b
0.85 kg/plot	28.59a	151.72a	191.41ab
1.70 kg/plot	29.41a	151.88a	192.16ab
2.55 kg/plot	30.56a	160.91a	218.47a
Rice Straw Mulch			
0 kg/plot	27.50a	147.84a	186.06b
1 kg/plot	28.06a	150.69a	187.06ab
2 kg/plot	29.56a	154.63a	193.25ab
3 kg/plot	30.63a	158.16a	212.66a

Note: Numbers in the same column followed by letters that are not the same mean that they are highly significant at the 5% level.

Table 1 shows that the effectiveness of applying quail manure 5 weeks after planting affects the height of the glutinous corn plants. The highest plant height can be seen in the treatment of 2.55 kg/plot, 218.47 cm, which is significantly different from the 1.70 kg treatment/plot, namely 192.16 cm and 0.85 kg/plot:191.41 cm, but very significantly different from the 0.00 kg/plot treatment, 177.00 cm as the lowest plant height. This is because quail manure contains organic matter needed for plant growth and development, especially in increasing plant height. This result conforms with Utami et al. (2018) that organic matter is sometimes the most important part of fertilizer. Organic matter consists of the remains of plants and animals which have been partially weathered or decomposed. According to Kusuma (2012), the application of quail manure saves some of the organic content needed for plant development and has a high enough nitrogen content to support plant growth.

The effectiveness of rice straw mulch 5 weeks after planting affected the height of the glutinous corn plants, where the highest plant height could be seen in the 3 kg/plot treatment. It was 212.66 cm which was not significantly different from the 2 kg/plot treatment, which was 193.25 cm, 1 kg/plot is 187.06 cm, and 0 kg/plot is 186.06 cm. This treatment can provide an optimum effect in reducing weed growth so that the main plants experience significant growth.

Straw mulch is more profitable because it is environmentally friendly. With increasing time, it can function as organic fertilizer; the straw will experience

weathering to add nutrients to the glutinous corn plant. Giving rice straw mulch can increase the average plant height in glutinous corn plants compared to without mulching (Bilalis *et al.,* 2016).

The results of the data analysis showed that the application of quail manure and rice straw mulch was significantly different at the age of 5 MST, which can be seen in Table 2.

Total leaf (strands)

Table 2. Average Number of Leaves (strands) of Glutinous Corn Plants Due to Quail Manure Fertilizer and Rice Straw Mulch Age 3, 4, and 5 Weeks After Planting (MST).

Treatment	Total Leaf strands)		
	3 MST	4 MST	5 MST
Quail Manure			
0.00 kg/plot	8.56a	10.78a	11.53b
0.85 kg/plot	8.72a	10.81a	11.66b
1.70 kg/plot	8.66a	10.84a	11.78b
2.55 kg/plot	8.88a	11.41a	13.59a
Rice Straw Mulch			
0 kg/plot	8.53a	10.78a	11.69b
1 kg/plot	8.53a	10.91a	11.69b
2 kg/plot	8.78a	11.03a	11.75ab
3 kg/plot	8.97a	11.13a	13.44a

Note: Numbers in the same column followed by letters that are not the same are significantly different at the 5% level.

Table 2 can show that the effectiveness of applying quail manure at the age of 5 weeks after planting affected the number of glutinous corn leaves, where the highest total leaf could be seen in the 2.55 kg/plot treatment, 13.59 strands, which was significantly different from the 1.70 treatment. Kg/plot, namely 11.78 leaves, 0.85 kg/plot, 11.66 leaves, 0 kg/plot, and 11.53 leaves, is the lowest number of leaves. Susanto (2015) states that plants need Nitrogen for the growth process, where Nitrogen forms the structure of chlorophyll; nitrogen will affect the green color of the leaves. When plants don't get enough nitrogen, the green color fades and eventually turns yellow. The main role of Nitrogen for plants is to stimulate overall plant growth, especially leaves, stems, and branches.

Quail manure has a fairly high nitrogen content, and the availability of organic elements can increase plant growth and development. The availability of appropriate organic elements also increases the development and growth rate, especially the number of leaves. According to Sumendap (2019), the role of organic matter can provide sufficient nutrients for plants during the growth period. The organic matter given can encourage the availability of nitrogen nutrients which affect the number of leaves.

The application of rice straw mulch at the age of 5 weeks after planting affected total leaf of the glutinous corn plant, which the highest leaf could be seen in the 3 kg/plot treatment of 13.44 strands. It was not significantly different from the 2 kg/plot treatment, namely

11.75 strands, 1 kg/plot is 11.69 strands, and 0 kg/plot is 11.69 strands. This is because this treatment can provide an optimum effect in reducing weed growth so that the main plants experience significant growth. This is reinforced by Damayanti (2013), who said that mulching using organic matter could increase plant height, leaf area, number of leaves, total crop yield, fresh fruit weight of plants, and fruit diameter.

Besides reducing water loss and temperature, straw can also maintain conditions around the plants so that soil moisture is higher. In addition, applying organic mulch to the soil will have a good effect on improving soil physical properties, increasing soil water absorption, increasing soil humus levels, and suppressing weed growth which can become competitors for cultivated plants in absorbing nutrients (Limonu et al., 2021).

Cob Weight Per Sample (g)

Based on the results of the analysis shows that the application of quail manure and rice straw mulch is very significantly different, as can be seen in Table 3.

Table 3. Average Cob Weight per Sample (g) of Glutinous Corn Plants Due to Quail Manure and Rice Straw Mulch

Treatment	Average
Quail Manure	
0.00 kg/plot	128.03b
0.85 kg/plot	180.94b
1.70 kg/plot	183.63b
2.55 kg/plot	220.16a
Rice Straw Mulch	
0 kg/plot	164.06b
1 kg/plot	171.84b
2 kg/plot	177.53b
3 kg/plot	199.31a

Note: Numbers in the same column followed by the same letter are not significantly different at the 5% level

Table 3 shows that the effectiveness of applying quail manure at harvest affects the cobs weight per sample of glutinous corn plants, which the highest cob weight can be seen in the treatment of 2.55 kg/plot, namely 220.16 g. It is significantly different from the 1.70 kg treatment/plot is 183.63 g, 0.85 kg/plot 180.94 g, and 0 kg/plot 128.03 g, as the lowest cob weight. Syarief (2015) said that sufficiently available nutrients would spur plant height, stimulate root system growth, increase production yields, and increase leaf growth to enhance the photosynthesis process. Sutedjo and Kartasapoetra (2012) explained that providing sufficient K will help the process of absorption of N and P nutrients. Thus high production can be achieved.

Based on the provision of rice straw mulch at harvest affected the weight of the cobs per sample of

glutinous corn plants, where the highest cob weight could be seen in the 3 kg/plot treatment, which was 199.31 g which was significantly different from the 2 kg/plot treatment which was 177.53 g, 1 kg/plot is 171.84 g and 0 kg/plot is 164.06 g. Applying rice straw mulch will significantly increase the available phosphorus and potassium in the soil (Sonsteby et al., 2016). The results of the decomposition of organic matter can increase the elements N, P, and K, which can increase carbohydrates in the photosynthetic process because the N element is to form chlorophyll and which functions to absorb sunlight and as a place for the photosynthesis process to take place. At the same time, the element K increases CO2 absorption concerning the opening and closing of stomata leaves then these carbohydrates after the plant enters the reproductive phase are stored in the fruit (Harjadi and Setyati, 2016).

Bustami (2013) states that soil nutrient availability occurs not only due to increased activity of soil microorganisms in decomposing organic matter, but also through suppression of soil nutrient leaching from covering the soil surface. The availability of nutrients under mulch occurs because mulch prevents excessive infiltration of rainwater and reduces the evaporation of water from the soil.

Cob Weight Per Plot (g)

The data analysis results show that the application of quail manure and rice straw mulch has a very significant effect on can be seen in Table 4.

Table 4. Average Cob Weight per Plot (g) of Glutinous Corn Plants Due to Quail Manure and Rice Straw Mulch

Treatment	Average
Quail Manure	
0.00 kg/plot	767.85c
0.85 kg/plot	1084.13b
1.70 kg/plot	1122.38ab
2.55 kg/plot	1339.88a
Rice Straw Mulch	
0 kg/plot	985.21b
1 kg/plot	1029.50ab
2 kg/plot	1066.48b
3 kg/plot	1233.04a

Note: Numbers in the same column followed by the same letter are not significantly different at the 5% level

Table 4 can be explained how the effectiveness of applying quail manure at harvest affects the cobs weight per plot of glutinous corn plants, which the highest cob weight can be seen in the treatment of 2.55 kg/plot, namely 1339 g. It is significantly different from the treatment of 1.70 kg/ plot which is 1122.28 g, 0.85 kg/plot which is 1089.13 g and is very significantly different from 0 kg/plot which is 767.85 g as the lowest cob weight per plot. According to Khairiyah et al. (2017), the availability of nutrients is inseparable from filling the seeds. Nutrients that are

absorbed will be accumulated in the leaves to become proteins that form seeds. The accumulation of metabolic products in the formation of seeds will increase so that the seeds formed have the maximum size and weight; this occurs when the nutrient needs are met, which causes the metabolism to run optimally. Besides that, according to Puspadewi et al. (2016), the availability of nutrients needed by plants will increase the rate of photosynthesis and increase the assimilation results stacked in fruits and seeds. If the amount of accumulation of assimilates.

The effectiveness of giving rice straw mulch at harvest affects cobs weight per plot of glutinous corn plants, which the highest cob weight can be seen in the 3 kg/plot treatment of 1233.04 g. It is significantly different from the 2 kg/plot treatment, which is 1066.48 g. 1 kg/plot is 1029.50 g and is very significantly different from the 0 kg/plot treatment, which is 985.21 g. From these data, it can be explained that rice straw mulch or organic matter affects weed growth, affecting the total dry weight of weeds. This was also stated by Mahajan et al. (2007), who said that mulch has proven beneficial in environmental changes, soil temperature, reduced evaporation, weed competition, soil compaction, and erosion. So that the main plants can grow and reproduce well. The results of research confirm this by Akbar et al. (2014), who stated that mulch treatment was very effective in suppressing weed growth so that the formation of plant leaves could run in balance.

Cob Length Per Sample (cm)

The analysis of variance showed that the application of quail manure and rice straw mulch had a very significant effect, as seen in Table 5.

Table 5. Average Cob Length (cm) of Glutinous Corn Plants Due to Quail Manure and Rice Straw Mulch Application.

Treatment	Average
Quail Manure	
0.00 kg/plot	15.94b
0.85 kg/plot	16.98b
1.70 kg/plot	17.77b
2.55 kg/plot	18.30a
Rice Straw Mulch	
0 kg/plot	16.62b
1 kg/plot	16.71b
2 kg/plot	17.12b
3 kg/plot	18.53a

Note: Numbers in the same column followed by the same letter are not significantly different at the 5% level

Table 5 explains how the effectiveness of applying quail manure at harvest affects cob length per sample of glutinous corn plants; the highest cob length can be seen in the treatment of 2.55 kg/plot, namely 18.30 cm. It is significantly

different from the 1.70 treatment kg/plot is 17.77 cm, 0.85 kg/plot is 16.98 cm, and very significantly different from 0 kg/plot, which is 15.94 cm as the lowest cob length per sample. In this case, the energy required to form glutinous corn kernels is increasing. Element N is very influential because it is an important element for cell division which will support plant growth by increasing in size and volume (Puspadewi et al.2016).

It was also explained that the effectiveness of giving rice straw mulch at harvest affected cob length per sample of glutinous corn plants, which was the highest cob length that could be seen in the 3 kg/plot treatment, which was 18.53 cm. It was significantly different from the 2 kg/plot treatment, which was 17 .12 cm, 1 kg/plot is 16.71 cm, and 0 kg/plot is 16.62 cm. Weeds or staple crops have the same basic needs for growth and development: nutrients, water, light, space to grow, and CO2. If the germination of weed seeds is earlier than the germination of corn seeds, it can affect the growth and yield of corn plants. According to Sukman and Jacob (2002), competition at the beginning of growth will reduce total yields, while the disturbance of competition before harvest affects the quality of the harvest.

Limonu et al. (2021) stated that the results of observing the length of the cob showed that the treatment of fertilizer application techniques both in an array and in single strokes had not made a significant difference; this was indicated by the average number of leaves in each treatment which still looked the same. So that in this study, it cannot be concluded which fertilizer application technique is more likely to increase cob length production.

Total Lines Per Sample (lines)

The analysis of variance showed that the application of quail manure and rice straw mulch had a very significant effect on can be seen in Table 6.

Table 6. Average Number of Rows (rows) of Glutinous Corn Plants Due to the Application of Burunog Quail Manure and Rice Straw Mulch

Treatment	Average
Quail Manure	
0.00 kg/plot	10.69c
0.85 kg/plot	11.34b
1.70 kg/plot	11.94a
2.55 kg/plot	12.47a
Rice Straw Mulch	
0 kg/plot	11.25b
1 kg/plot	11.50b
2 kg/plot	11.56b
3 kg/plot	12.13a

Note: Numbers in the same column followed by letters that are not the same are significantly different at the 5% level

Table 6. It can be explained that the effectiveness of applying quail manure at harvest affects the total rows per sample of glutinous corn plants,

which the highest number of rows can be seen in the treatment of 2.55 kg/plot, 12.47 rows. It is significantly different from the treatment 1.70 kg/plot, which is 11.94 lines, 0.85 kg/plot, 11.34 lines, and 0 kg/plot, 10.69 lines, as the lowest number of lines per sample. Budiman (2019) states that the availability of element P causes more photosynthate to be allocated to the fruit so that the size of the fruit becomes larger. Increasing the length of the glutinous corn cob allows the number of seeds to be formed on the glutinous corn cob.

It was also explained that the effectiveness of giving rice straw mulch at harvest affected the number of rows per sample of glutinous corn plants, which the highest number of rows could be seen in the 3 kg/plot treatment at 12.13 rows. It was significantly different from the 2 kg/plot treatment, 11 .56 lines, 1 kg/plot, 11.50 lines, and 0 kg/plot, 11.25 lines. It is suspected that applying organic matter and dry mulch can increase the ability of plants to absorb and provide N elements. With sufficient N levels, the growth of plant organs will be perfect, and the photosynthate formed will increase, which in turn supports plant production. Nasrullah et al. (2018) stated that Krinyuh has a nutrient content of 2.65% N, so it can be used as a potential source of nutrients to increase corn production and improve soil fertility.

The use of organic mulch, such as straw, will provide a good growth environment for plants because it can reduce evaporation, prevent excessive direct sunlight on the soil, and prevent soil moisture can be maintained. So that plants can absorb nutrients and water, so photosynthesis takes place properly, which can increase energy assimilation (Marliah et al., 2011).

4. CONCLUSION

The application of quail manure did not affect the observed parameters of plant height (cm) and the number of leaves (strands) at the age of 3 and 4 weeks after planting (MST) but affected the age of 5 weeks after planting (MST). The parameters of cob weight per sample (g), cob weight per plot (g), cob length per sample (cm), and the number of rows per sample (rows) affect the best treatment dose of 2.55 kg/plot.

The application of rice straw mulch did not affect the parameters of plant height (cm) and the number of leaves (strands) at 3 and 4 weeks after planting (MST) but affected on 5 weeks after planting (MST). The parameters of cob weight per sample (g), cob weight per plot (g), cob length per sample (cm), and the number of rows per sample (rows) affect the best treatment dose of 3 kg/plot.

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