International Journal of Agricultural Technology 2026 Vol. 22(2):653-662
DOI: https://doi.org/10.63369/ijat.2026.22.2.653-662
Available online http://www.ijat-aatsea.com
ISSN 2630-0192 (Online)

Influence of mulch color on the productivity performance of red-fleshed dragon fruit (*Hylocereus polyrhizus* Britton and Rose)

Dollen, A. T.[1*], Sadio, N. A.[1], Gonzaga, A. B. Jr.[1,2], Gonzaga, N. R.[1], Taylaran, R. D.[1,3] and Harnaiz, L. A.[2]

[1]College of Agriculture, University of Science and Technology of Southern Philippines, Claveria 9004, Philippines; [2]Center of High-Value Crops, University of Science and Technology of Southern Philippines, Claveria 9004, Philippines; [3]Research Division, University of Technology of Southern Philippines, Claveria 9004, Philippines.

Dollen, A. T., Sadio, N. A., Gonzaga A. B. Jr., Gonzaga, N. R. and Taylaran, R. D. (2026). Influence of mulch color on the productivity performance of red-fleshed dragon fruit (*Hylocereus polyrhizus* Britton and Rose). International Journal of Agricultural Technology 22(2):653-662.

Abstract The various color was not significantly affected on the growth parameters. However, black and silver mulches (T_2 and T_3) exhibited highly significant and consistent impacts on yield performance, such as number of flower bud emergence where T_2 (Black) obtained the highest number of 223.13, weight of fruit (T_2 - 503.35 g and T_3 - 490.79 g respectively), and overall fruit yield (t ha-1) where T_3 (41.98 t ha^{-1}) obtained comparable results in T_2 (41.10 t ha^{-1}), resulting in the highest Return on Investment (ROI). Consequently, it is determined that T_3 (Silver) and T_2 (Black) consistently demonstrated yield performance, making them favourable choices for local growers seeking to enhance the productivity and economic returns of red-fleshed dragon fruit cultivation in the region. Adopting black and silver mulches is based on their consistent and comparable positive results on yield performance, which is recommended for local dragon fruit growers in Claveria, Misamis Oriental Agro-ecosystem.

Keywords: Crop management, Mulch color, Red-fleshed dragon fruit, Yield performance

Introduction

The former pitaya genus, *Hylocereus,* is derived from the Greek words "hyle," which means "woody," and "cereus," which means "waxen," while the new genus *Selenicereus* is taken from the Greek term "Selene," which refers to nighttime blooms (Kamran *et al*., 2023). Due to the leather-like texture of the fruit skin, pitaya is also known as pitaya roja in Central America, pitahaya in Mexico, and dragon fruit in Vietnam (Verona-Ruiz, 2020). The red-fleshed dragon fruit (*Hylocereus polyrhizus* Britton & Rose) is a fast-growing evergreen cactus, which reaches up to 1.5 to 2.5 meters in height with leafless, thin vine-

[*]**Corresponding Author:** Dollen, A. T.; **Email:** dollenanthony@gmail.com

like branches (Hossain *et al*., 2021) belongs to the Cactaceae family, genus *Hylocereus*, and is a long-day and diploid tropical plant (Xiong *et al*., 2020). It is now commercially cultivated and widely distributed throughout the tropics and some temperate regions (Nangare *et al*., 2020).

The fruit is fleshy, oblong to ovoid, up to 6-12 cm long, 4-9 cm thick, red with huge bracteoles, pulp red, tasty, embedded with many small black seeds, and it has hermaphroditic flowers – it only opens at night, and nocturnal visitors include nectar-feeding bats and moths, which are important pollinators for this species (Nangare *et al*., 2020). Because of its production and economic importance, this fruit is categorized as a high-value crop and shows a competitive advantage for the local fruit industry (Eusebio and Alaban, 2018). Dragon fruit can handle some shade but may suffer damage from intense sunshine, however in Central and South American countries, it is regarded as a crop that needs full sunlight (Nangare *et al*., 2020).

An increasing number of local growers are using mulch in their orchards to mitigate the effects of extreme temperatures, damaging sunlight, and soil erosion during pitaya growth (Luo *et al*., 2021). The development of polyethylene (PE) as a plastic film in 1938 and its introduction as a plastic mulch for vegetable crop production in the 1950s significantly enhanced commercial crop production (Lamont, 2017).

Mulching is a well-established horticultural practice that involves covering the soil around the base of plants with various materials to modify the microenvironment and promote plant growth. In addition, plastic mulch helps to control weed, insect infestation, and regulate soil temperature, water use effectiveness, plant development, yield, and quality (Amare and Desta, 2021). Plastic mulches with different colors have been developed and utilized in different crop production systems. Furthermore, the choice of mulch color can potentially impact the microclimate around the plant, influencing factors such as soil temperature, moisture retention, weed suppression, and light reflection.

Consequently, the color of mulch may affect the physiological processes, nutrient uptake, and overall growth of red-fleshed dragon fruit, ultimately influencing crop productivity. The plastic colors known today are mainly, black, white, green, brown, red, silver, and blue (Alizadeh, 2016). These colored plastic mulches are utilized in the cropping systems of various plants for a variety of functions. The purpose of the variation of colors is to impact the absorption and reflection of FR: R (far-red to Red) ratios, resulting in phytochrome regulation (Franquera, 2016). Among the factors that can influence mulching effectiveness, the color of the mulch has been gaining attention as a potential determinant of productivity in several fruit crops (Nguyen *et al*., 2020).

The study aimed to evaluate the influence of different mulch colors on the growth and productivity performance of red-fleshed dragon fruit (*Hylocereus polyrhizus*), specifically in terms of flower bud emergence, number of fruits, fruit weight, fruit yield, and return on investment (ROI), to identify the most effective mulch color for enhancing yield and economic returns under Claveria, Misamis Oriental conditions.

Materials and methods

Site details

This study is institutionally funded and was conducted in the experimental area under the Research Office of the University of Science and Technology of Southern Philippines (USTP)—Claveria Campus, Claveria, Misamis Oriental, Philippines. The site is situated at 8º36'39.66 North and 124º52'51.93 East and is 605 meters above sea level (masl).

Treatments

This was laid out following the Randomized Complete Block Design (RCBD), with four treatments and three replications: T_1—control (no mulch), T_2—black mulch color, T_3—silver mulch color, and T_4—clear mulch color.

Cultural management and practices

Five sample posts are assigned in each treatment per replication, so sixty experimental posts were to be covered for the study. A four-year-old bearing red-fleshed dragon fruit was planted on March 19, 2019.

It was planted using the conventional trellising setup, the *mop top system* in which the varied heights of concrete posts with sizes of fifth teen cm in width and fifth teen cm in thickness were buried following the planting distance of three meters between hills and three meters between rows and the used motorcycle tires were linked to the top of each post, and support metals (two pieces) was positioned above horizontally. Four cuttings of cladodes were used as planting materials during planting. The "red-royal" red-fleshed dragon fruit is the specific variety used for the experimental study since it is the variety available in the USTP—Claveria, Campus. Various color of plastic mulch was applied on the soil surface surrounding every post of the dragon fruit. It was applied firmly on the mounted surface to make it secure and done manually. Specifically, three rows were used in this study; each row represents per replication, which contains

twenty- posts; however, only twenty posts were used for this experimental study. Treatments are determined through mulch color which was applied in five (5) consecutive posts. Removal of weeds was usually done on the part that doesn't undergo plastic mulch which is the control (no mulch) in this experimental study. Fertilizer was applied monthly basis staring from March up to November (end of the harvest season) at the suggested rate suitable for the Jasaan series type of soil, N60-P120-K240 kg ha^{-1} (Gonzaga *et al*., 2017). Dragon fruit was harvested 36^{th} day after anthesis, it is usually done in the morning. The fruit is harvested manually using pruning shears to cut the fruit from the cladodes.

Data collection and analysis

The following parameters were gathered: the number of flower bud emergences, the number of fruits, the fruit weight (g), the fruit yield (t ha^{-1}), and the return on investment (ROI). The yield data gathered was analyzed through Analysis of Variance (ANOVA) using STAR Nebula software and the Tukey's Test (HSD) at 5 % was used to test the differences among treatment means.

Results

Number of flower bud emergence

The number of flower bud emergence was highly significant differences among treatments (Figure 1). The maximum number of flower bud emergence was obtained in black color (T_2), which averaged number of 223.13, while clear color (T_4) was recorded as the ^{second} highest, with an average number of 206.73. Silver color (T_3) obtained an average number of 192.40, respectively. The least was observed in control (T_1), which averaged number of 155.67.

Number of fruits

Results revealed that the number of fruits per post was found to be highly significant differences among treatments (Figure 2). It was observed that the black color (T_2) obtained the highest number of fruits, garnering 94.13, and it was also noted that its fruit weight ranked as highest among treatments. Moreover, silver color (T_3) and clear color (T_4) attained 89.80 and 88.66, respectively. Alternatively, the least was observed in control (T_1), which only has 61.87, but its fruit weight was the second highest rank among other treatments.

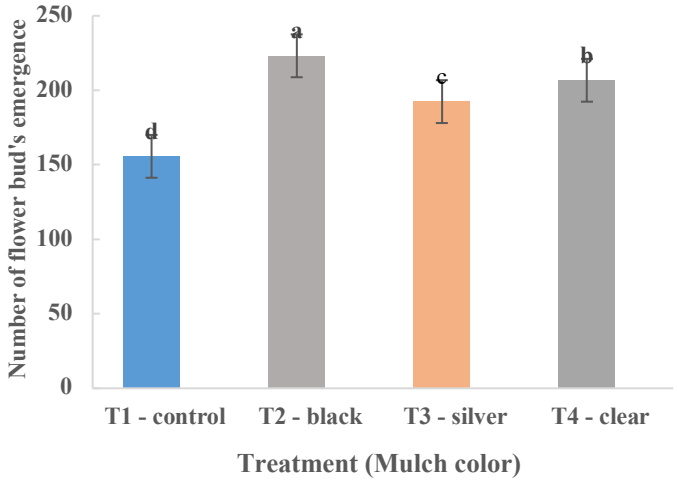

Figure 1. Effect of mulch color on the number of flower bud's emergence of red-fleshed dragon fruit under Claveria, Misamis Oriental condition

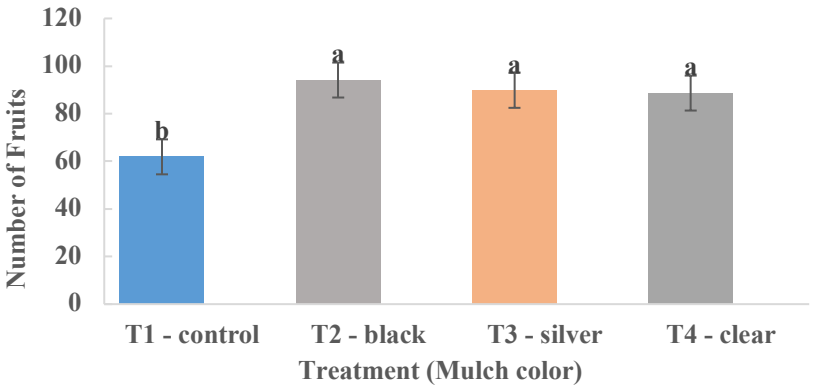

Figure 2. Effect of mulch color on the number of fruits per post of red-fleshed dragon fruit under Claveria, Misamis Oriental condition

Weight of fruit (g)

It was significantly differed among treatments in terms of fruit weight on the yield performance of red-fleshed dragon fruit (Figure 2). The black color (T_2) and silver color (T_3) found consistent results of 503.35 g and 490.79 g which were comparable to control (T_1) attained 449.11 g, respectively. On the other hand, the least was observed in clear color (T_4), attaining 387.49 g.

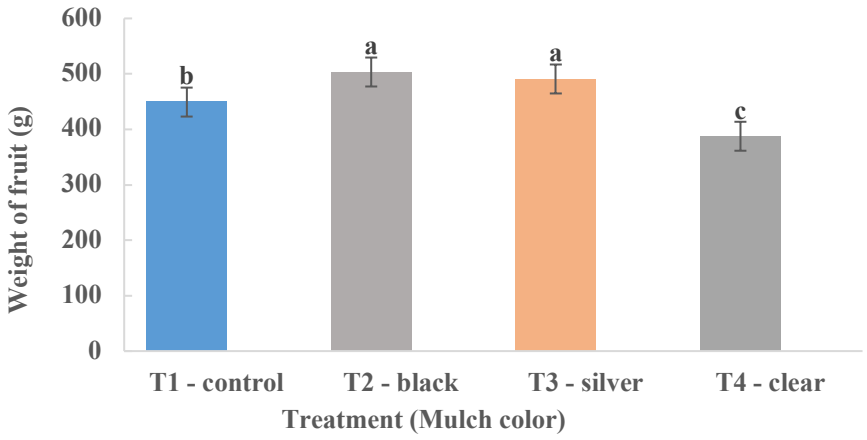

Figure 3. Effects of mulch color on the fruit weight (g) per fruit of red-fleshed dragon fruit under Claveria, Misamis Oriental condition

Fruit yield (t ha^{-1})

Throughout the fruiting season, results showed highly significant differences among treatments. The highest fruit yield was recorded in silver color (T_3), which projected an average of 41.98 t ha^{-1}, followed by black color (T_2), which attained an average of 41.10 t ha^{-1} (Figure 4). Meanwhile, clear color (T_4) gained an average of 35.63 t ha^{-1}, and the least was garnered by control (T_1), with an average yield of 26.40 t ha^{-1}, respectively.

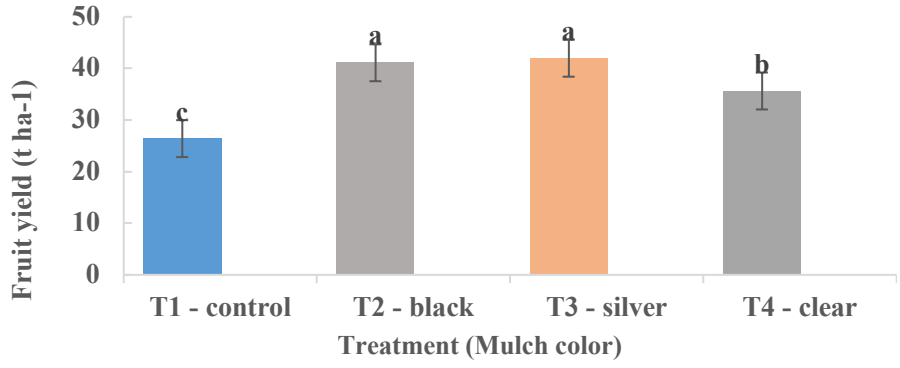

Figure 4. Effects of mulch color on the fruit yield (t ha^{-1}) of red-fleshed dragon fruit under Claveria, Misamis Oriental condition

Return on investment (ROI)

Results showed highly significant differences among treatments (Table 1). The highest number of fruits per post and the total yield t ha^{-1} were observed comparable results in black color (T_2) and silver color (T_3), where the use of black and silver mulch was recorded as the highest computed value of 323.70 percent and 332.84 percent, respectively. This was followed by using clear color (T_4) with the highest number of fruits per post and minimum weight of fruit, resulting in reaching which computed value of 267.32 percent, and control (T_1) generated the lowest computed value of 181 percent.

Table 1. Cost and return analysis of red-fleshed dragon fruit as influenced by various mulch colors

Treatment	Cost of production (Php)	Net income (Php)	ROI %
T_1 – Control	702,960	1,276,790	181.63^{b}
T_2 – Black	727,460	2,354,790	323.70^{a}
T_3 – Silver	727,460	2,421,290	332.84^{a}
T_4 – Clear	727,460	1,944,790	267.34^{a}
CV (%)	-	-	12.00
F-test	-	-	**

Means in a column with the same letters are not significantly different at 5% level using Tukey's test.
** - significant at a level of 1% of probability ($p < .01$)

Discussion

Black and silver color (T_2 and T_3) exhibited highly significant and consistent impacts on yield performance, such as number of flower bud emergence where black color (T_2) obtained the highest number of 223.13, weight of fruit (T_2 - 503.35 g and T_3 - 490.79 g respectively), and overall fruit yield (t ha-1) where T_3 (41.98 t ha^{-1}) obtained comparable results in T_2 (41.10 t ha^{-1}), resulting in the highest Return on Investment (ROI). Consequently, it is determined that silver color (T_3) and black color (T_2) consistently demonstrate yield performance, making them favorable choices for local growers seeking to enhance the productivity and economic returns of red-fleshed dragon fruit cultivation in the region.

The study represents the effects of mulch color on several parameters of red-fleshed dragon fruit. Specifically, it drew a significant impact on the number of flower buds emergence, the number of fruits, fruit weight, fruit yield, and ROI. Sarmah *et al.* (2014) determined that black polyethylene significantly stimulates

plant growth and development (vegetative growth) and also boosts flower output in gerbera plants, either numerically or qualitatively. Mendonca *et al.* (2021) stated that yellow and silver plastic film mulches improved tomato plant development at 40 DAT, whereas green and silver plastic film mulches increased yield and the total number of fruits by 33 and 34%, respectively. Hybrid eggplant states that clear plastic mulch significantly improves fruit length, diameter, and number of fruits/plants, and yield, while black mulch is superior in fruit weight (Saeid *et al.,* 2021). Yadav *et al.* (2023) reports that research into the impacts of reflecting mulch color on return on investment (ROI) in agriculture has yielded positive findings.

Adopting black and silver mulches, based on their consistent and comparable positive yield performance results, is recommended for local dragon fruit growers in Claveria, Misamis Oriental Agroecosystem. Growers should also conduct a thorough economic analysis to assess the feasibility of incorporating these mulches into their cultivation practices.

Acknowledgements

The author would like to recognize and express her gratitude to the University of Science and Technology of Southern Philippines – Claveria campus for the assistance through funding this study from inception to completion.

Conflicts of interest

The authors declare no conflict of interest.

References

Alizadeh, A. (2016). Study of changes in soil moisture and salinity under plastic mulch and drip irrigation in pistachio trees. Journal of Nuts, 7:21-33.

Amare, G. and Desta B. (2021). Colored plastic mulches: impact on soil properties and crop productivity. Chemical and Biological Technologies in Agriculture, 8:1-9.

Eusebio, J. E. and Alaban, M. C. S. (2018). Current status of dragon fruit and its prospects in the Philippines. In Country report, dragon fruit regional network initiation workshop. FFTC Agricultural Policy Platform (FFTC-AP).

Franquera, E. N. and Mabesa, R. C. (2016). Colored plastic mulch effects on the yield of lettuce (*Lactuca sativa* L.) and soil temperature. Journal of Advanced Agricultural Technologies 3:155-159. doi:10.18178/joaat.3.3.155-159

Gonzaga, N. R., Gonzaga, A. B., Taylaran, R. D., Pahinarg, R. T. and Quirino, R. A. (2017). Agronomic performance of red-fleshed "Bloody Mary" dragon fruit (*Hylocereus*

costaricensis Weber) as influenced by different levels of NPK under Claveria, Misamis Oriental condition. Journal of Multidiciplinary Studies, 6:27-46. doi: http://dx.doi.org/10.7828/jmds.v6i2.1043

Hossain, F. M., Numan, S. M. and Akhtar, S. (2021). Cultivation, nutritional value, and health benefits of dragon fruit (*Hylocereus* spp.): A Review. Canadian Journal of Plant Science, 8:259-269. doi:10.22059/ijhst.2021.311550.400

Kamran, S., Chen, J., Chen, J. and Qin, Y. (2023). Pitaya Nutrition, Biology, and Biotechnology: A Review. International Journal of Molecular Sciences 24, 18:13986. https://doi.org/10.3390/ijms241813986

Lamont, W. J. (2017). Plastic mulches for the production of vegetable crops. In: A guide to manufacture, performance and potential plastic agriculture. pp.45-60. https://doi.org/10.1016/b978-0-08-102170-5.00003-8.

Luo, J., Xu, M., Liu, C., Wei, S. and Tang H. (2021). Effects comparation of different mulching methods on soil in pitaya orchards. International Agrophysics, 35:269-278.

Mendonça, S. R., Ávila, M. C. R., Vital, R. G., Evangelista, Z. R., De Carvalho, N. and Dos Reis, A. (2021). The effect of different mulching on tomato development and yield. Scientia Horticulturae, 275:109657. https://doi.org/10.1016/j.scienta.2020.109657

Nangare, D. D., Taware, P. B., Singh, Y., Kumar, P. S., Bal, S. K., Ali, S. and Pathak H. (2020). Dragon fruit: a potential crop for abiotic stressed areas. Technical Bulletin, 46.

Nguyen, M. P., Vaast, P., Pagella, T. and Sinclair, F. (2020). Local knowledge about ecosystem services provided by trees in coffee agroforestry practices in northwest Vietnam. Land, 9:486. https://doi.org/10.3390/land9120486

Saeid, A., Rafeeq, S., Mohammad, O. and Aswad, S. (2021). Effect of seaweed extract and mulching by different plastic colour on vegetative growth and yield of two eggplants hybrid (*Solanum melongena* L.). The Journal of The University of Duhok, 24:82-93. https://doi.org/10.26682/ajuod.2021.24.1.8.

Sarmah, D., Mahanta, P., Talukdar, M. C. and Das, R. (2014). Effect of mulching on growth and flowering of gerbera (*Gerbera jamesonii* Bolus) cv. Red Gem under Assam Condition. Research on Crops, 15:211-214. doi:10.5958/j.2348-7542.15.1.029

Verona-Ruiz, A., Urcia-Cerna, J. and Paucar-Menacho, L. (2020). Pitahaya (*Hylocereus* spp.): Culture, physicochemical characteristics, nutritional composition, and bioactive compounds. Scientia Agropecuaria, 11:439-453. doi:10.17268/sci.agropecu.2020.03.16

Xiong, R., Liu, C., Xu, M., Wei, S. S., Huang, J. Q. and Tang, H. (2020). Transcriptomic analysis of flower induction for long-day pitaya by supplementary lighting in short-day winter season. BMC genomics, 21:1-17. doi:10.21203/rs.2.17997/v2

Yadav, D., K. V, R. R., Ayu, A. T., Rajwade, Y. and Verma, N. (2023). Reflective mulch films a boon for enhancing crop production: A review. Environment Conservation Journal, 24:281-287. doi:10.36953/ecj.12962367s

(Received: 12 September 2025, Revised: 23 January 2026, Accepted: 26 February 2026)