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Growth and Yield Responses of Green Eggplant (*Solanum melongena* L.) under Different Mulch Types

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Abstract: Mulching is an important agronomic practice for modifying the soil microenvironment and supporting crop growth and productivity. However, the effectiveness of different mulch materials in green eggplant production may vary depending on their physical characteristics and effects on soil conditions. This study evaluated the effects of different mulch types on the growth, flowering, fruit characteristics, and yield of green eggplant (Solanum melongena L.). The experiment was conducted using a randomized complete block design with five mulch treatments and five replications. Mulch type significantly affected several vegetative growth parameters. Silver-black plastic mulch generally promoted greater vegetative growth, while rice straw mulch also produced comparable growth responses for several parameters. Mulch type did not significantly affect flowering time, fruit weight, or fruit length, but significantly affected fruit diameter. Overall, silver-black plastic mulch demonstrated the most consistent positive numerical response in vegetative growth and cumulative fruit production, although its advantage in final yield was not statistically significant. These findings indicate that mulch selection should consider both crop growth responses and production objectives, while further research is needed to clarify the effects of mulch systems on soil microclimate, water availability, and resource competition in green eggplant production.

Keywords: Arachis pintoi; Eggplant; Fruit yield; Living mulch; Plastic mulch; Rice straw mulch

1. Introduction

Eggplant (*Solanum melongena* L.) is an important vegetable crop cultivated widely in tropical and subtropical regions and contributes to food supply, dietary diversity, and agricultural livelihoods. The crop is valued for its edible fruits and its adaptation to diverse production environments. As a horticultural commodity, eggplant productivity is influenced by cultivar characteristics, environmental conditions, and crop management practices (Abrham & Shumbulo, 2024). Maintaining favorable conditions in the crop root zone is therefore important for supporting vegetative growth and fruit production (Díaz-pérez, 2023).

In open-field vegetable production, crop performance can be constrained by fluctuations in soil moisture and temperature, weed competition, and other changes in the soil environment. These factors can influence root development, water and nutrient uptake, and ultimately crop productivity. Mulching is therefore considered an important agronomic practice for modifying the soil environment and improving crop growing conditions. By covering the soil surface, mulch can reduce direct exposure of the soil to solar radiation and rainfall, decrease evaporation, moderate soil temperature, and reduce soil erosion. These functions make mulching particularly relevant for vegetable production systems where maintaining favorable soil moisture and temperature conditions is essential (Choudhary et al., 2022; Kader et al., 2017).

Vegetative propagation using cuttings is more widely employed than generative propagation because the procedure is relatively simple, enables faster plant production, and preserves genetic characteristics identical to those of the parent plant (Nurholis, 2017). In vanilla nursery practices, the use of single-node cuttings serves as an efficient alternative for sourcing planting material. However, single-node cuttings still require a nursery phase to develop approximately 5–7 new nodes before they are ready for use. The primary limitation of this technique lies in the minimal reserve of assimilates stored within the cutting material, resulting in an initial growth rate that tends to be slower and suboptimal (Suteja and Dharma, 2016).

The effects of mulching extend beyond soil moisture conservation. Mulch can also suppress weed emergence by creating a physical barrier that restricts light penetration and inhibits weed establishment. Reduced weed pressure may decrease competition between weeds and crops for water, nutrients, and light, thereby improving resource availability for the cultivated plants. The effectiveness of weed suppression, however, depends on the type, thickness, and persistence of the mulch material. Organic mulches, for example, can provide effective weed suppression while gradually decomposing and contributing to soil organic matter, whereas synthetic materials generally provide longer-lasting soil coverage during the crop cycle (Choudhary et al., 2022; Rodan et al., 2020).

Different mulch materials can generate different soil microclimates and consequently influence crop growth and yield in different ways. Plastic mulch is widely used in vegetable production because it can reduce soil evaporation, suppress weeds, and modify soil temperature. The optical properties and color of plastic films are particularly important because they determine the amount of solar radiation reflected, transmitted, or absorbed by the mulch surface. Consequently, black, transparent, white, and reflective plastic films may produce different thermal conditions in the root zone and different responses in crop growth (Díaz-pérez, 2023; Kader et al., 2017).

The response of eggplant to plastic mulch has been demonstrated in recent field research. The degradation of plastic mulch altered root-zone temperature and affected fruit yield in eggplant, indicating that the physical condition and persistence of the mulch material can influence crop performance (Díaz-pérez, 2023). Biodegradable mulching films have been shown to modify soil temperature and improve several agronomic characteristics of open-field eggplant under hot-arid conditions. These findings indicate that the benefits of mulching cannot be generalized across all materials because the characteristics of individual mulch types influence their effects on the soil environment and crop performance (Iacuzzi et al., 2024).

Organic mulch provides a different set of functions from plastic mulch. Materials such as straw and other crop residues can reduce evaporation, moderate soil temperature, suppress weeds, and contribute organic matter to the soil as they decompose. In addition, organic mulching may improve soil structure and support soil biological processes. However, the effectiveness of organic mulch depends on material characteristics, application thickness, decomposition rate, and environmental conditions. Recent research in eggplant has demonstrated that different organic materials and application thicknesses can differ substantially in their ability to suppress weeds and influence crop yield (Gurbuz & Okatan, 2025).

Living mulch represents another approach to soil surface management in which a cover crop is maintained alongside the main crop. Unlike dead organic residues or plastic films, living mulches remain biologically active and may provide continuous soil cover, reduce erosion, suppress weeds, and contribute to soil health. However, living mulch systems may also compete with the main crop for water, nutrients, and light, meaning that their effectiveness depends strongly on species selection and crop management. A review of living mulch systems highlighted their potential to reduce weed pressure, soil erosion, and nutrient losses while improving soil health, although successful implementation requires careful management of competition between the living mulch and the main crop (Bhaskar et al., 2021).

The potential of different mulch materials to influence eggplant productivity has also been demonstrated under water-limited conditions. The application of straw and plastic mulches was reported to mitigate some adverse effects of drought stress in eggplant by improving physiological and quality-related responses. These findings suggest that mulching can contribute to crop resilience by modifying the soil environment and improving the availability of water to plants, although the magnitude of the response may depend on the type of mulch and environmental conditions (Rodan et al., 2020).

Recent evidence further indicates that mulch type can substantially affect eggplant productivity. Under conservation tillage in organic greenhouse production, different mulch strategies resulted in significant differences in total fruit yield, with black plastic mulch producing higher yields than several other mulch treatments, including straw mulch and bare soil. This finding reinforces the importance of evaluating mulch materials comparatively rather than assuming that all mulches provide equivalent agronomic benefits (Amami et al., 2025).

Although the benefits of mulching for vegetable production are well established, the relative effectiveness of different mulch materials for green eggplant production remains dependent on the characteristics of the materials, crop management, and growing environment. In particular, comparative evaluation of synthetic plastic mulch, organic residue mulch, and living mulch can provide valuable information for identifying practical strategies that balance crop productivity with the availability and sustainability of mulching resources. Therefore, evaluating different mulch types under the same field conditions is important for determining their relative effects on the growth and yield of green eggplant.

The objective of this study was to evaluate the effects of different mulch types on the growth and yield of green eggplant (*Solanum melongena* L.). The study was conducted to compare the responses of green eggplant to different mulching treatments and to identify a suitable mulching practice for improving crop growth and productivity under field conditions. The findings are expected to provide practical information for selecting appropriate mulch materials for green eggplant cultivation and contribute to the development of efficient soil management practices for vegetable production.

2. Materials and Methods

Experimental Site and Time

The experiment was conducted from June to November 2024 in Jemberlor, Patrang District, Jember Regency, East Java, Indonesia, at an elevation of approximately 89 m above sea level. During the experimental period, the site was characterized by air temperatures ranging from approximately 23 to 31 °C. The experiment was conducted under open-field conditions.

Plant Material and Experimental Treatments

Green eggplant (*Solanum melongena* L.) cultivar Hitavi F1 was used as the test crop. The treatments consisted of five soil surface management practices: no mulch (bare soil) as the control (M0), silver-black plastic mulch (M1), black plastic mulch (M2), rice straw mulch (M3), and living mulch of Arachis pintoi (M4).

The experiment was arranged in a randomized complete block design (RCBD) with five mulch treatments and five replications, resulting in 25 experimental units. Each experimental unit consisted of one raised bed measuring 1.2 m × 2.5 m. Plants were spaced 70 cm × 60 cm, with six plants established per bed. Thus, the experiment comprised a total of 150 plants. Six plants were selected as observation plants in each experimental unit. The total experimental area was approximately 139.5 m². The spacing between adjacent beds was 50 cm.

Crop Management and Statistical Analysis

Eggplant seeds were initially sown in seedling trays containing a 1:1 (v/v) mixture of soil and farmyard manure. Seedlings were maintained under nursery conditions and transplanted to the experimental field at 14–21 days after sowing, when they had developed approximately three to four fully expanded leaves. Before transplanting, the experimental field was cleared of weeds and previous crop residues and prepared into raised beds measuring 1.2 m × 2.5 m. Farmyard manure was incorporated into the soil as a basal amendment at a rate of 20 t ha^{-1} (7.4 kg per bed).

Plastic mulch treatments were installed before transplanting and perforated according to the designated plant spacing of 70 cm × 60 cm. Rice straw was manually distributed over the bed surface at a thickness of approximately 3–4 cm. For the living mulch treatment, *A. pintoi* was established on the bed surface 14 days before eggplant transplanting and allowed to develop as a living ground cover. Eggplant seedlings were transplanted at one plant per planting hole. Missing or dead plants were replaced during the first 7–14 days after transplanting. Weeds were manually removed when necessary to minimize competition with the eggplant plants. All treatments received the same crop management practices throughout the experiment.

Nitrogen, phosphorus, and potassium fertilizer (NPK 16:16:16) was applied as supplementary fertilizer at a rate of 60 g per bed. The fertilizer was dissolved in 2 L of water and applied by drenching around the plants. Fertilization was conducted twice, at 15 and 30 days after transplanting (DAT). Plants were irrigated twice daily, in the morning and afternoon, according to field conditions and crop water requirements. Pest and disease management was conducted when visible symptoms or pest infestations were observed. Insect pests observed during the experiment included whiteflies, grasshoppers, and fruit borers. Chemical insecticides were applied when necessary, following the crop management practices used at the experimental site. Eggplant fruits were first harvested at approximately 55 days after transplanting and subsequently harvested at seven-day intervals. A total of 13 harvests were conducted during the experimental period.

Plant growth and reproductive characteristics were evaluated using selected plants from each experimental unit. Plant height and leaf number were recorded weekly from 7 to 28 days after transplanting (DAT). Plant height was measured from the soil surface at the base of the stem to the highest growing point. The number of leaves was determined by counting the leaves present on each sampled plant. Leaf area was measured at 40 DAT using a gravimetric method. A representative middle-position leaf was traced onto paper with a known area and weight. The leaf area was subsequently estimated from the ratio between the weight of the paper replica and the weight of the paper with a known area. Time to flowering was recorded as the number of days after transplanting (DAT) required for at least three plants within the observation unit to produce flowers. Fruit characteristics were evaluated at harvest. Fruit diameter was measured at the widest portion of the fruit using a vernier caliper, while fruit length was measured from the fruit base to the distal end using a ruler. Individual fruit weight was determined using an analytical balance. Yield-related variables included fruit weight per plant at each harvest, number of fruits per plant, and cumulative fruit yield per plant. Cumulative yield was calculated by summing the fruit weight obtained from the first through the seventh harvest.

The data were subjected to analysis of variance (ANOVA) based on the randomized complete block design. When the F-test indicated significant treatment effects, means were separated using Duncan's multiple range test (DMRT) at the 5% significance level. Statistical analyses were performed to determine the effects of mulch treatments on eggplant growth, flowering, fruit characteristics, and yield-related variables.

3. Results and Discussion

Effects of Mulch Types on Vegetative Growth of Green Eggplant

Mulch type affected the early vegetative growth of green eggplant, particularly plant height from 14 to 28 days after transplanting (DAT). At 7 DAT, plant height did not differ significantly among treatments, ranging from 13.2 to 15.8 cm. However, significant differences emerged at 14 DAT, with plants grown under silver-black plastic mulch and rice straw mulch reaching 22.6 and 22.5 cm, respectively, compared with 18.3 cm in the bare-soil control. At 21 DAT, these two treatments continued to produce the tallest plants (35.7 and 35.9 cm), while at 28 DAT, rice straw mulch and silver-black plastic mulch resulted in plant heights of 48.9 and 48.1 cm, respectively. Black plastic mulch also produced relatively high plant height (45.4 cm), whereas the control and *Arachis pintoi* living mulch treatments resulted in lower values (Table 1). The greater plant height under plastic and rice straw mulches may be associated with improved soil surface conditions, including moisture conservation and reduced weed competition. Plastic mulches can modify soil temperature and moisture regimes while suppressing weed emergence, although their effects vary with mulch colour, crop, and environmental conditions (Amare & Desta, 2021; Díaz-pérez, 2023). Similar benefits of mulch application in vegetable production have also been reported, with both organic and inorganic mulches capable of improving crop performance compared with bare soil (Machanoff et al., 2022).

Table 1. Summary of observations on the effect of applying plant growth regulators (shallot extract and amino acids) on the growth of vanilla (*Vanilla planifolia* Andrews) cuttings.

Mulch Types	**Plant Height (cm)**				**Leaves number (leaves plant^{-1})**				Leaf Area (cm^2)
	7 DAT	**14 DAT**	**21 DAT**	**28 DAT**	**7 DAT**	**14 DAT**	**21 DAT**	**28 DAT**	
Control	13.2	18.3 b	27.0 c	38.4 b	4	4	6 b	9 c	158 b
Silver-black plastic	15.8	22.6 a	35.7 a	48.1 a	5	5	7 a	16 a	188 a
Black plastic	14.6	21.0 ab	33.0 ab	45.4 a	4	5	6 b	15 ab	187 a
Rice straw	14.5	22.5 a	35.9 a	48.9 a	4	5	6 b	18 a	172 ab
A. Pintoi	13.6	19.7 ab	29.4 bc	39.2 b	4	4	6 b	12 bc	167 ab

Note: DAT = days after transplanting. Means followed by different lowercase letters within the same column were significantly different according to Duncan's multiple range test (DMRT) at $p < 0.05$.

The positive response of vegetative growth was also reflected in leaf development. At 7 and 14 DAT, the number of leaves was relatively similar among treatments, but differences became significant at 21 and 28 DAT. At 21 DAT, silver-black plastic mulch produced the highest number of leaves (7 leaves plant^{-1}), whereas the other treatments produced approximately 6 leaves plant^{-1}. By 28 DAT, rice straw mulch produced the highest number of leaves (18 leaves plant^{-1}), followed by silver-black and black plastic mulch with 16 and 15 leaves plant^{-1}, respectively. The control and *A. pintoi* treatments produced fewer leaves, with 9 and 12 leaves plant^{-1}, respectively. A similar pattern was observed for leaf area, where silver-black and black plastic mulches produced the largest leaf areas (188 and 187 cm^2, respectively), while the control produced the smallest leaf area (158 cm^2). Greater leaf development under plastic mulch may increase the photosynthetically active canopy and subsequently support assimilate production. The observed response is consistent with recent evidence that mulch materials can influence plant height and crop productivity through modifications of soil conditions and weed pressure (Amare & Desta, 2021). Organic straw mulch may provide additional benefits through gradual decomposition and improvement of soil nutrient dynamics, although the magnitude of these effects depends on residue characteristics and environmental conditions (Liu et al., 2023).

Overall, the results indicate that mulch effects on eggplant vegetative growth became more pronounced after the initial establishment period, with silver-black plastic mulch and rice straw mulch showing the most consistent effects on plant height and leaf development. In contrast, *A. pintoi* living mulch did not provide a comparable growth advantage during the early vegetative phase, with plant height and leaf number generally closer to the bare-soil control. Although *A. pintoi* can function as a soil-covering legume, its living biomass may also compete with the main crop for water, nutrients, light, or space, particularly during the early establishment of the eggplant canopy. Therefore, the benefits of living mulch should be considered together with its potential competitive effects on the main crop. Because soil moisture, soil temperature, weed biomass, and resource competition were not directly measured in the present study, these mechanisms should be interpreted as possible explanations rather than direct causal evidence. The results nevertheless suggest that the choice of mulch material is an important management factor influencing the early vegetative development of green eggplant, with the strongest growth responses observed under silver-black plastic and rice straw mulches.

Effects of Mulch Types on Flowering Time and Fruit Characteristics of Green Eggplant

Mulch type had little effect on the timing of flowering in green eggplant. The mean time to flowering ranged from 43.6 to 44.2 days after transplanting (DAT), with the rice straw mulch treatment showing the earliest flowering (43.6 DAT), followed by black plastic mulch and Arachis pintoi living mulch (43.8 DAT), silver-black plastic mulch (44.0 DAT), and the bare-soil control (44.2 DAT) (Table 2). The narrow difference of only 0.6 days among treatments indicates that the onset of flowering was relatively stable regardless of the mulch type. Thus, under the conditions of this experiment, mulch application did not substantially alter the transition from vegetative to reproductive growth. Similar findings have been reported in eggplant, in which the effects of different mulch treatments on growth and yield components were dependent on the specific cultivar, mulch material, and environmental conditions (Bagele et al., 2022; Saeid et al., 2021). The timing of flowering may also be influenced more strongly by plant genotype and environmental conditions than by soil surface management when the differences in root-zone conditions among treatments are relatively small.

Table 2. Effects of mulch types on flowering time and fruit characteristics of green eggplant

Mulch Types	Time to Flowering (DAT)	Fruit Weight (g fruit^{-1})	Fruit Diameter (mm)	Fruit Length (cm)
Control	44.2	78.22	35.89 a	16.36
Silver-black plastic	44.0	81.00	35.56 bc	16.62
Black plastic	43.8	80.44	35.78 ab	16.54
Rice straw	43.6	76.20	34.99 bc	16.01
A. Pintoi	43.8	76.60	34.93 c	15.72

Note: DAT = days after transplanting. Means followed by different lowercase letters within the same column were significantly different according to Duncan's multiple range test (DMRT) at $p < 0.05$.

The effect of mulch type on fruit characteristics was also generally limited, except for fruit diameter. Mean fruit weight ranged from 76.20 to 81.00 g fruit^{-1}, with silver-black plastic mulch producing the highest numerical value (81.00 g fruit^{-1}), followed by black plastic mulch (80.44 g fruit^{-1}), bare soil (78.22 g fruit^{-1}), *A. pintoi* living mulch (76.60 g fruit^{-1}), and rice straw mulch (76.20 g fruit^{-1}). Fruit length followed a similar pattern, with the longest fruits recorded under silver-black plastic mulch (16.62 cm) and the shortest under *A. pintoi* living mulch (15.72 cm). However, these differences were not statistically significant. In contrast, fruit diameter was significantly affected by mulch type, with the bare-soil control producing the largest diameter (35.89 mm), statistically comparable with black plastic mulch (35.78 mm), whereas *A. pintoi* living mulch resulted in the smallest fruit diameter (34.93 mm). These results indicate that the response of fruit size components to mulching was not uniform. The treatment with the highest numerical fruit weight, silver-black plastic mulch, did not produce the largest fruit diameter. Similar variations in eggplant responses to mulch treatments have been reported, with plastic mulch influencing crop growth and yield components differently depending on mulch colour and growing conditions (Díaz-pérez, 2023; Saeid et al., 2021). Studies using biodegradable mulch films have also demonstrated that mulching can affect eggplant production parameters, including fruit number and average fruit weight, although the magnitude of the response may differ among production environments (Miceli et al., 2024).

The relatively small differences in flowering time and fruit characteristics among treatments may indicate that the effects of mulch observed during vegetative growth did not necessarily translate into proportional changes in reproductive development and individual fruit size. Although silver-black plastic mulch promoted vegetative growth and resulted in the highest numerical fruit weight, its fruit diameter was lower than that of the bare-soil control. This suggests that the effect of mulch on crop performance may depend on the specific developmental component being evaluated. Mulching can modify the soil thermal and moisture environment and consequently influence crop water and nutrient availability, but the resulting effects on flowering, fruit development, and fruit quality may depend on the interaction between mulch characteristics and crop management (Díaz-pérez, 2023; Zhou et al., 2023). Water and nitrogen availability during flowering, fruit set, and fruit development are also important determinants of eggplant yield and fruit quality, indicating that changes in the root-zone environment do not necessarily produce identical responses across all reproductive traits (Zhou et al., 2023). Furthermore, recent research has shown that nutrient management can influence eggplant productivity and fruit quality, emphasizing that fruit development is controlled by multiple interacting factors beyond soil surface management alone (Bana et al., 2022). Because soil temperature, soil moisture, and other microenvironmental variables were not directly measured in this experiment, the mechanisms underlying these responses should be considered as possible explanations rather than direct causal evidence.

Effects of Mulch Types on Fruit Yield and Fruit Number

Mulch type did not significantly affect total fruit yield or fruit number per plant, although numerical differences were observed among treatments (Table 3). The highest total fruit yield was recorded under silver-black plastic mulch (2760.33 g plant^{-1}), followed by black plastic mulch (2561.83 g plant^{-1}), rice straw mulch (2339.67 g plant^{-1}), bare soil (2309.17 g plant^{-1}), and *Arachis pintoi* living mulch (1896.27 g plant^{-1}). A similar numerical pattern was observed for fruit number, with silver-black plastic mulch producing the highest number of fruits (35.03 fruits plant^{-1}), followed by black plastic mulch (31.13 fruits plant^{-1}), rice straw mulch (27.93 fruits plant^{-1}), bare soil (26.83 fruits plant^{-1}), and *A. pintoi* living mulch (24.67 fruits plant^{-1}). Although these differences were not statistically significant, the numerical trends indicate that silver-black plastic mulch tended to support greater fruit production throughout the harvesting period. This tendency may be associated with the greater vegetative growth observed under plastic mulch treatments, particularly the higher plant height, leaf number, and leaf area. A more developed canopy may provide greater photosynthetic capacity to support reproductive growth and fruit production over successive harvests. However, because the differences were statistically non-significant, these numerical trends should not be interpreted as a definitive effect of mulch type on yield. Recent studies have shown that eggplant yield responses to production practices can vary depending on cultivar, environmental conditions, and crop management, with yield being determined by the interaction of several yield components (Kumar et al., 2024; Nyasapoh et al., 2024).

Table 3. Effects of mulch types on flowering time and fruit characteristics of green eggplant

Mulch Types	Total Fruit Yield (g plant^{-1})	Fruit Number (fruits plant^{-1})
Control	2309.17	26.83
Silver-black plastic	2760.33	35.03
Black plastic	2561.83	31.13
Rice straw	2339.67	27.93
A. Pintoi	1896.27	24.67

Note: DAT = days after transplanting

The numerical superiority of silver-black plastic mulch in total fruit yield and fruit number may be related to its ability to modify the soil surface environment and potentially improve the conditions of the crop root zone. Plastic mulches can reduce direct soil evaporation and alter soil temperature, which may contribute to improved water availability and root-zone conditions during crop development. These effects may subsequently support vegetative growth and fruit production, particularly under conditions where soil moisture is a limiting factor (Adamczewska-Sowińska et al., 2022). However, the magnitude of these effects depends on mulch colour, material properties, environmental conditions, and the duration of mulch use (Díaz-pérez, 2023). In the present study, the higher numerical yield under silver-black plastic mulch was consistent with its superior vegetative growth, suggesting a possible relationship between canopy development and cumulative fruit production. Nevertheless, because soil moisture and soil temperature were not directly measured, the proposed mechanisms should be regarded as possible explanations rather than direct causal relationships. Similar studies have reported that mulch materials can influence eggplant yield and fruit production, although the magnitude and statistical significance of the response may vary among production environments (Miceli et al., 2024).

In contrast, *A. pintoi* living mulch resulted in the lowest numerical total fruit yield and fruit number. Although *A. pintoi* has potential as a living ground cover because of its capacity to protect the soil surface and contribute to soil biological processes, competition for water, nutrients, and light during crop establishment may reduce the resources available to the main crop. This possibility is particularly relevant when the living mulch is established before transplanting, as in the present study, where *A. pintoi* was planted 14 days before eggplant transplanting. The lower numerical yield observed under *A. pintoi* living mulch may therefore reflect a balance between the potential benefits of soil coverage and possible competition with eggplant. However, this interpretation requires further verification because competition intensity was not directly quantified in this experiment. Overall, the results indicate that mulch type affected the numerical pattern of fruit production, with silver-black plastic mulch showing the highest cumulative yield and fruit number, whereas *A. pintoi* living mulch showed the lowest values. Nevertheless, the absence of significant differences indicates that none of the mulch treatments could be considered statistically superior in terms of final fruit yield or fruit number under the conditions of this study. Future research should combine yield measurements with observations of soil moisture, soil temperature, weed suppression, and resource competition to clarify the mechanisms underlying the observed responses.

4. Conclusions

The type of mulch influenced the vegetative growth and selected fruit characteristics of green eggplant (*Solanum melongena* L.), but its effects on reproductive development and final productivity were relatively limited. Silver-black plastic mulch and rice straw mulch promoted greater plant height and leaf development than the bare-soil control at several observation periods, while silver-black and black plastic mulches resulted in greater leaf area. Mulch type did not significantly affect the time to flowering, fruit weight, or fruit length. However, fruit diameter was significantly affected, with the bare-soil control producing the largest fruit diameter, whereas *Arachis pintoi* living mulch produced the smallest. Although no significant differences were detected in total fruit yield or fruit number, silver-black plastic mulch showed the highest numerical values for both parameters over 13 harvests, indicating a potential advantage for cumulative fruit production. Overall, silver-black plastic mulch showed the most consistent positive numerical response in vegetative growth and fruit production under the conditions of this study. However, further research is needed to evaluate the effects of mulch types on soil moisture, soil temperature, weed suppression, and resource competition, particularly when using *A. pintoi* as a living mulch, to better explain the mechanisms underlying crop responses and to determine the suitability of different mulch systems for sustainable green eggplant production.

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