Effects of Different Colored-Plastic Mulches on the Growth, Yield and Weed Density in Eggplant (Solanum Melongena L) Production

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ABSTRACT

This study evaluated the effects of different colored plastic mulches on the growth, yield, and weed density of eggplant (Solanum melongena L.). The experiment was conducted from January to May 2025 at Purok 9, Highlander, Baylo, Monkayo, Davao de Oro using a Randomized Complete Block Design (RCBD) with five treatments and three replications: T1 – Control (no mulch), T2 – Black plastic mulch, T3 – Transparent plastic mulch, T4 – Red plastic mulch, and T5 – Black-silver plastic mulch. Data collected included plant height, leaf count, days to first flower initiation, leaf area, fruit count, fruit size, fruit weight, marketable fruits, weed density, and weed classification. Results showed that plastic mulch had no significant effect on plant height during early growth stages. However, significant differences were observed in leaf number and leaf area, with red and transparent plastic mulches producing higher leaf counts and larger leaf areas. In terms of yield, red plastic mulch resulted in higher fruit weight and a greater number of marketable fruits. Plastic mulch treatments significantly reduced weed density compared to the control, with black-silver and black plastic mulches providing the greatest weed suppression. Overall, the study indicates that colored plastic mulches, particularly red mulch, can enhance eggplant growth and yield while effectively reducing weeds, although its higher cost and limited availability may affect adoption by farmers.

Keywords: Eggplant (Solanum melongena L.), colored plastic mulch, growth, yield, weed density, Monkayo Davao De Oro.

INTRODUCTION

Background of the Study

Eggplant (Solanum melongena L.) is one of the most important vegetables in the Philippines. It belongs to the Solanaceae family similar to tomato, pepper, and potato. Native to India, where it is known as 'brinjal,' and internationally known as 'aubergine,' eggplant is called 'talong' (Tagalog), 'tarong' (Ilocano), or 'bringhinas' (Bisaya) in the Philippines. It is cultivated for its immature fruits, which can be roasted, fried, stuffed, pickled, or processed. However, maximizing eggplant production requires effective management of growing condition including soil moisture, temperature and weed competition, all of which significantly affect plant's overall growth, yield quality. Eggplant is also considered one of the most inexpensive and profitable vegetable crops. According to PSA (2021), the net income from eggplant production generally increased from PhP 67,033 in 2015 171, 789 in 2020. This allows farmers and farmworkers, mostly resource-poor (ISAAA, 2020), to generate income from eggplant production.

One of the major problems in eggplant cultivation is weed competition, which competes with the crop for nutrient, water and light, leading to reduced plant growth and yield. Crop-weed competition can result in loss in eggplant production, studies reported that uncontrolled weed growth with eggplant fields can be caused a loss of up to 78% of crop production (Marques et al., 2017). Furthermore, one of the studies reported that weeds reduced yield and quality of eggplant by 67% and 96%, respectively (Almhemed, & Üstüner, 2022). Traditional methods of weed control, such as manual weeding or chemical herbicides, can be labor intensive costly and pose

environmental risk. Therefore, there is a need for an innovative, cost effective solution to improve eggplant growth and reduce weed pressure while maintaining sustainable farming.

Plastic mulching has emerged as a promising solution to address these challenges by covering the soil to make more favorable conditions for plant growth, development, and efficient crop production. Mulch technical term that means 'covering of soil'. Covering the soil with plastic film, and mulches can help suppress weed growth. More interestingly, the color of plastic mulch has been shown to influence its effectiveness. Different colored plastic mulches can alter the light environment around plants, affecting photosynthesis, microclimate conditions and the overall growth and yield of crops. Plastic mulches are completely impermeable to water; it therefore prevents direct evaporation of moisture from the soil and thus limits the water losses and soil erosion over the surface. In this manner, it plays a positive role in water conservation. However, there as limited research specifically how in investigating how different colored plastic mulches affects eggplant particularly in terms of yield and weed density (Jambeck et al., 2015; Heidbreder et al., 2019; Kim and An, 2019).

This study aims to evaluate the effect of various colored plastic mulches on the growth, yield and weed density in eggplant. The goal of this research is to address gaps in knowledge regarding the best mulch color for optimizing eggplant productivity and weed control by exploring the interactions between mulch color, plant growth and weed dynamics, for this study seek to provide practical insights for improving eggplant techniques.

Objectives of the Study

The general objective of this study aimed to evaluate the effect of different colored plastic mulches on eggplant growth, yield, and weed density. Specifically aimed to;

1. Evaluate the effects of various colored plastic mulches on the growth parameters of eggplants such as plant height, number of flowers, leaf counts, and leaf area.
2. Determine the impact of colored plastic mulches on the eggplant yield component, including the fruit count, size, weight, and marketable fruits.
3. Assess the weed-suppressing efficacy of different colored plastic mulches.
4. Identify and classify the predominant weed species that emerge under different colored plastic mulches used in eggplant cultivation.

METHODOLOGY

Location and Duration of the Study

The study was conducted at Purok 9, Highlander, Baylo, Monkayo, Davao de Oro. The study lasted from January to May 2025.

Experimental Design and Treatments

The study employs a randomized complete block design (RCBD) with 5 treatments, 3 replications, and 5 samples per replication a total of 75 samples of eggplant. The treatment groups consist of different colored plastic mulch as follows:

T1 - Control (no mulch applied)

T2 - Black Plastic mulch

T3 - Transparent Plastic mulch

T4 - Red Plastic mulch

T5 – Silver-Black Plastic mulch

Soil Sample Collection and Soil Analysis

Soil samples were gathered from the chosen study site. Ten (10) sampling spots were marked across the field to capture differences in soil properties. At each spot, soil was taken from the top 0–30 cm layer using a shovel. These samples were mixed together to form one composite sample, then were placed in labeled bags. The samples were air-dried, ground, and sieved through a 2 mm mesh for laboratory analysis. The sample was sent to the soil laboratory in Magro, Monkayo, Davao de Oro.

Mulching Material

The mulching materials to be used include black, transparent, red, and silver-black mulch with a thickness of 40 microns. The plastic mulch was sourced from the hardware store.

Planting Material

The Calixto King F1 was used as the experimental planting material. The seeds of this variety were sourced from the Agrivet supply store. This high-yielding eggplant variety matured early, reaching harvest readiness 45–50 days after transplanting. It featured long, glossy, slender fruits with a long shelf life.

Land Preparation and Plot Layout

The study site was cleared of any debris, weeds, and previous crop residue. The soil was plowed and harrowed to create a fine, level surface conducive to even plant growth and mulch application. A plot layout was designed with uniform plots, each assigned to a specific color of plastic mulch treatment. Each plot had a uniform size with a 1-meter width and 4-meter length at 15 cm high. The space between plots was 0.5 meters apart.

Mulch Application

The mulch sheets were cut to fit each plot size, leaving space at the edges for securing. Mulch was spread tightly over the soil surface, with the edges buried or pinned down to prevent it from being displaced by wind. Circular holes were cut into the mulch at an equal distance of 50 cm apart for the planting of the eggplant seedlings. The spacing of these holes aligned with the crop requirement.

Seedling Preparation

Seeds were sown in seedling trays filled with a well-drained and nutrient-rich growing medium, such as a mix of compost and coco peat. Each seedling tray cell held a single seed, planted at a depth of 0.25 inch and lightly covered with a growing medium. The tray was placed in a nursery area with partial shade to provide a controlled environment for germination. Regular watering was done to keep the growing medium moist but not waterlogged. After approximately 4–6 weeks, or when the seedlings had 4–6 true leaves, they were hardened by gradually exposing them to outdoor conditions for one week. Once hardened, the seedlings were ready for transplanting into the plots covered with the respective colored mulches.

Transplanting

Eggplant seedlings were carefully transferred from the nursery to the prepared field plots covered with different colored plastic mulches. Transplanting took place during the late afternoon to reduce transplant shock from sun exposure. Eggplant seedlings were gently removed from the tray to avoid root damage and then placed into the designated holes within each mulch-covered plot. The soil was pressed firmly around the base, and watering followed immediately to help the seedlings establish in their new environment.

Fertilizer Application

The type and rate of fertilizer applied were based on the results of the soil analysis to ensure that the nutrient

requirements of the crop were adequately supplied. The recommended fertilizer rate was 80-80-30 kg ha^{-1} of nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O), respectively. During the first application, the entire amount of phosphorus and potassium fertilizers, together with one-half of the recommended nitrogen fertilizer, was applied in the furrow at transplanting. The second application consisted of side-dressing with one-fourth of the nitrogen fertilizer one month after transplanting. The remaining one-fourth of the nitrogen fertilizer was applied immediately after the second picking of marketable fruits through side-dressing to sustain plant growth and fruit production during the later stages of cropping.

Table 1. Soil Analysis Result

N	P	K	Soil pH
1.075	7ppm	0.8	5.8

Pruning

Pruning played a crucial role in maximizing the growth, yield, and overall health of eggplants by enhancing air circulation, reducing disease risk, and improving fruit quality. During the seedling stage, approximately 3–4 weeks after transplanting, initial pruning involved removing weak or damaged leaves to ensure nutrients were directed toward healthier growth.

Suckers, or small shoots emerging from the plant's base, were also trimmed to promote strong stem development. As the plant entered the early vegetative stage, around 30–40 days after transplanting, structural pruning focused on selecting and maintaining two to three main stems while removing excess shoots. Additionally, low-hanging branches that touched the soil were cut off to prevent disease, and the first flower was pinched off to encourage vegetative growth before fruit production began.

Watering

Each eggplant plot was irrigated by hand using a watering can. Water was applied directly at the base of each plant. During the initial week after transplanting, daily watering was required to support seedling establishment. Once the plants were established, watering was adjusted depending on the weather and soil moisture level.

Pest and Diseases Management

The study area was regularly monitored for any pests or diseases that could affect the experimental plants. Any pests were removed by hand when spotted, and recommended pesticides were applied only when necessary to control infestations, taking care to protect plant health and growth.

Harvesting and Postharvest Operations

Eggplants were harvested at their marketable maturity stage, typically when they reached full size, had a glossy appearance, and a firm texture. The optimal harvesting stage varied by cultivar but generally occurred 46–50 days after transplanting. Eggplants were harvested using sharp pruning shears or knives to avoid damaging the plant and fruit. A short portion of the stem (calyx) was left attached to extend shelf life and maintain quality. Fruits were harvested twice a week to ensure continuous production and prevent over-maturity, which affects marketability.

Immediately after harvesting, eggplants were sorted based on size, shape, color, and absence of defects (such as bruises, insect damage, or over-ripeness). Grading categories followed standard market classifications. Eggplants were packed in well-ventilated plastic crates or bamboo baskets to prevent bruising and physical damage.

Data Gathered

Plant Height

The height of the eggplant was measured from the soil level at the base of the stem to the tip of its main growing point, usually the plant's apex, and recorded in centimeters (cm). Measurements began on the 7th day after transplanting (DAT) and were conducted at weekly intervals until the first flower initiation. The data collection process encompassed a total of five samples per replication.

Leaf Counts

The number of leaves per eggplant was determined by visually inspecting each plant and counting only the healthy leaves. All leaves present on a single plant were tallied while excluding diseased or damaged ones. This process began on the 7th day after transplanting (DAT) and was repeated at weekly intervals until the first flower initiation. The data collection process encompassed a total of five samples per replication.

Number of Days of the First Flower Initiation

The transplanting date was recorded, and sample plants were monitored daily to identify the emergence of the first visible flower bud. The total number of days from transplanting to the initiation of the first flower was recorded for each sample plant.

Leaf Area

The measurement of leaf area focused on selecting the largest fully functional leaf from each sample plant to ensure an accurate representation of leaf development. The surface area of the selected leaf was measured and expressed in square centimeters (cm^2). Leaf size was determined by recording the length and width of the chosen leaf and calculating its area. Data collection began on the 7th day after transplanting (DAT) and was conducted at 7-day intervals until first flower initiation. A total of 15 samples per treatment were evaluated, with each set consisting of five samples per replication to ensure data consistency and reliability.

Fruit count

Data collection began once the eggplants reached fruiting maturity. During each harvest period, the total number of fruits per plant was manually counted and recorded. This process was carried out over four (4) harvest periods to accurately capture the average fruit yield per plant. Only fully developed and harvestable fruits were included in the count to assess the effects of different colored plastic mulches on fruit production.

Fruit size

Fruit size was collected by selecting a representative fruit from each sample plant, specifically the largest fruits, to ensure consistency. Measurements were conducted using a caliper to determine both the fruit's length and diameter. The measurement of fruit size was performed at each harvest period, and there were four (4) harvest periods to capture the average fruit size.

Fruit weight

At each harvest interval, mature fruits per sample plant were carefully collected, and their weight was measured using a digital scale for precision. Weighing was conducted over four (4) harvest periods to capture the average fruit weight.

Marketable Fruits

The collection of marketable fruit data began once the eggplants reached harvest maturity. During each harvest period, fruits were manually harvested, and only those meeting market standards—fully developed, uniform in size, free from deformities, and undamaged—were counted and recorded. The process continued over four (4) harvest periods to determine the total yield of marketable fruits per plant.

Weed Counts

At the termination of the study, weed density was assessed to determine the effectiveness of different colored plastic mulches in suppressing weed growth. Weed density was measured by counting the total number of weeds present within each treatment plot. The weeds were manually uprooted, and only those emerging within each treatment plot area were recorded.

Weed Classification

At the termination of the study, weed classification was conducted to determine the dominant weed species in each treatment plot. Weeds were collected from each plot and categorized based on their morphological characteristics, classifying them into major groups such as broadleaf, grasses, and sedges. The total number of weeds in each category was counted to identify the most prevalent weed types.

Statistical Analysis

Data were analyzed using analysis of variance (ANOVA) in a randomized complete block design (RCBD), and significant differences between treatment means were compared using Least Significant Difference (LSD). The software that was used was the Statistical Tool for Agricultural Research (STAR).

RESULTS AND DISCUSSIONS

Plant Height

Table 2 presents the effect of different colored plastic mulches on the plant height of eggplant at 7, 14, 21, and 28 days after transplanting (DAT). Results indicate that plant height was not significantly influenced by mulch color at all observation periods. Although slight numerical differences were observed among treatments, these variations were not statistically significant, suggesting that mulch color had minimal effect on early vegetative growth in terms of height.

Table 2. Plant Height of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches.

TREATMENTS	**PLANT HEIGHT**			
Colored Plastic Mulch	**(7 DAT)^{ns}**	**(14 DAT)^{ns}**	**(21 DAT)^{ns}**	**(28 DAT)^{ns}**
T1- Control	7.63	10.90	20.10	34.73
T2- Black	7.93	10.67	19.00	34.80
T3- Transparent	8.17	11.80	20.43	34.80
T4- Red Plastic	8.27	11.70	18.70	33.40
T5- Black-Silver	7.90	10.63	18.09	31.80
CV%	**9.66**	**4.77**	**7.24**	**8.49**
Pr(> F)	**0.8633**	**0.0655**	**0.2949**	**0.6543**

** highly significant at 1% level *significant at 5% level ns- not significant. Same letter superscript means not significant.

Mean plant height ranged from 7.63–8.27 cm at 7 DAT, 10.63–11.80 cm at 14 DAT, and 18.09–20.43 cm at 21 DAT. At 28 DAT, the highest height (34.80 cm) was observed in black and transparent mulches, while black-

silver mulch had the lowest (31.80 cm). Although numerical differences existed, they were not statistically significant, indicating that mulch color had little effect on early plant height. Vegetative growth at early stages was likely influenced more by environmental conditions and varietal traits than by the type of plastic mulch used.

Plastic mulching can improve plant growth due to it modifies the soil environment by conserving soil moisture, regulating temperature, and reducing weed competition. However, some studies reported that mulching does not always significantly affect early vegetative growth such as plant height depending on environmental conditions and crop stage (Barreto, 2024). Similarly, mulching helps improve soil conditions and plant development by maintaining favorable soil temperature and moisture, which can support plant growth and yield in vegetable crops (Dhatt et al., 2018).

Wang et al., (2025) asserted that acidic soil significantly reduces nutrient absorption in eggplant, affecting growth parameters like height, with soil pH levels between 6.0 and 4.5 showing decreased nutrient uptake capacity. Furthermore, according to Alabdallah et al., (2021) Drought stress significantly reduces plant height in eggplant by limiting key growth processes. When water becomes scarce, plants struggle to maintain normal development, resulting in shorter and weaker growth.

In eggplant specifically, mulching treatments have been observed to influence plant growth parameters such as plant height, leaf number, and branching, primarily since mulches help maintain optimal soil moisture and temperature conditions that support plant development (Singh et al., 2023).

Leaf Counts

Table 3 presents the leaf count of eggplant (Solanum melongena L.) grown under different colored plastic mulch treatments measured at 7, 14, 21, and 28 days after transplanting (DAT). The results show that mulch color influenced leaf development during the crop's early growth stages.

Table 3. Leaf Count of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches.

TREATMENTS	**LEAF COUNT**			
Colored Plastic Mulch	**(7 DAT)^{ns}**	**(14 DAT)^{ns}**	**(21 DAT)^{ns}**	**(28 DAT)****
T1- Control	4.93	5.80	7.33	10.80^{a}
T2 - Black	4.60	5.40	6.47	9.47^{b}
T3- Transparent	4.80	6.00	7.53	11.07^{a}
T4- Red	4.93	5.87	7.33	11.60^{a}
T5- Black-Silver	4.73	5.40	7.00	11.07^{a}
CV%	**2.80**	**6.68**	**6.28**	**6.37**
Pr(> F)	**0.0692**	**0.2659**	**0.1144**	**0.0439**

The number of leaves was similar across treatments at 7, 14, and 21 DAT (4.60–4.93, 5.40–6.00, and 6.47–7.53, respectively). At 28 DAT, significant differences were observed, with red mulch producing the most leaves (11.60), followed by transparent (11.07), black-silver (11.07), control (10.80), and black mulch (9.47). These results indicate that mulch color had little effect on leaf production during early growth, but at later stages, red, transparent, and black-silver mulches promoted higher leaf production compared to black mulch.

These results agree with previous studies indicating that plastic mulches improve vegetative growth in eggplant by modifying the soil microclimate and maintaining soil moisture, which promotes better leaf development and plant vigor. Midhula et al. (2026) reported that eggplant plants grown with plastic mulch produced higher leaf numbers and better growth due to improved soil moisture and temperature conditions compared with non-mulched plots. Similarly, Subedi et al. (2022) found that mulching materials significantly increased the number of leaves per plant in brinjal, with black-silver mulch producing the highest leaf number due to favorable soil conditions that enhance vegetative growth.

In addition, Dhatt et al. (2018) reported that plastic mulch treatments increased vegetative growth parameters such as plant height and leaf number in brinjal since mulching improves soil temperature and moisture availability, creating favorable conditions for plant development.

Leaf Area (cm^2)

Table 4 presents the leaf area of eggplant as affected by different colored plastic mulches at 7, 14, 21, and 28 days after transplanting (DAT). The results show that mulch treatments influenced leaf area during the early stages of growth.

Table 4. Leaf Area ($Cm^{2)}$ of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches.

TREATMENTS	**LEAF AREA (cm^2)**			
Colored Plastic mulch	**(7 DAT)****	**(14 DAT)^{ns}**	**(21 DAT)****	**(28 DAT)****
T1- Control	55.10^{b}	96.77	298.27^{ab}	428.70^{ab}
T2 - Black	44.33^{d}	79.30	196.87^{c}	318.07^{bc}
T3- Transparent	61.30^{a}	134.50	330.33^{a}	470.37^{a}
T4- Red	50.53^{c}	112.73	256.23^{b}	376.13^{abc}
T5- Black-Silver	44.60^{d}	90.87	259.17^{b}	340.77^{c}
CV%	**1.94**	**28.85**	**11.05**	**20.29**
Pr(> F)	**0.0000**	**0.2580**	**0.0054**	**0.0395**

** highly significant at 1% level *significant at 5% level ns- not significant. Same letter superscript means not significant**.**

At 7 DAT, the transparent plastic mulch (T3) produced the largest leaf area (61.30 cm^2), while the black plastic mulch (T2) and black-silver mulch (T5) recorded the smallest values. At 14 DAT, differences among treatments were observed but were less pronounced. At 21 DAT, the transparent plastic mulch (T3) again produced the highest leaf area (330.33 cm^2), while the black plastic mulch (T2) had the smallest value (196.87 cm^2). By 28 DAT, the transparent mulch (T3) still recorded the largest leaf area (470.37 cm^2), whereas the black plastic mulch (T2) produced the lowest leaf area.

The larger leaf area observed in plants grown under transparent plastic mulch (T3) suggests that this mulch type created a more favorable microclimate for early vegetative growth of eggplant. Transparent mulch can increase soil temperature and improve soil moisture conservation, which enhances leaf expansion and plant growth. According to Kader et al. (2020), plastic mulching improves soil moisture retention and regulates soil temperature, which promotes vegetative growth and better leaf development in vegetable crops.

The increased leaf area may also be associated with improved light reflection and soil warming around the plant canopy. These conditions enhance photosynthetic activity, allowing plants to produce larger leaves and accumulate more biomass. Similarly, Amare and Desta (2021) reported that colored plastic mulches significantly influence plant growth by modifying soil microclimate conditions and improving nutrient availability.

Furthermore, the generally smaller leaf area observed in the black plastic mulch (T2) treatment may be related to excessive heat absorption by the mulch, which can sometimes limit early vegetative growth in certain environmental conditions. Studies by Díaz-Pérez (2022) explained that mulch color affects soil temperature dynamics and can influence plant growth responses depending on crop type and climatic conditions.

Additionally, Hou et al., (2019) pointed that plastic mulch has the potential of increasing leaf area index by 59 per cent to 73.7 per cent where plants are able to absorb more sunlight and conduct photosynthesis more effectively. This enhances better growth which supports increased grain production and increase water-use efficiency which makes crops utilize better what is available to it and yield larger and more healthier harvests.

Number of Days to Flower

Table 5 shows the number of days to first flowering of eggplant (Solanum melongena L.) grown under different colored plastic mulch treatments. The data present the effect of mulch color on the flowering response of eggplant plants during the reproductive stage.

Table 5. Number of Days to First Flowering of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches.

TREATMENTS	**NUMBER OF DAYS TO FLOWER**			
Colored Plastic Mulch				**ns**
T1- Control				29.00
T2 - Black				30.27
T3- Transparent				28.87
T4- Red				28.67
T5- Black-Silver				29.60
CV%	**-**	**-**	**-**	**2.15**
Pr(> F)				**0.0754**

** highly significant at 1% level *significant at 5% level ns- no significant. Same letter superscript means not significant**.**

All treatments flowered uniformly at 7, 14, and 21 DAT. Slight variations were observed at 28 DAT, where red mulch produced the earliest flowering (28.67 days), while black mulch showed the latest (30.27 days). However, the differences were not statistically significant, indicating that mulch color had minimal influence on flowering time in eggplant. This suggests that flowering was more affected by genetic characteristics and environmental conditions than by mulch-induced changes in soil temperature and moisture. Similar findings were reported by Sokombela et al. (2025), who observed that mulch color affected vegetative growth but had little effect on flowering time. Nothmann (2019) also emphasized that temperature strongly influences eggplant flowering, with warmer conditions promoting earlier flowering. Furthermore, Lee et al. (2023) explained that environmental stresses such as drought and salinity may delay floral initiation, while improved soil moisture and temperature under plastic mulch can enhance plant growth and accelerate crop development (Kasirajan & Ngouajio, 2017; Lamont, 2017).

Fruit Weight

Table 6 presents the fruit weight of eggplant (Solanum melongena L.) grown under different colored plastic mulch treatments during the first, second, and third harvest periods. The data illustrate the influence of mulch color on fruit development and yield performance of eggplant.

Table 6. Number of Days to First Flowering of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches.

TREATMENTS **Colored Plastic Mulch**	**NUMBER OF DAYS TO FLOWER**			
				ns
T1- Control				29.00
T2 - Black				30.27
T3- Transparent				28.87
T4- Red				28.67
T5- Black-Silver				29.60
CV%	**-**	**-**	**-**	**2.15**
Pr(> F)				**0.0754**

** highly significant at 1% level *significant at 5% level ns- not significant. Same letter superscript means not significant**.**

Fruit weight was significantly affected by colored plastic mulches during the second and third harvests, but not during the first harvest. In the second harvest, black-silver mulch produced the highest fruit weight, followed by red mulch, while the control had the lowest yield. This may be due to improved soil moisture retention, nutrient availability, and soil temperature under mulching, which enhanced fruit development (Kasirajan & Ngouajio, 2017; Liu et al., 2020).

A reversal in performance was observed between harvests, where red mulch produced higher fruit weight during the second harvest, while black mulch recorded the highest fruit weight during the third harvest. This indicates that mulch color effectiveness varies with crop stage and environmental conditions. Red mulch may stimulate earlier fruiting through enhanced light reflection, whereas black mulch improves soil temperature and nutrient uptake during later harvests (Franquera & Mabesa, 2016; Lamont, 2017). The lower fruit weight in the control further highlights the importance of mulching in improving eggplant yield and growth performance (Ilyas et al., 2021).

Fruit Counts

Table 7 presents the fruit count of eggplant (Solanum melongena L.) grown under different colored plastic mulch treatments during the first, second, and third harvest periods. The data illustrate the influence of mulch color on the number of fruits produced by the plants.

Table 7. Fruit Count of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches During Three Harvest Periods.

TREATMENTS		**FRUIT COUNT**	

Colored Plastic Mulch	1st Harvest**	2nd Harvest**	3rd Harvest*
T1- Control	1.07[b]	2.07[c]	2.67[b]
T2 - Black	1.87[a]	3.13[b]	3.73[a]
T3- Transparent	1.97[a]	3.40[ab]	3.60[a]
T4- Red	1.80[a]	3.53[ab]	3.60[a]
T5- Black-Silver	1.77[a]	3.67[a]	3.67[a]
CV%	**12.99**	**8.45**	**3.81**
Pr(> F)	**0.0188**	**0.0005**	**0.0000**

** highly significant at 1% level *significant at 5% level ns- not significant. Same letter superscript means not significant**.**

Table 7 shows that colored plastic mulches significantly affected the number of fruits per plant in all three harvests. In the first and second harvests, transparent and black-silver mulches produced the highest fruit numbers, while the control had the lowest. In the third harvest, all mulched treatments yielded more fruits (5.60–5.73) than the control (4.53). These results indicate that colored plastic mulches effectively increased fruit production compared to the control across harvest periods.

The increased fruit count in plastic-mulched treatments indicates that these mulches improved soil conditions such as temperature regulation and moisture retention, which promote better flowering and fruit development. Colored plastic mulches also reduce weed competition and create a more favorable environment for plant growth, leading to increased fruit production. This result is consistent with the findings of Yadav et al. (2023), who reported that plastic mulches enhanced fruit set and overall yield in solanaceous vegetables.

Colored plastic mulches, particularly black-silver and black types, consistently increase eggplant fruit production across harvest periods by improving soil temperature regulation, conserving moisture, and suppressing weed growth. These conditions reduce competition for water and nutrients, resulting in better plant growth and higher fruit yield. This aligns with findings that plastic mulching enhances yield performance in eggplant cultivation (Mishra et al., 2020; Betageri et al., 2018).

Fruit Size (Length & Diameter)

Table 8 shows the fruit size of eggplant in terms of length and diameter as affected by different colored plastic mulch treatments during the three harvest periods. The results indicate that mulch color influenced fruit length, while fruit diameter showed only minimal variation among treatments.

Table 8. Fruit Size (Length-Diameter) of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches During Three Harvest Periods.

TREATMENTS Colored Plastic Mulch	FRUIT SIZE (LENGTH & DIAMETER)					
	1st Harvest* Length	Diameter	2nd Harvest** Length	Diameter	3rd Harvest** Length	Diameter
T1- Control	14.98[c]	3.52	15.26[b]	3.63	15.26[c]	3.52[c]
T2 - Black	15.17[b]	3.53	15.47[a]	3.62	15.44[ab]	3.63[ab]

T3- Transparent	15.19[b]	3.53	15.46[a]	3.61	15.40[b]	3.61[b]
T4- Red	15.35[a]	3.57	15.47[a]	3.61	15.46[a]	3.61[ab]
T5- Black-Silver	15.20[ab]	3.58	15.52[a]	3.58	15.48[a]	3.67[a]
CV%	**0.55**	**1.09**	**0.34**	**0.84**	**0.18**	**0.97**
Pr(> F)	**0.0078**	**0.2859**	**0.0023**	**0.3604**	**0.0001**	**0.0077**

** highly significant at 1% level *significant at 5% level ns- not significant Same letter superscript means not significant.

During the first harvest, the red plastic mulch (T4) produced the longest fruits with a mean length of 15.35 cm, while the control treatment (T1) recorded the shortest fruit length at 14.98 cm. Fruit diameter ranged from 3.52 to 3.58 cm, showing minimal variation among treatments. In the second harvest, the black-silver mulch (T5) produced the longest fruits with a mean length of 15.52 cm, whereas the control treatment again recorded the lowest value at 15.26 cm. Similarly, fruit diameter remained relatively uniform across treatments. During the third harvest, the black-silver mulch (T5) and red mulch (T4) treatments produced the longest fruits and slightly larger diameters, while the control (T1) consistently recorded the smallest values. Overall, the application of colored plastic mulches slightly improved fruit size compared with the control treatment.

The results suggest that the use of plastic mulch enhanced fruit size by creating more favorable growing conditions for the plants. Plastic mulches help conserve soil moisture, regulate soil temperature, and reduce weed competition, which support improved plant growth and fruit development. These favorable conditions enable plants to allocate more resources toward fruit enlargement, resulting in larger and healthier fruits.

These findings are consistent with the results reported by Manengkey et al., (2022) who stated that the use of plastic mulch can enhance fruit length and overall size compared with straw mulch and bare soil due to improved soil moisture conservation and effective weed suppression. Likewise, Saini et al. (2026) explained that mulching, particularly plastic mulching, improves fruit production by maintaining soil moisture and reducing plant stress, which ultimately results in larger and longer fruits.

Studies conducted on other fruit crops also support these findings. Beelagi et al., (2023) reported that plastic mulch increased the length and size of pomegranate fruits by improving soil moisture retention and regulating soil temperature. Similarly, Abhivyakti and Kumari., (2017) observed that mulching improved fruit diameter by providing favorable growing conditions that allowed plants to produce larger and smoother fruits. Furthermore, Kafle et al. (2023) found that plastic mulch promotes the development of larger and more marketable fruits by conserving soil moisture and minimizing weed competition.

According to Steinmetz et al., (2016) plastic mulch also improves fruit quality and diameter by maintaining soil moisture, suppressing weeds, and creating a more favorable environment for plant growth. Overall, the results of the present study indicate that the use of colored plastic mulches, particularly red and black-silver mulches, can enhance the fruit size of eggplant, thereby improving fruit quality and marketability.

Marketable Fruits

Table 9 presents the number of marketable fruits of eggplant (Solanum melongena L.) grown under different

colored plastic mulch treatments during the first, second, and third harvest periods. The table illustrates the effect of mulch color on the production of fruits suitable for market sale.

Table 9. Number of Marketable Fruits of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches During Three Harvest Periods.

TREATMENTS Colored Plastic mulch	**MARKETABLE FRUITS**		
	1st Harvest*	**2nd Harvest****	**3rd Harvest****
T1- Control	1.00[b]	1.27[d]	1.73[b]
T2 - Black	1.40[a]	2.53[c]	3.00[a]
T3- Transparent	1.47[a]	2.73[bc]	2.80[a]
T4- Red	1.40[a]	2.87[ab]	2.80[a]
T5- Black-Silver	1.40[a]	3.00[a]	2.80[a]
CV%	**11.29**	**5.31**	**6.67**
Pr(> F)	**0.0301**	**0.0000**	**0.0001**

** highly significant at 1% level *significant at 5% level ns- not significant. Same letter superscript means not significant**.**

Table 9 shows that colored plastic mulches had no significant effect on the number of marketable fruits during the first harvest. However, significant differences were observed in the second and third harvests. In the second harvest, black-silver mulch produced the highest marketable fruits (3.40), followed by red, transparent, black, and the control. In the third harvest, black mulch produced the highest number (3.53), followed by black-silver, red, transparent, and the control. These results indicate that colored plastic mulches, particularly black and black-silver, improved fruit yield and quality compared to the control during later harvests.

The increase in marketable fruits in mulched treatments can be attributed to the improved growing environment provided by plastic mulches. Plastic mulches help conserve soil moisture, regulate soil temperature, and suppress weed growth, which promotes healthier plant development and improves fruit quality. These favorable conditions allow plants to produce fruits that are more uniform, less damaged, and suitable for market. Similar findings were reported by Indhumathi et al. (2020), who stated that plastic mulching improves both the quality and productivity of fruits by creating better growing conditions for plants. With reduced weed competition and stable soil moisture, plants are able to produce healthier and more uniform fruits that are more marketable.

Furthermore, McIntosh et al. (2023) reported that the use of plastic mulches can significantly increase the yield of marketable fruits, ranging from 33–139%, while reducing the production of unmarketable fruits by 40–71%. This improvement is partly due to reduced pest infestation and improved plant health, which contribute to better fruit development.

Plastic mulching also enhances fruit quality by promoting better color development, uniform fruit shape, and reducing fruit damage such as sunburn or physical defects. According to Guerra et al. (2024), these improvements result in higher-quality produce that is more acceptable and profitable in the market.

Non-Marketable Fruits

Table 10 presents the number of non-marketable fruits of eggplant (Solanum melongena L.) grown under

different colored plastic mulch treatments during the first, second, and third harvest periods. This table shows how mulch color affected the production of fruits that did not meet market standards.

Table 10. Number of Non-Marketable Fruits of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches During Three Harvest Periods.

TREATMENTS **Colored Plastic mulch**	**NON-MARKETABLE FRUITS**		
	1st Harvest^{ns}	**2nd Harvest^{ns}**	**3rd Harvest^{ns}**
T1- Control	0.2000	0.8000	0.9333
T2 - Black	0.2000	0.6000	0.7333
T3- Transparent	0.3333	0.5333	0.8667
T4- Red	0.4000	0.6667	0.7333
T5- Black-Silver	0.2000	0.6667	0.8000
CV%	**28.20**	**26.21**	**11.45**
Pr(> F)	**0.1719**	**0.4609**	**0.1152**

** highly significant at 1% level *significant at 5% level ns- not significant. Same letter superscript means not significant**.**

Table 10 shows that the number of non-marketable fruits per plant was not significantly affected by the different colored plastic mulch treatments across all harvest periods. Non-marketable fruits ranged from 0.00–0.13 in the first harvest, 0.27–0.53 in the second harvest, and 0.20–0.60 in the third harvest. Although numerical differences were observed, they were not statistically significant, indicating that mulch color had little effect on fruit quality. Overall, most fruits in all treatments were marketable with minimal defects throughout the cropping period.

Although the treatments were not statistically significant, the results indicate that plots with plastic mulch generally produced fewer non-marketable fruits compared with the control in some harvest periods. This suggests that plastic mulches may help improve fruit quality by creating a more favorable growing environment for eggplant plants. The use of plastic mulch can reduce the number of non-marketable fruits by suppressing weeds, conserving soil moisture, and maintaining favorable soil temperature conditions. These improvements support better plant growth and allow fruits to develop more uniformly, increasing their marketability. Similar findings were reported by Ajibola et al. (2019), who stated that plastic mulch enhances fruit quality by improving plant growing conditions and reducing environmental stress that can lead to fruit defects.

In addition, Kelbore et al. (2024) reported that plastic mulching helps maintain soil moisture and improves soil fertility by increasing nitrogen and organic carbon levels in the soil. These improved soil conditions allow plants to produce healthier fruits with better quality and reduced occurrence of non-marketable produce.

Furthermore, Gurbuz et al. (2025) indicated that mulching practices can reduce fruit defects and improve marketable yield by minimizing environmental stress and weed competition in eggplant production systems. As a result, plants grown with mulch tend to produce better-quality fruits with fewer defects.

Weed Counts

Table 11 presents the total weed count observed in eggplant (Solanum melongena L.) plots covered with

different colored plastic mulch treatments. This table shows the effect of mulch color on weed suppression during the cropping period.

Table 11. Weed Count of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches.

TREATMENTS Colored Plastic mulch	**Weed Count****
T1- Control	28.33[a]
T2 - Black	1.13[c]
T3- Transparent	14.47[b]
T4- Red	1.20[c]
T5- Black-Silver	1.20[c]
CV%	**16.73**
Pr(> F)	**0.0000**

** highly significant at 1% level *significant at 5% level ns- not significant Same letter superscript means not significant**.**

Table 11 shows that plastic mulch significantly affected weed density at the 5% level of significance. The highest number of weeds was recorded in the control treatment with 28.33 weeds per plot. In contrast, the lowest weed densities were observed in the plots treated with black, red, and black-silver plastic mulches, which recorded 0.13, 0.33, and 0.20 weeds per plot, respectively. Transparent plastic mulch showed a moderate effect, with 14.47 weeds per plot. These findings indicate that colored plastic mulches, particularly black, red, and black-silver, were highly effective in suppressing weed growth in eggplant cultivation.

Plastic mulches effectively reduce weed growth by blocking sunlight, which inhibits weed seed germination and emergence. This suppression minimizes competition for water, nutrients, and light, allowing crops like eggplant to grow more efficiently. Studies confirm that plastic mulching is a reliable weed management strategy that lowers weed density and biomass while enhancing crop growth and productivity (Maida et al., 2019; Jayalalitha et al., 2020; Dragumilo et al., 2025).

Weed Classification

Table 12 presents the weed density of grass and broadleaf weeds under different colored plastic mulch treatments.

Table 12. Weed Classification of Eggplant (Solanum melongena L.) as Affected by Different Colored Plastic Mulches.

TREATMENT Colored Plastic Mulch	WEED CLASSIFICATION	
	Grass Counts**	Broadleaf Counts**
T1- Control	11.00[a]	17.33[a]
T2 - Black	0.27[b]	1.80[c]
T3- Transparent	2.13[b]	12.33[b]
T4- Red	0.47[b]	1.07[c]
T5- Black-Silver	0.53[b]	1.00[c]

CV%	**28.58**	**23.99**
Pr(> F)	**0.0001**	**0.0000**

** highly significant at 1% level *significant at 5% level ns- not significant Same letter superscript means not significant**.**

The results showed that weed population was significantly affected by the different treatments applied. The control treatment recorded the highest counts of both grass and broadleaf weeds, while the mulched treatments significantly reduced weed density. Grass weed counts in the mulched plots were markedly lower and statistically similar to each other, confirming the strong weed suppression effect of the treatments. Similarly, broadleaf weeds were highest in the control and were greatly reduced in treatments with plastic mulch, particularly in Treatments 2, 4, and 5, which exhibited the lowest weed populations.

These findings indicate that plastic mulching effectively suppresses weed growth by limiting light penetration and creating unfavorable conditions for weed emergence. The absence of mulch in the control plots allowed weeds to grow more freely due to direct sunlight and exposed soil surfaces. Overall, darker-colored plastic mulches demonstrated superior weed control efficiency, supporting previous studies that highlighted their effectiveness in reducing weed density and improving crop competitiveness.

These findings agree with the study of Kader et al. (2019), who reported that plastic mulch significantly reduced weed density by limiting light penetration and disrupting weed emergence. Similarly, Kasirajan and Ngouajio (2017) explained that polyethylene mulches act as an effective weed management tool by creating unfavorable conditions for weed establishment while improving soil moisture retention and crop competitiveness.

The higher weed density observed in the control plots suggests that the absence of mulch allows optimal conditions for weed growth, including direct sunlight exposure and undisturbed soil surface. Treatment 3, which still showed relatively higher weed counts than the other mulched treatments, may have allowed partial light transmission, thus permitting some weed emergence. This supports the findings of Liu et al. (2020), who noted that transparent or light-colored mulches can sometimes promote weed germination when not combined with additional weed-control measures.

Furthermore, the superior performance of Treatments 2, 4, and 5 in controlling both grass and broadleaf weeds aligns with the conclusions of Zhang et al. (2018), who emphasized that darker-colored mulches are more efficient in weed suppression because they absorb light and maintain higher soil temperatures that are unfavorable for weed seedlings.

CONCLUSION

The experiment was a Randomized Complete Block Design (RCBD) consisting of five treatments, including control (without mulch), black plastic mulch, transparent plastic mulch, red plastic mulch, and black-silver plastic mulch, repeated three times. They were collected and measured on plant height, number of leaves, number of days to first flower initiation, leaf area (length and width), fruit size (length and diameter), fruit weight, marketable and non-marketable fruits, weed count, and weed classification. The findings revealed that the color of mulch did not have a significant effect on height of plants and days to flower initiation, which suggested that the early vegetative performance and flowering were largely determined by the varietal characteristics and the environmental factors. In contrast, plastic mulch treatments had a lot of positive influence on the leaf area, fruit size, fruit weight, fruit count and marketable yield especially on the second and third harvest. The number of weeds was significantly lower in all the mulched plots than in the control and this proved the powerful weed-suppressive influence of plastic mulch. The non-marketable fruit production was kept low and statistically equivalent among treatments indicating that the use of mulch increased productivity without raising the number of fruit defects.

The use of colored plastic mulches did not significantly affect eggplant height and flowering time but had a substantial positive impact on yield components and weed management. Black, red, and black-silver plastic mulches showed a consistent increase in the fruit weight, fruit size, number of fruits, and marketable yield compared to control treatment. The large number of weeds reduced in mulched plots also led to better crop performance, as it reduced the competition of nutrients, water, and light. These results verify that plastic mulching is a cultural practice that boosts the productivity of eggplant and also enhances the efficiency of the field management especially when the growing environment is local.

RECOMMENDATION

Plastic mulch is strongly suggested to the eggplant farmers at Monkayo, Davao de Oro, in order to enhance yield and minimize the incidence of weeds. Red plastic mulch was also determined to be highly effective in enhancing the fruit yield and marketable production but due to its inaccessibility in the local market, this method may not be practically applicable in large-scale use. Thus, it can be concluded that black and black-silver plastic mulches should be used as appropriate and more available options since they also offered high yield performance and good weed control. Farmers are advised to use the types of mulch depending on the availability and the cost as well as combine the use of the mulch with the correct application of the fertilization, irrigation, and managing the fields.

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