IIAJ INTERNATIONAL INTEGRATED AGRICULTURAL JOURNAL
Volume 01 Number 02
November 2025
p-ISSN: 0000-0000
e-ISSN: 0000-0000

Response of Pulut Maize (Zea mays Ceratina) to Corn Cob Biochar as Soil Improver

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Abstract:
Pulut corn is one of the corn varieties consumed by Indonesians for its nutritional content. However, its production has declined due to suboptimal land conditions, such as water deficit and low organic matter content. This research was conducted in Kebonsari, Sumbersari Subdistrict, Jember District, from August to October 2024, on land at 100 meters above sea level with a temperature of 26-31°C, humidity of 88-90%, and rainfall of 6-20 mm/day. The study used a non-factorial Randomized Group Design (RAK) with six doses of corn cob biochar (0.8 kg/m2, 1.6 kg/m2, 2.4 kg/m2, 3.2 kg/m2, 4 kg.m2, and 4.8 kg/m2) and four replications. Variables observed included vegetative growth and yield of pulut corn plants, such as plant height, stem diameter, number of leaves, sweetness content, cob length and diameter, and fresh and dry weight. The results showed that the biochar dose of 1.6 kg/m² gave a very significant effect on fresh cob weight per sample (1.08 kg) and dry weight per sample (0.23 kg). Meanwhile, the dose of 0.8 kg/m² had a significant effect on fresh weight (2.60 kg) and dry weight per plot (1.91 kg). Biochar effectively improves soil structure, increases microorganisms, and supports the growth and production of pulut corn.

Keywords:
corn cob biochar, pulut corn, productivity

Article info:
Submitted:
26-06-2025
Revised:
03-11-2025
Accepted:
06-11-2025

INTRODUCTION

In Indonesia, maize is the second most important food after rice. Corn production in East Java province in 2024 decreased (BPS Indonesia, 2024). This decline is attributed to low productivity resulting from the excessive use of inorganic fertilizers, which alter the physical, biological, and chemical properties of the soil (Dewi et al., 2019).

To meet the demand for maize, increasing yields can be achieved by using organic fertilizers. One type of organic fertilizer that can be used is biochar. Biochar is produced from the remains of organic waste that has not burned completely or has been subjected to a limited oxygen supply (Lubis, 2019). Biochar is also an organic material that has soil-improving properties, one of which is particularly beneficial in dry land. Biochar added with the application of organic or inorganic fertilizers plays a role in improving soil fertility for plants (Yosephine et al., 2021). The selection of biochar raw materials is based on the abundant and untapped production of crop residues. Corn cob biochar is one of the factors that improves soil properties and increases the productivity of pulut corn plants.

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METHOD

This research was conducted from August to October 2024 on agricultural land located in Sumber Pak Neighborhood, Kebonsari Village, Sumbersari Subdistrict, Jember Regency, East Java Province, at an altitude of 160 meters above sea level, with an average temperature of 23°C and air humidity of around 95%. The research location is at coordinates -8.189495° South latitude and 113.714758° East longitude.

The tools used were hoes, sickles, paddles, timba, koret, sprayer, meter, digital scales, stationery, plastic packaging, worksheets, brix meter, banner, ajir, and kenco rope. and a 150 L drum. The materials used were pulut corn plants of the Arumba variety, biochar, NPK fertilizer, tetraniliprol active pesticide, copper oxide active fungicide, paracuat dichloride active herbicide, and firewood.

The design used in this study is a non-factorial Randomized Group Design (RAK), factor: biochar dose consists of 6 treatments, as follows: 0.8 kg/m2, 1.6 kg/m2, 2.4 kg/m2 (Peres et al, 2021), 3.2 kg/m2, 4.0 kg/m2, and 4.8 kg/m2. There were six treatment doses that were repeated four times, resulting in 24 experimental units.

Research activities were conducted in stages, beginning with biochar production, land preparation, and biochar application 2 weeks prior to planting. This was followed by planting, maintenance, and harvesting.

Observations were made on the production of pulut corn plants in the form of fresh weight of cobs per sample, dry weight of cobs per sample, fresh weight of cobs per plot, and dry weight of cobs per plot. All observation data were analyzed using analysis of variance (ANOVA). If there were significant differences among treatments, the 1% Tukey test was used; if there were significant differences among treatments, the 5% Tukey test was used. To determine the response of pulut corn to corn biochar.

RESULT

The results of this study are presented in Table 1.

Table 1. Recapitulation of Variety Analysis Results

No	Observation Variable	F count
1	Fresh Weight of Cobs Per Sample	4,65**
2	Dry Weight of Cobs Per Sample	5,22**
3	Fresh Weight of Cob Per Plot	3,00*
4	Dry Weight of Cob Per Plot	3,78*

Based on the results of the analysis of variance in the table above, it can be seen that the provision of corn cob biochar on sticky corn plants (Zea Mays Ceratina). Shows a very significantly different effect on the variable fresh weight of cob per sample and dry weight of cob per sample, and a significantly different effect on the variable fresh weight of cob per plot and dry weight of cob per plot.

Fresh Weight of Cobs Per Sample

The highest average fresh weight of cob per sample was found at a dose of 4.0 kg/m2 (1.24 kg), while a dose of 0.8 kg/m2 produced an average fresh weight of cob per sample (0.93 kg). This difference is caused by each plant having the same ability to absorb nutrients, but the nutrients

Volume 01 Number 02
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p-ISSN: 0000-0000
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present in each sample are different, depending on the area in which it was planted (Montolalu and Bili, 2023).

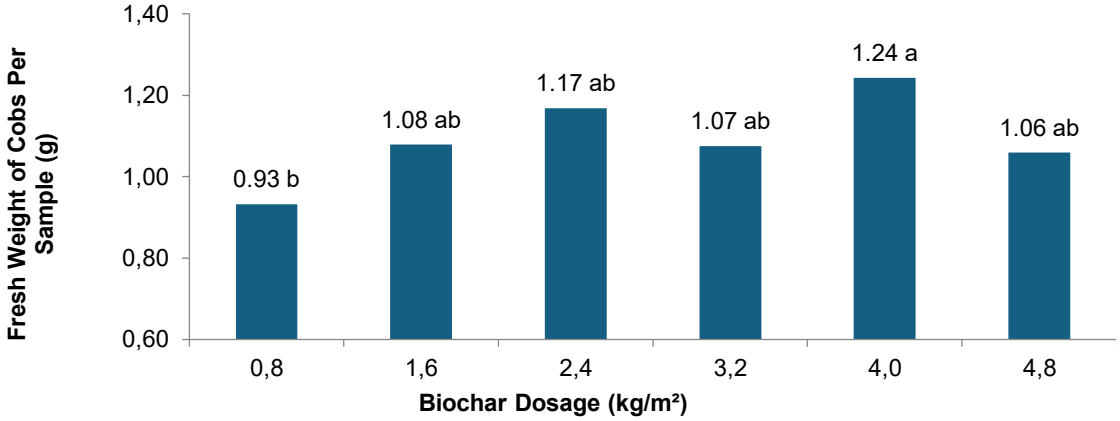

Figure 1. Fresh Weight of Cobs Per Sample

Dry Weight of Cobs Per Sample

The highest average fresh weight of cob per sample was found at a dose of 4.0 kg/m2 (0.34 kg), while a dose of 0.8 kg/m2 produced an average fresh weight of cob per sample (0.19 kg). These results indicate that the effect of biochar on production is not uniform. One of the factors affecting the yield difference is the amount of biochar applied. Biochar serves as a storage medium for essential nutrients, including nitrogen, phosphorus, and potassium, which are released gradually and can be absorbed by plants more efficiently (Agviolita et al., 2021).

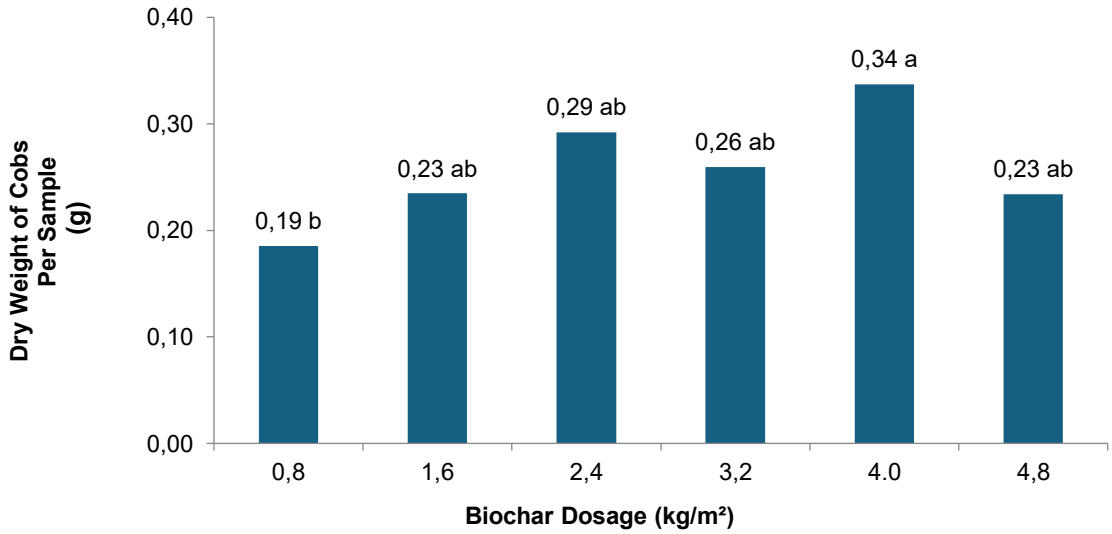

Figure 2. Dry Weight of Cobs Per Sample

Fresh Weight of Cob Per Plot

The highest average fresh weight of cobs per plot was observed at a dose of 0.8 kg/m2 (2.60 kg), while a dose of 3.2 kg/m2 produced an average fresh weight per plot (2.07 kg). This is due to various factors, including fertilizer and climate. Fertilizer affects the growth of pulut corn plants during the vegetative phase, where it is an essential nutrient, and climate is also a factor that influences the

Volume 01 Number 02
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p-ISSN: 0000-0000
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response to various doses of biochar. Biochar also plays a role in helping to retain water and nutrients in the soil, which are later absorbed slowly by pulut corn plants (Purwanto et al., 2022).

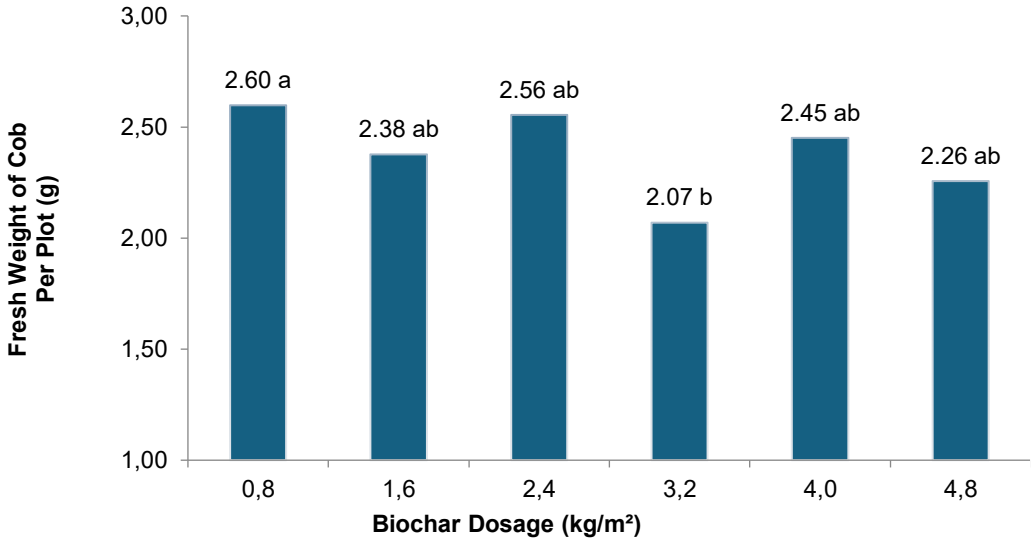

Figure 3. Fresh Weight of Cob Per Plot

Dry Weight of Cob Per Plot

The highest average fresh weight of cobs per plot was seen at a dose of 0.8 kg/m2 (1.91 kg), while a dose of 3.2 kg/m2 produced an average fresh weight per plot (1.44 kg). This is due to the combination and amount of biochar used, and can be influenced by other factors, such as environmental conditions. Biochar is capable of binding carbon, thereby improving soil health. Lack of water can affect cob weight and the ability of roots to absorb water (Dewi et al., 2019).

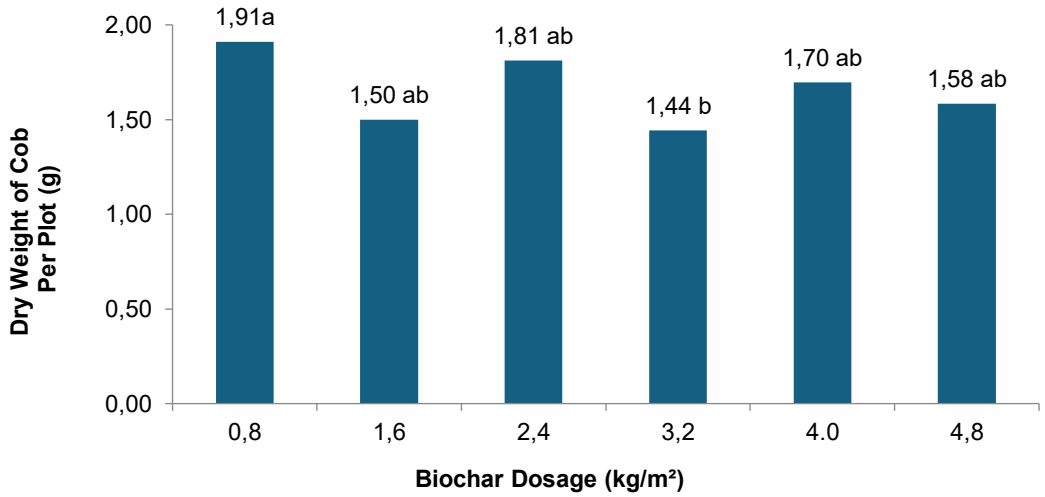

Figure 3. Dry Weight of Cob Per Plot

DISCUSSION

The results showed that the application of corn cob biochar as a soil conditioner increases the productivity of pulut corn plants. Affected in increasing the weight of fresh cobs per sample (1.08 kg)

Volume 01 Number 02
November 2025
p-ISSN: 0000-0000
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and dry weight per sample (0.23 kg) with a biochar dose of 1.6 kg/m2, while a biochar dose of 0.8 kg/m2 was able to increase the weight of fresh cobs per plot (2.60 kg) and the weight of dry cobs per plot (1.91 kg).

This is because the availability of water in the soil can help plants absorb nutrients (Nurshanti et al., 2019). The nutrients in the soil that plants need must be dissolved in water before they can be absorbed by the plant, then transported to all parts of the plant required for growth and production. Furthermore, the addition of biochar serves as a microbial habitat, enhancing and increasing soil fertility by creating a favorable environment for microbes (Tanjung et al., 2022).

CONCLUSION

The provision of biochar differs significantly in terms of fresh cob weight per sample (1.08 kg) and dry cob weight per sample (0.23 kg) with a biochar dose of 1.6 kg/m². In the parameters of fresh cob weight per plot, weighing (2.60 kg) and (1.91 kg) in dry weight per plot, with a biochar dose of 0.8 kg/m2. This is because biochar is rich in activated carbon, which functions to improve soil conditions and increase the activity of soil microorganisms.

The data obtained show that the provision of corn cob biochar has a significant effect on the variables of fresh weight of cobs per sample and per plot, as well as dry weight of cobs per sample and per plot. This is due to the activity of microorganisms in improving soil structure; however, the effectiveness of biochar depends on the dose given and soil conditions, such as marginal soils, so that biochar can increase growth and production results optimally.

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