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Research Article
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Effects of chicken manure dose and Eco Farming spray intensity on growth and ear traits of baby corn (*Zea mays* L.)

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Abstract: Organic nutrient management is important in baby corn because this crop has a short production cycle and requires rapid early growth and timely reproductive development. However, information on the combined use of chicken manure and repeated Eco Farming liquid organic fertilizer spraying under field conditions remains limited. This study evaluated the effects of chicken manure dose, Eco Farming spray intensity, and their interaction on the growth and ear traits of baby corn using a 3 × 3 factorial randomized block design with three replications. Chicken manure was applied at 0, 4.5, and 5.5 kg bed^{-1}, whereas Eco Farming was applied as 0, six, or seven foliar sprays. Plant height and leaf number were recorded at 15, 25, and 35 days after planting (DAP), whereas days to female flowering, husk weight, cob weight, and cob length were measured at harvest. Chicken manure significantly increased plant height at 25 and 35 DAP, whereas Eco Farming had no significant main effect on plant height. Significant interaction effects were detected for plant height at 25 DAP and for leaf number at 15 and 25 DAP, indicating that early vegetative responses depended on the combination of both inputs. Eco Farming significantly accelerated female flowering and increased husk weight and cob length, with seven sprays producing the best response. Cob weight was not significantly affected by either factor or their interaction. Overall, chicken manure more consistently supported vegetative growth, whereas intensified Eco Farming spraying improved flowering earliness and market-relevant ear traits in baby corn.

Keywords: foliar nutrient application, integrated nutrient management, silk emergence, sustainable agriculture

1. Introduction

Maize (*Zea mays* L.) is one of the most widely cultivated cereal crops and remains a strategic commodity for food, feed, and agro-industry in many regions (Erenstein et al., 2022). In addition to grain production, maize also has horticultural value when harvested at an immature stage prior to pollination and kernel filling. At this stage, the developing ear is marketed as baby corn, typically harvested shortly after silk emergence and consumed as a whole tender cob (Yeasmin et al., 2024). Baby corn production is attractive because it offers a short production cycle, diversified market channels, and potential income opportunities for farmers, particularly where intensive or peri-urban cultivation systems are developing.

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A distinctive feature of baby corn is its narrow harvest window and reliance on rapid early growth to support ear initiation and elongation within a limited time. Consequently, crop performance is highly sensitive to early vegetative vigor and to nutrient availability during the transition from vegetative growth to reproductive development. Plant height development and leaf formation are important indicators of canopy establishment and photosynthetic capacity that can affect assimilate supply to developing ears. In parallel, quality-related traits such as cob length and husk characteristics influence market acceptance and economic value. Recent evidence suggests that agronomic management can shape not only yield components but also nutritional-quality indicators of baby corn, indicating that production strategies should consider both productivity and market-relevant quality (Haque et al., 2024).

Nutrient management is therefore a key leverage point for improving baby corn performance. While mineral fertilizers can increase productivity, there is growing interest in integrating organic inputs that may support crop nutrition while improving soil quality and long-term fertility. Organic amendments can contribute organic matter and stimulate soil biological activity, potentially enhancing nutrient cycling and availability across the season (Anshori et al., 2022). Among commonly available organic resources, chicken manure is frequently highlighted as a nutrient-rich amendment that supplies essential macronutrients and can promote vegetative growth indicators such as plant height and leaf number in maize systems (Rasool et al., 2023; Essilfie et al., 2024). Improvements in soil physical structure and nutrient retention associated with organic amendments may be particularly relevant for short-duration crops like baby corn, where timely nutrient supply is critical for rapid canopy development.

In addition to soil-applied amendments, liquid organic fertilizer (LOF) and foliar-based nutrient strategies have been explored to address short-term nutrient limitations during periods of high demand. Reported responses in maize depend on fertilizer formulation, dose, timing, and application frequency (Zaki & Ahmed, 2023; Ssemugenze et al., 2025). However, the effectiveness of foliar-applied nutrients depends on their absorption through the leaf surface and subsequent translocation within the plant, processes that remain complex and not fully predictable (Fernández & Brown, 2013). Eco Farming is a liquid organic fertilizer typically applied via repeated spraying, and such practices may influence both vegetative processes and phenological progression. For baby corn, management interventions that support early vigor and synchronize flowering and ear development may translate into improved cob attributes and more consistent harvest scheduling (Yeasmin et al., 2024).

Despite the reported benefits of chicken manure and foliar or liquid fertilizer inputs (Zaki & Ahmed, 2023; Essilfie et al., 2024; Yeasmin et al., 2024), evidence remains limited regarding their combined use under comparable management conditions, particularly in terms of whether they produce additive benefits or interaction effects. This gap is important because soil-applied amendments and repeated foliar applications may act through different pathways: manure can strengthen baseline nutrient supply and soil condition, whereas LOF sprays may provide timely supplementation at critical growth stages. Studies in maize indicate that integrating soil fertilisation with foliar liquid fertilizer can improve nutrient uptake and stabilize yield responses compared with single-input approaches, supporting the plausibility of complementarity or interaction between the two strategies (Adeniyan et al., 2016; Onte et al. 2025). Clarifying these effects is necessary to develop practical and efficient organic nutrient-management options for baby corn production.

Accordingly, this study aimed to evaluate (i) the effect of chicken manure dose, (ii) the effect of Eco Farming spraying intensity, and (iii) their interaction on baby corn growth and ear traits. We hypothesised that responses would vary across manure doses and spraying intensities, and that combined application could generate interaction effects on key vegetative and market-relevant indicators.

2. Materials and Methods

2.1 Study site and experimental period

The field experiment was conducted from January to March 2024 in Dusun Borong Bulo, Bontoala Village, Pallangga District, Gowa Regency, South Sulawesi, Indonesia. The experimental site was located at 5°12'58.15"S, 119°25'41.78"E. Field activities included land preparation, treatment application, planting, crop maintenance, growth observations, and harvest at the baby corn stage.

2.2 Plant materials and inputs

Baby corn seeds of the Exotic Pertiwi F1 variety were used in this study. This variety was selected because Exotic Pertiwi F1 is a superior hybrid sweet corn cultivar that is resistant to rust, leaf blight, and downy mildew, and is well adapted to lowland conditions. The organic inputs tested were chicken manure and Eco Farming liquid organic fertilizer (LOF). The Eco Farming product used was Eco Farming Premium, produced by PT Bandung Eco Sinergi Teknologi (PT BEST), and was applied using a 2-L manual pressure hand sprayer (Torab brand). Chicken manure was applied as dry manure mixed with rice husk used as poultry litter in broiler chicken houses.

2.3 Land preparation and crop establishment

The field was first cleared manually of weeds and crop residues. The soil was then loosened using hand tools, and planting beds were formed. Each bed measured 300 cm × 30 cm (0.90 m²). Beds were spaced 75 cm apart, while the distance between blocks was 100 cm. Planting holes were prepared manually on each bed according to the designated spacing. Two seeds were dibbled into each planting hole, and seedlings were thinned to one plant per hole at 7 days after planting (DAP). Replanting was carried out when necessary, up to 14 DAP to maintain a uniform plant stand.

2.4 Treatments

The experiment consisted of two factors arranged in a 3 × 3 factorial pattern. Factor A was chicken manure dose: A0 = 0 kg bed^{-1}, A1 = 4.5 kg bed^{-1}, and A2 = 5.5 kg bed^{-1}. Because each bed had an area of 0.90 m², these rates are equivalent to approximately 0, 50.0, and 61.1 t ha^{-1}, respectively. The hectare conversion was calculated from the plot area and is numerically correct. These rates represent relatively high-input organic treatments intended to test crop response under intensive organic nutrient supply conditions. Factor E was Eco Farming spray intensity: E0 = no spraying, E1 = six sprays at 5, 10, 15, 20, 25, and 30 DAP, and E2 = seven sprays at 5, 10, 15, 20, 25, 30, and 35 DAP.

2.5 Eco Farming preparation and application

Eco Farming was prepared by dissolving one tube (30 g) of the product in 1 L of water, preferably coconut water or sugarcane water, and allowing the solution to stand for at least 15 min before use as a starter solution. For field spraying, 25–50 mL of the starter solution was mixed with 15–20 L of water. In each application, Eco Farming solution was sprayed at 30 mL plant^{-1} onto the leaves and stems. Based on this volume, the cumulative spray volume was 180 mL plant^{-1} for E1 and 210 mL plant^{-1} for E2 over the full treatment period. Spraying was conducted uniformly on the leaf and stem surfaces until the assigned volume was completely applied.

2.6 Experimental design and plot layout

The study used a 3 × 3 factorial randomized block design with three replications (blocks) to account for field variability (e.g., soil heterogeneity and micro-topography), generating nine treatment combinations per block (27 plots in total). Each plot consisted of one bed measuring 300 cm × 30 cm (bed area = 0.90 m²). Beds were spaced 75 cm apart, and the distance between blocks was 100 cm. Plants were spaced 30 cm within each bed (in-row) and 75 cm between beds (inter-row), resulting in nine plants per bed and a total population of 243 plants across the experiment. Treatment combinations were randomly assigned to beds within each block. Plant spacing was set to reflect standard baby corn management practices (Saptorini & Sutiknjo, 2021; Jena et al., 2025).

2.7 Crop management

Chicken manure was applied according to treatment during plot preparation and placed in the planting holes before sowing. Eco Farming was sprayed according to the assigned treatment schedule. Routine crop management included manual weeding and irrigation according to field conditions. No pesticide was applied during the experiment.

2.8 Observations and measurements

Plant height and leaf number were recorded at 15, 25, and 35 DAP. Plant height was measured from the soil surface to the tip of the highest leaf, while leaf number was counted as the number of fully expanded leaves per plant. Days to female flowering were recorded as the number of days from planting to first silk emergence. Husk weight, cob weight, and cob length were measured at harvest. Harvesting was carried out at the baby corn stage, namely 1–3 days after silk emergence, when the ears were still tender and kernels had not yet developed. Measurements were taken from five centrally located plants per plot to minimize border effects. The sample plants were labeled at the beginning of the observation period.

2.9 Statistical analysis

All variables were analyzed using two-way analysis of variance (ANOVA) under a randomized block design, with chicken manure dose and Eco Farming spray intensity as fixed factors and block as a random factor. When significant main effects or interactions were detected, treatment means were compared using Duncan's Multiple Range Test (DMRT) at the 5% significance level.

3. Results and Discussion

3.1 Plant height

Plant height increased progressively from 15 to 35 DAP, indicating continued vegetative development across treatment combinations. At 15 DAP, no significant effects were detected for chicken manure dose, Eco Farming spray intensity, or their interaction. The overall model was not significant ($F = 1.535$; $p = 0.214$), and the main effects of chicken manure and Eco Farming were also not significant ($p = 0.727$ and $p = 0.935$, respectively). The interaction between both factors was close to the significance threshold but remained non-significant at the 5% level ($F = 2.875$; $p = 0.053$). These results indicate that treatment effects on plant height had not yet become clearly expressed during the early growth stage.

At 25 DAP, the overall model became significant ($F = 2.716$; $p = 0.037$). Chicken manure significantly affected plant height ($F = 3.590$; $p = 0.049$), whereas Eco Farming spray intensity did not show a significant main effect ($F = 0.168$; $p = 0.847$). The interaction between chicken manure and Eco Farming was significant ($F = 3.553$; $p = 0.026$), indicating that plant height at this stage depended on the specific combination of the two treatments (Figure 1). Descriptively, the highest plant height was recorded in A1E2, followed by A2E1, A2E0, and A1E0, whereas A0E0 produced the lowest value. This pattern suggests that plant height during the mid-vegetative stage responded to the synchrony between soil-applied manure and foliar Eco Farming application.

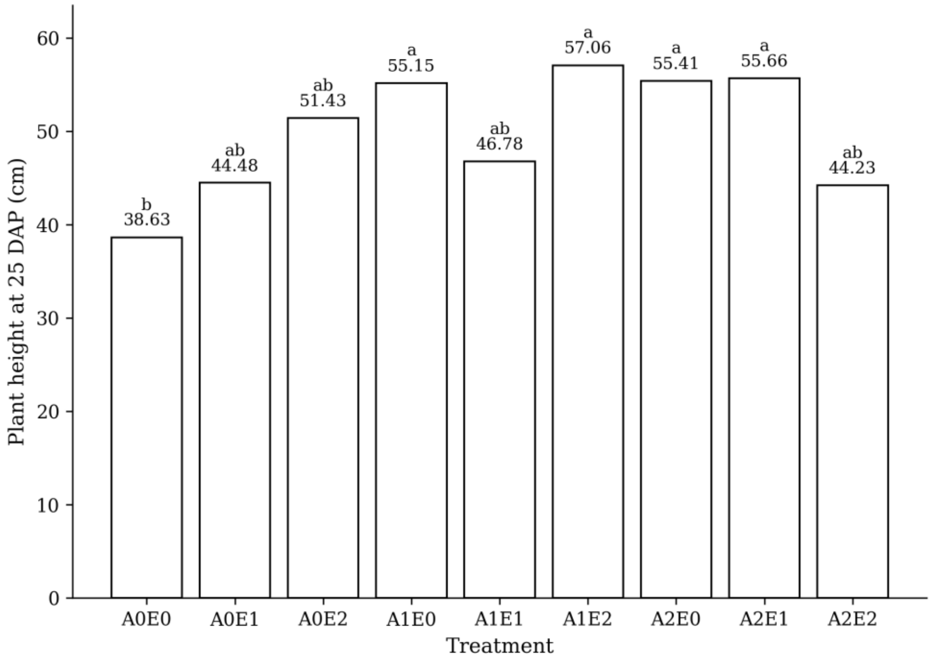

Figure 1. Plant height at 25 days after planting (DAP) under factorial combinations of chicken manure dose and Eco Farming spray intensity. Bars represent treatment means. Means followed by the same letter are not significantly different according to Duncan's Multiple Range Test at $\alpha = 0.05$.

At 35 DAP, the overall model remained significant ($F = 2.560$; $p = 0.047$). Chicken manure continued to have a significant effect on plant height ($F = 4.213$; $p = 0.032$), while Eco Farming remained non-significant ($F = 0.220$; $p = 0.805$). The interaction term was not significant at $\alpha = 0.05$, although it remained close to the threshold ($F = 2.903$; $p = 0.051$). This indicates that, at the later vegetative stage, plant height was influenced mainly by chicken manure rather than by Eco Farming spray intensity or their interaction.

Overall, these findings show that chicken manure was the more consistent factor affecting plant height, particularly at 25 and 35 DAP, whereas Eco Farming did not produce a significant main effect across observation times. The significant interaction observed at 25 DAP indicates that treatment combinations were particularly important during the mid-vegetative stage, when plant growth was likely more sensitive to the synchrony between soil-applied and foliar-applied nutrient inputs. Similar responses have been reported in maize under integrated nutrient management, where organic amendments improve baseline nutrient availability and support vegetative growth (Essilfie et al., 2024).

3.2 Leaf number

Leaf number was evaluated at 15, 25, and 35 DAP to assess canopy establishment during vegetative growth. At 15 DAP, the overall model was significant ($F = 2.720$; $p = 0.037$), although the main effects of chicken manure and Eco Farming were not significant ($p = 0.126$ and $p = 0.837$, respectively). In contrast, the interaction between chicken manure and Eco Farming was significant ($F = 4.187$; $p = 0.014$), indicating that early leaf development depended on the specific combination of both factors rather than on either factor alone (Figure 2). The highest leaf number at this stage was observed in A2E1 and A1E0, whereas the lowest values occurred in A2E2, A0E1, and A0E0.

At 25 DAP, the overall model was not significant at the 5% level ($F = 2.026$; $p = 0.102$).

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However, the interaction between chicken manure and Eco Farming remained significant (F = 3.288; p = 0.034), whereas the main effects of chicken manure and Eco Farming were not significant (p = 0.313 and p = 0.753, respectively). The highest leaf number was recorded in A2E0 and A2E1, while the lowest values were observed in A0E0 and A2E2. This result indicates that leaf formation at the mid-vegetative stage was affected more by the combined treatment than by either factor individually.

At 35 DAP, no significant effects were detected. The overall model was not significant (F = 1.112; p = 0.401), and neither chicken manure, Eco Farming, nor their interaction showed significant effects (p = 0.821, p = 0.859, and p = 0.131, respectively). This suggests that differences in leaf number among treatment combinations became less apparent at the later vegetative stage (Figure 2).

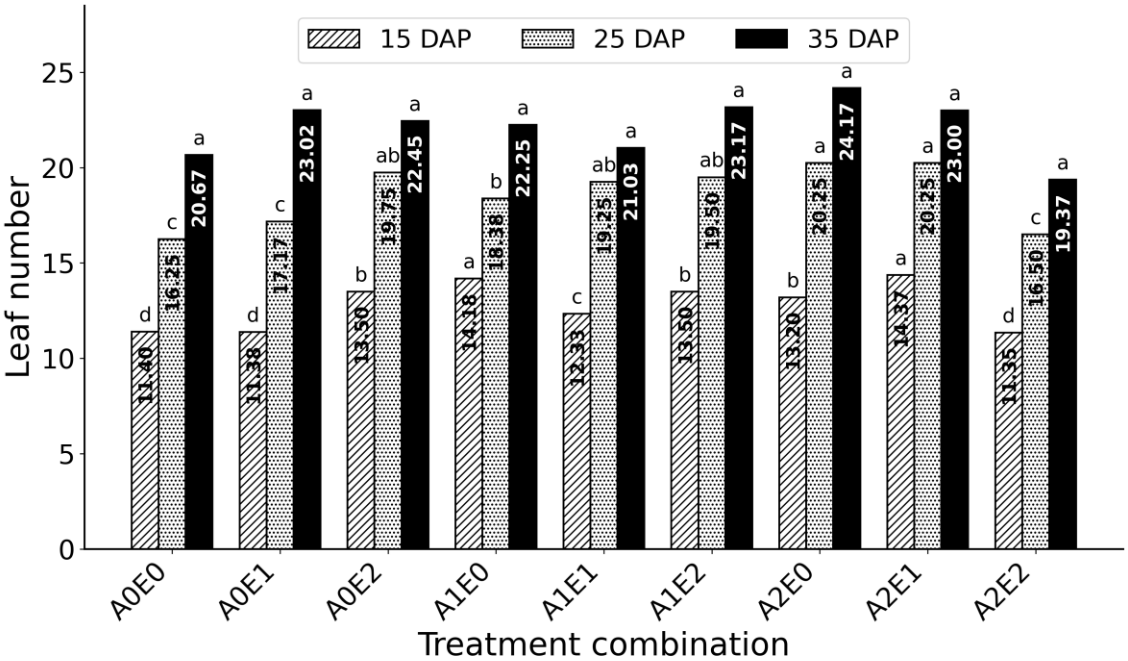

Figure 2. Leaf number at 15, 25, and 35 days after planting (DAP) under factorial combinations of chicken manure dose and Eco Farming spray intensity. Bars represent treatment means. Means followed by the same letter within the same observation time are not significantly different at α = 0.05.

3.3 Days to female flowering

Days to female flowering were significantly influenced by Eco Farming spray intensity, whereas chicken manure and the interaction between both factors were not significant. The two-way ANOVA showed that the overall model was not significant at the 5% level (F = 1.895; p = 0.124), but Eco Farming had a significant main effect on days to flowering (F = 5.147; p = 0.017). In contrast, chicken manure had no significant effect (F = 0.095; p = 0.910), and the interaction between chicken manure and Eco Farming was also not significant (F = 1.168; p = 0.358).

Duncan's multiple range test showed that E2 had the lowest mean value for days to flowering (53.72 days), followed by E1 (54.19 days) and E0 (54.42 days), indicating that the seven-spray treatment accelerated female flowering compared with the lower spray intensities (Figure 3). By contrast, the means for chicken manure levels were very similar and remained within the same homogeneous subset, confirming the absence of a significant manure effect.

Earlier flowering is agronomically important in baby corn because harvest timing is directly linked to silk emergence. The earlier flowering observed under E2 suggests that repeated Eco Farming application may have improved plant physiological status or nutrient availability during the transition from vegetative to reproductive growth, allowing plants to reach flowering slightly sooner. Similar benefits of timely foliar nutrient supply in maize have been reported previously (Ssemugenze et al., 2025).

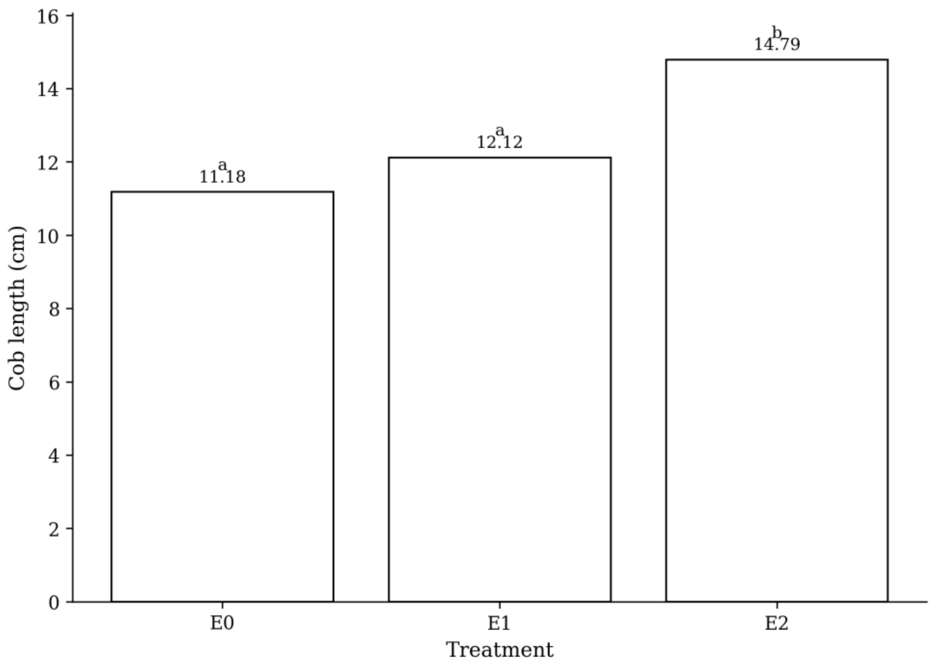

Figure 3. Days to female flowering under Eco Farming treatments. Bars represent treatment means. Lower values indicate earlier flowering. Means followed by the same letter are not significantly different according to Duncan's Multiple Range Test at α = 0.05.

3.4 Husk weight

Husk weight was significantly influenced by Eco Farming spray intensity, whereas chicken manure and the interaction between both factors were not significant. The two-way ANOVA showed that the overall model was marginal at the 5% level ($F = 2.324$; $p = 0.066$). Chicken manure did not significantly affect husk weight ($F = 1.215$; $p = 0.320$), and the interaction between chicken manure and Eco Farming was also not significant ($F = 1.405$; $p = 0.272$). In contrast, Eco Farming had a significant main effect on husk weight ($F = 5.268$; $p = 0.016$), indicating that the frequency of foliar application played an important role in husk development.

Duncan's multiple range test showed that E2 produced the highest husk weight (137.39 g), whereas E0 and E1 produced lower values of 98.00 g and 110.64 g, respectively (Figure 4). This result indicates that the seven-spray treatment was superior to the lower spray intensities in promoting husk development. By contrast, the chicken manure means remained within the same homogeneous subset, confirming that manure dose did not significantly affect husk weight.

These findings suggest that husk development in baby corn was more responsive to repeated Eco Farming application than to chicken manure dose. Because baby corn is harvested at an immature stage, husk weight may reflect the effectiveness of nutrient supply during the early reproductive period, when ear-associated tissues are still actively developing. This interpretation is in line with previous studies showing that nutrient management can improve baby corn ear traits and quality-related characteristics (Haque et al., 2024; Yeasmin et al., 2024).

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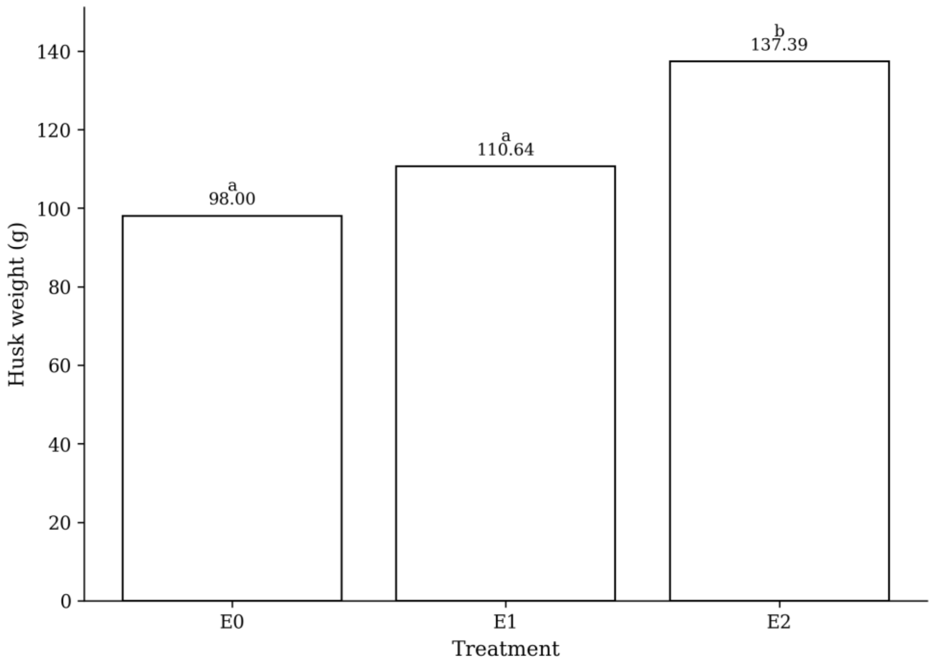

Figure 4. Husk weight under Eco Farming treatments. Bars represent treatment means. Means followed by the same letter are not significantly different according to Duncan's Multiple Range Test at α = 0.05.

3.5 Cob weight

Cob weight did not show a significant response to chicken manure, Eco Farming, or their interaction. The two-way ANOVA showed that the overall model was not significant ($F = 1.473$; $p = 0.235$). The main effect of chicken manure was not significant ($F = 0.861$; $p = 0.439$), and the interaction between chicken manure and Eco Farming was also not significant ($F = 0.849$; $p = 0.513$). Eco Farming showed a tendency toward significance ($F = 3.333$; $p = 0.059$), but this effect did not reach the 5% significance threshold (Figure 5).

These results indicate that cob weight was relatively stable across treatment combinations under the conditions of the present study. One plausible explanation is that baby corn is harvested at a very early developmental stage, namely 1–3 days after silk emergence, before substantial kernel filling and dry matter accumulation can occur. As a result, cob weight may be less sensitive to nutrient management treatments than traits such as cob length or husk weight, which can respond earlier during ear formation. Similar observations have been noted in baby corn studies where some ear-quality traits responded more clearly than fresh cob mass under short harvest windows (Haque et al., 2024; Jena et al., 2025).

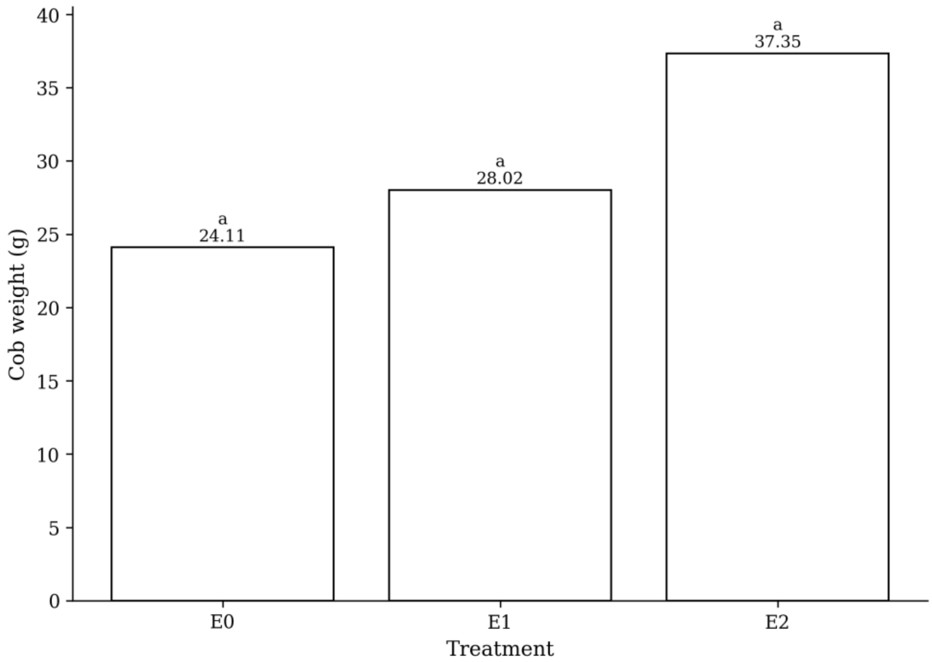

Figure 5. Cob weight under Eco Farming treatments. Bars represent treatment means. No significant difference among treatments was detected by analysis of variance at $\alpha = 0.05$.

3.6 Cob length

Cob length was significantly affected by Eco Farming spray intensity, whereas chicken manure and the interaction between both factors were not significant at the 5% level. The two-way ANOVA showed that the overall model was significant ($F = 3.594$; $p = 0.012$). Eco Farming had a significant main effect on cob length ($F = 7.034$; $p = 0.006$), indicating that differences in spray intensity contributed substantially to variation in cob elongation. Chicken manure showed a near-significant tendency ($F = 3.332$; $p = 0.059$), but the effect did not reach the 5% significance threshold. The interaction between chicken manure and Eco Farming was not significant ($F = 2.005$; $p = 0.137$), suggesting that the response of cob length to Eco Farming was relatively consistent across manure levels (Figure 6).

Duncan's multiple range test supported this pattern. For Eco Farming, E2 produced the greatest cob length (14.79 cm), whereas E0 and E1 produced shorter cobs of 11.18 and 12.12 cm, respectively. This confirms that the seven-spray treatment was associated with the longest cobs. Although chicken manure showed a tendency to increase cob length, its main effect was not statistically significant at $\alpha = 0.05$.

These findings indicate that cob elongation in baby corn was more responsive to Eco Farming intensity than to chicken manure dose. Because cob length is a key market-related quality trait in baby corn, the significant response under E2 suggests that more frequent foliar application improved conditions for ear development during the early reproductive stage. Comparable improvements in baby corn yield and quality traits under enhanced nutrient management have been reported previously (Jena et al., 2025; Yeasmin et al., 2024).

Taken together, the results show trait-specific responses. Chicken manure more consistently supported vegetative growth, especially plant height, whereas Eco Farming spray intensity had clearer effects on flowering time and market-relevant ear traits such as husk weight and cob length. The significant early-stage interactions for plant height and leaf number further indicate that the effectiveness of one input depended on the level of the other, particularly during crop establishment. Overall, these results support the use of integrated nutrient management to optimize different stages of baby corn development (Adeniyan et al., 2016; Essilfie et al., 2024).

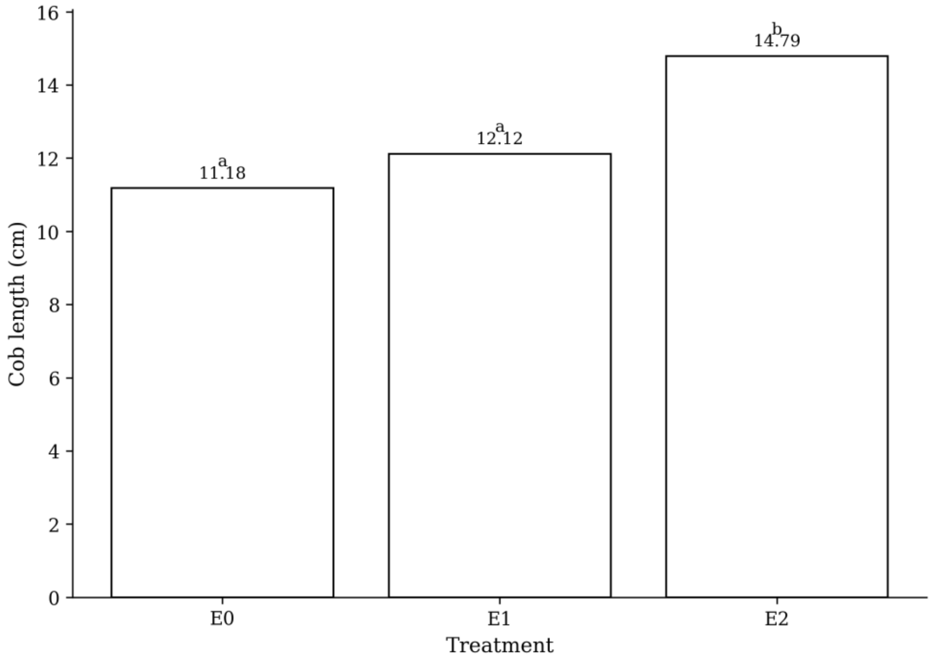

Figure 6. Cob length under Eco Farming treatments. Bars represent treatment means. Means followed by the same letter are not significantly different according to Duncan's Multiple Range Test at α = 0.05.

4. Conclusion

Chicken manure and Eco Farming affected baby corn performance in different ways. Chicken manure more consistently influenced vegetative growth, particularly plant height at 25 and 35 DAP. Eco Farming spray intensity did not significantly affect plant height, but it significantly accelerated female flowering and increased husk weight and cob length, with seven sprays producing the best response. Interaction effects were important during the early to mid-vegetative stage, as shown by significant interactions on plant height at 25 DAP and on leaf number at 15 and 25 DAP. Cob weight did not respond significantly to either factor or their interaction, likely because baby corn was harvested at an early stage before substantial biomass accumulation occurred. Overall, the results indicate that chicken manure was more important for supporting vegetative growth, whereas intensified Eco Farming spraying was more effective for improving flowering earliness and market-relevant ear traits. These findings provide practical support for integrating soil-applied chicken manure with repeated foliar Eco Farming application in baby corn cultivation.

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