



Research Article

Influence of Colored Plastic Mulches on Growth, Yield and Quality of Colored Potato Cultivars

Md. Habibur Rahman Munna¹, Md. Harun Ar Rashid¹✉, Md. Habibur Rahman¹, Md. Abdur Rahim² and Ratna Saha¹¹Department of Horticulture, Bangladesh Agricultural University, Mymensingh-2202²Department of Agricultural Science, Daffodil International University, Daffodil Smart City, Birulia 1216, Savar, Dhaka.

ARTICLE INFO	ABSTRACT
Article history Received: 04 August 2026 Accepted: 24 September 2026 Published: 30 September 2026 Keywords Colored potato, plastic mulch, black polythene, red polythene, tuber yield Correspondence Md. Harun Ar Rashid ✉: harun_hort@bau.edu.bd OPEN ACCESS	An experiment was conducted to study the performance of colored potato cultivars under different colored plastic mulches at the Horticulture Farm, Department of Horticulture, Bangladesh Agricultural University, Mymensingh, from October 2022 to February 2023. It consisted of two-mulch treatments, viz., black polythene mulch and red polythene mulch, and eight colored potato cultivars, viz., BAU Alu-1, BAU Alu-3, BAU Alu-4, BAU Alu-6, BAU Alu-7, AC-10062, BARI Alu-72, BARI Alu-77. The study was laid out in a Randomized Complete Block Design with three replications. Colored mulches had a significant influence on growth, yield components, and yield of colored potato varieties. The results revealed that black polythene mulch promoted better growth (plant height, foliage coverage, weight of tubers per hill) and yield performance, producing the tallest plant height (60.91 cm), highest number of leaves per plant (63.36), number of tillers per plant (4.25), leaf area (139.04 cm²), tubers per plant (3.51), and maximum yield (18.97 t/ha). However, red polythene mulch showed slightly lower performance, though it produced a higher dry matter percentage (21.05%) compared to black polythene mulch (20.71%). Significant varietal influences were also observed. BARI Alu-77 gave the tallest plant height (62.78 cm), BAU Alu-4 had the highest number of leaves per plant (68.73), AC-10062 had the highest number of tillers per plant (4.40), and BARI Alu-72 produced the highest yield (26.77 t/ha). The combination of black polythene mulch with BARI Alu-72 resulted in the highest tuber yield (28.83 t/ha), whereas the lowest yield (3.81 t/ha) was recorded from BAU Alu-1 under red polythene mulch. This study concludes that the use of black plastic mulch is economically beneficial, and it improves growth and yield of colored potato cultivars under rain-fed conditions.
Copyright ©2026 by authors and BAURES. This work is licensed under the Creative Commons Attribution International License (CC By 4.0).	

Introduction

Potatoes are a staple food for a significant portion of the global population. After rice, wheat, and maize, potatoes are the fourth-largest food crop in the world (Haas *et al.*, 2009; Chakraborty *et al.*, 2000). Potatoes contribute to fulfilling daily caloric requirements and offer a range of vital nutrients and vitamins such as potassium, phosphorus, manganese, magnesium, folate, vitamin C, and vitamin B-6 (Haynes *et al.*, 2012). Because of their nutritious value, high yield potential, and price stability, potatoes are growing in importance in developing countries (Fageria *et al.*, 2011).

Since 1960, Bangladesh has been cultivating potatoes with special varieties imported from the Netherlands (Chowdhury and Hasan, 2013). Colored fleshed potatoes are one of the richest sources of vitamin C and

antioxidant compounds, including polyphenols, flavonoids, and anthocyanins (Lachman *et al.*, 2003; Lee *et al.*, 2016; Luo *et al.*, 2019), which can play a key role in potato production as well as in combating hidden hunger in Bangladesh. On considering this point, Bangladesh Agricultural University Germplasm Centre (BAU-GPC) has collected several colored potato germplasms and multiplying them for adaptability and yield performance trials at the local climatic condition (Islam *et al.*, 2020). The growth and yield of potato cultivars are strongly influenced by environmental factors such as soil type, moisture availability, elevation, and temperature.

Mulching is one of the major intercultural operations for potatoes, contributing minimal soil disturbance and nutrient loss along with efficient water use (Ahmed *et*

Cite This Article

Munna, M.H.R., Rashid, M.H.A., Rahman, M.H., Rahim, M.A., and Saha, R. 2026. Influence of Colored Plastic Mulches on Growth, Yield and Quality of Colored Potato Cultivars. *Journal of Bangladesh Agricultural University*, 24(2): 247-257. <https://doi.org/10.3329/jbau.v24i3.93893>

al., 2017). Utilizing appropriate mulching techniques can be considered one of the most effective alternative approaches to enhance potato productivity and meet the increasing demand of the growing population by providing both yield and input efficiency (Zhang *et al.*, 2022). Plastic mulches, among other mulching materials, have been found to improve soil fertility and yield in arid regions, controlling weeds and reducing soil erosion (Moreno and Moreno, 2008; Hidayat *et al.*, 2013). They can increase soil temperature and soil moisture retention capacity, which can potentially enhance growth and tuber development (Suwon and Judah, 1985; Park *et al.*, 1987; Fortnum *et al.*, 1995; Petrov and Al-Amiri, 1976).

Plastic polythene mulches vary in spectral balance, and their color differences alter the quality and quantity of light reaching plants; thereby, they influence plant growth, development, and overall production. (Matsoukis and Gasparatos, 2015). The most widely accessible and utilized type of plastic mulch is black polythene mulch, which has a substantial impact on soil heat by absorbing solar energy (Amare and Desta, 2021).

In certain regions of Bangladesh, farmers have adopted mulching technology, employing various potato varieties. As of yet, no standardized mulching material has been developed, nor have screening studies been carried out using currently growing potato varieties that perform better in no-tillage conditions. Farmers use diverse organic and inorganic materials for mulching, and there is also a lack of awareness regarding the quality, optimal thickness, and materials of the mulch. As a result, they are not achieving the anticipated potato yields. Therefore, the present experiment aims to evaluate the main and interactive effects of colored potato cultivars and colored plastic mulches on the growth, yield, and quality parameters of potatoes.

Materials and Methods

Experimental site

The research work was conducted at the Horticulture Farm of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh, in order to study the performance of colored potato cultivars under colored plastic mulches during October 2022 to February 2023. Colored potato varieties were collected from Prof. Dr. Md. Abdur Rahim (Retired), Dept. of Horticulture, BAU, Mymensingh.

Experimental Design and Treatments

The two-factor experiment was laid out in a Randomized Complete Block Design (RCBD) with three

replications. Factor A involved eight colored potato cultivars, viz., BAU Alu-1, BAU Alu-3, BAU Alu-4, BAU Alu-6, BAU Alu-7, AC-10062, BARI Alu-72, BARI Alu-77. In factor B, two-colored plastic mulches were used, viz., M₁ = Black plastic mulch and M₂ = Red plastic mulch. The experimental area was divided into 3 blocks, each containing 16 plots (1.0 m × 1.5 m), with 48 plots in total. There was a 50 cm gap between the two plots and a 75 cm gap between the blocks. Each of the plots was designed with a plant-to-plant and row-to-row spacing of 25 cm × 50 cm.

Land Preparation

The experimental area underwent extensive preparation through repeated ploughing using a power tiller, followed by laddering. Weeds and stubbles were diligently gathered and cleared from the land. Clods were broken down to achieve a friable soil texture, and the surface was leveled to the desired tilth. Subsequently, the experimental plot was divided into individual units based on the experimental design. Irrigation and drainage channels were established surrounding the plots.

Application of manures and fertilizers

The experimental plots were treated with recommended doses of NPKS fertilizers (Hossain *et al.*, 2024). The whole amount of cow dung, DAP, MoP, gypsum, and 1/2th of the urea was applied during the final land preparation as a basal dose. The rest of the urea was applied in the top-dressing period at 25 days after sowing and before the mulching process.

Planting of Seed Tubers

Disease-free, uniform-sized, well-sprouted potatoes were selected as planting materials for this experiment. Seed tubers were planted on 16th November, 2022 in forty-eight (48) plots, maintaining the (plant-plant and row-row) spacing of 25 cm × 50 cm.

Intercultural operations

Gap filling and Weeding

The seedling was replaced by a healthy seedling from the border within 15 days after sowing. Weeding was done two times in these plots, considering the optimum time for removal before using mulches.

Earthing up

Earthing up around the plants was done at the time of half of the urea application and weeding of the experimental plots.

Irrigation

After the transplanting process, light overhead irrigation was provided to the plots immediately with a watering can. Additionally, irrigation was carried out based on the assessment of soil moisture levels. Furthermore, each application of urea fertilizer top dressing was followed by irrigation.

Mulching

The soil was covered with black and red plastic mulches after 30 days of tuber planting in the field. 21 gauges of black plastic mulch and 20 gauges of red plastic mulch were required to cover all. Before using the plastic mulches, a total of 20 holes per plot were created with sharp scissors. The red and black plastic mulches, made of high-density and airtight material with a thickness of 0.08 mm, were applied to the soil once the potato plants reached an average height of 15 cm.

Plant protection

The crop was protected from the attack of insect pests by spraying Extramil 720 WP (8% Cymoxanil + 64% Mancozeb) @ 2 ml/liter of water.

Data collection and harvesting

Data were collected from randomly selected uniform plants from each unit plot. The crop was harvested on 16 February, 2023, when plants attained maturity by showing drying out of the leaves with 80-90% senescence and lodging of stems to the ground. Hum pulling was done before the harvest. Care was taken to avoid injury to the colored potato tuber.

Parameters Measured

Vegetative growth of plants, such as plant height in centimeters (cm), number of leaves per plant, number of tillers per plant, and leaf area (cm²), were measured from 5 selected plants of each plot started after 40 days of planting at an interval of 15 days up to 85 days of sowing.

Individual tuber weight (g), tuber length (cm), tuber diameter (cm), and yield of tuber (kg/plot) were determined from the average of five selected plants from each unit of plot at harvest.

The weight of tuber in kilograms was converted into yield per hectare in tons and was expressed in tons (t) and calculated by the following formula:

$$\text{Tuber yield (t/ha)} = \frac{\text{Crop yield per plot (kg)} \times 1000}{\text{Area of plot in square meter} \times 1000}$$

Dry weight of tuber was taken from oven-dried fresh tubers per hill, where the fresh tubers were oven-dried

for 72 hours at 70° C in an oven just after sun drying for three days. The dry weight of the oven-dried tuber sample was then recorded and expressed as a percentage using the following formula:

$$\%DMC = \frac{\text{Dry weight}}{\text{Fresh weight}} \times 100$$

Number of 5 tubers from each plot were weighed separately at intervals of 7 days up to 30 days of storage. The weight loss of the tuber was calculated by following the formula-

$$\text{Weight loss (\%)} = \frac{(W_1 - W_2)}{W_1} \times 100$$

Where, W_1 = Fresh weight of tuber; W_2 = Dry weight of tuber.

Statistical Analysis

The data for different parameters were statistically analyzed by F-test and the MSTAT-C package program to find out the significance of the variation among the treatments. The significance of differences between pairs of treatment means was evaluated by the least significant difference (LSD) test at 5% and 1% levels of probability (Gomez and Gomez, 1984).

Results and Discussion

Plant height

Data on plant height were recorded at 40, 55, 70, and 85 days after planting (DAP). Both colored plastic mulches and potato varieties had significant effects on plant height, except that mulch was not significant at 40 DAP (Figure 1 and Figure 2). At 85 DAP, black polythene mulch (M_1) produced the tallest plants (60.91 cm), while red polythene mulch (M_2) resulted in the shortest plants (54.93 cm). Potato variety V_8 achieved the tallest plant height (62.78 cm), and V_1 showed the shortest plant height (46.97 cm) at 85DAP. The interaction between potato variety and plastic mulch was significant for plant height (Table 1). The combination of BARI Alu-77 variety with black polythene mulch (V_8M_1) produced the maximum plant height (67.47 cm) at 85DAP, while BAU Alu-1 variety with red polythene mulch (V_1M_2) had the minimum plant height (39.43 cm). At earlier stages, the tallest plants were observed with combinations of BAU Alu-4 variety and red polythene mulch (V_3M_2) at 40 DAP and BAU Alu-7 with black polythene mulch (V_5M_1) at 55DAP. These results aligned with previous findings that mulching, including black plastic mulch, enhances potato plant height (Farrag et al., 2016; Ahmed et al., 2017).

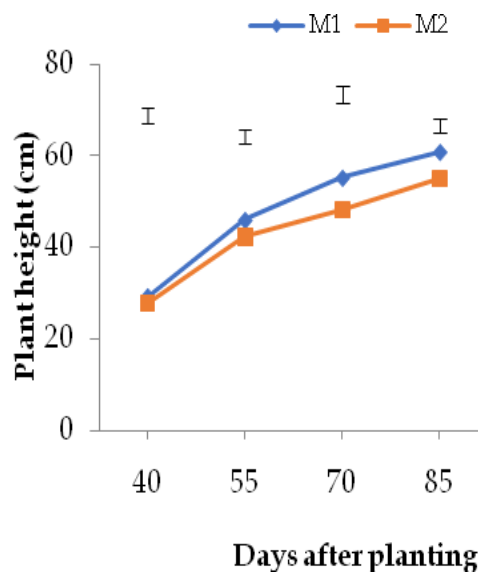


Fig. 1: The performance of colored mulching on plant height of colored potato cultivars at different days after planting. Vertical bars represent LSD at 1% level of significance. M₁= Black polythene mulch, M₂ = Red polythene mulch.

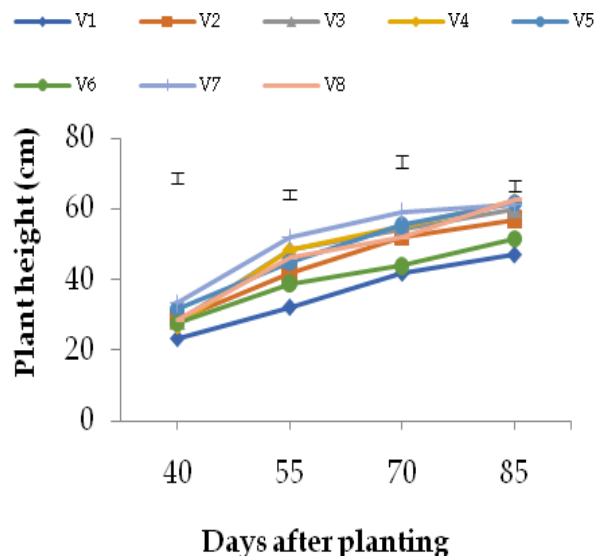


Fig. 2: Effects of different varieties of colored potato on plant height at different days after planting. Vertical bars represent LSD at 1% level of significance. V₁ = BAU Alu-1, V₂ = BAU Alu-3, V₃ = BAU Alu-4, V₄ = BAU Alu-6, V₅ = BAU Alu-7, V₆ = AC-10062, V₇ = BARI Alu-72, V₈ = BARI Alu-77

Number of leaves

The number of leaves per plant was significantly influenced by colored plastic mulches at 55, 70, and 85 DAP, with black polythene mulch (M₁) producing the higher number of leaves (63.36) and red polythene mulch (M₂) the lower (58.40) at 85 DAP (Figure 3). Colored potato varieties also showed significant effects, with V₃ (BAU Alu-4) having the most leaves (68.73) and V₁ (BAU Alu-1) the fewest (54.78) at 85 DAP (Figure 4).

The interaction between variety and plastic mulch was significant, with BAU Alu-4 under black polythene mulch

(V₃M₁) consistently producing the highest leaf number across all stages, while V₈M₁ (40 DAP) and V₁M₂ (55–85 DAP) had the lowest (Table 1). Overall, black polythene mulch combined with V₃ variety resulted in maximum leaf production. Jalil *et al.* (2004) reported that the maximum leaf coverage in potato plants was observed with black polythene mulch. Mulching enhances leaf coverage and photosynthetic area, thereby increasing yield (Rashid, 1981).



Plate 1: Pictorial views of various growth stages of colored potatoes

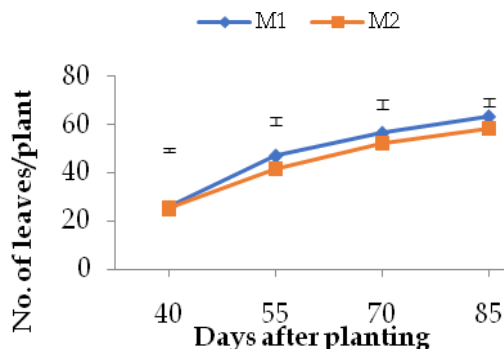


Fig. 3: The performance of colored plastic mulches on number of leaves of colored potato cultivars at different days after planting. Vertical bars represent LSD at 1% level of significance. M₁= Black polythene mulch, M₂= Red polythene mulch.

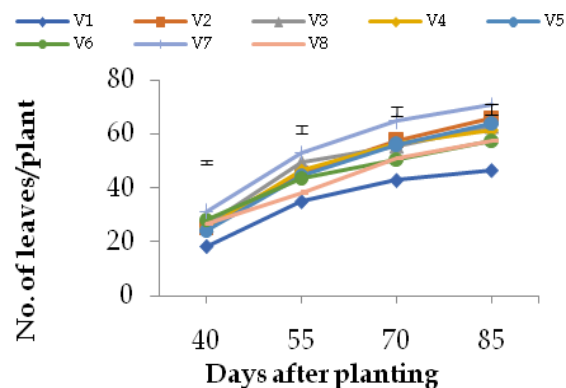


Fig. 4: Effects of different varieties of colored potato on number of leaves at different days after planting. Vertical bars represent LSD at 1% level of significance. V₁ = BAU-1, V₂ = BAU-3, V₃ = BAU-4, V₄ = BAU-6, V₅ = BAU-7, V₆ = AC-10062, V₇ = BARI-72, V₈ = BARI-77

Number of tillers

Black polythene plastic mulch (M₁) significantly increased the number of tillers per plant compared to red mulch (M₂), with the highest (4.25) at 85 DAP (Figure 5). Colored potato varieties also had significant effects, with V₆ (AC-10062) producing the most tillers per plant (4.40) and V₇ (BARI Alu-72) the fewest (3.38) at 85 DAP (Figure 6). The variety and plastic mulch interaction was significant, with V₆M₁ yielding the highest number of tillers per plant across all stages, while V₈M₂ (40–70 DAP) and V₅M₂ (85 DAP) had the

lowest (Table 1). Overall, black mulch combined with variety V₆ (AC-10062) resulted in maximum tiller production per plant. Ahmad et al. (2009) reported that mulching with black polythene boosted the number of stems, plant height, and emergent characteristics. Al-Jubouri (2011) reported that, when compared to non-mulching and yellow plastic, black plastic showed the greatest number of leaves and stems per plant, as well as plant height, leaf area per plant, tuber length, diameter, weight, and number of tubers per plant.

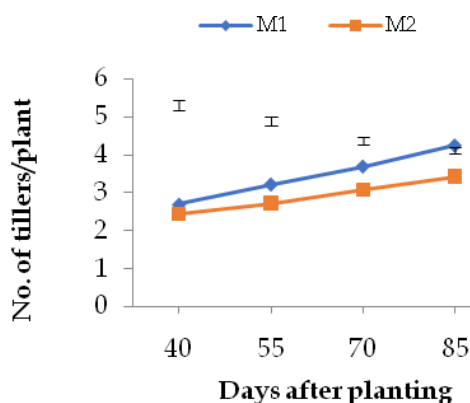


Fig. 5: The performance of colored plastic mulches on the number of tillers of colored potato cultivars at different days after planting. Vertical bars represent LSD at a 1% level of significance. M₁= Black polythene mulch, M₂= Red polythene mulch.

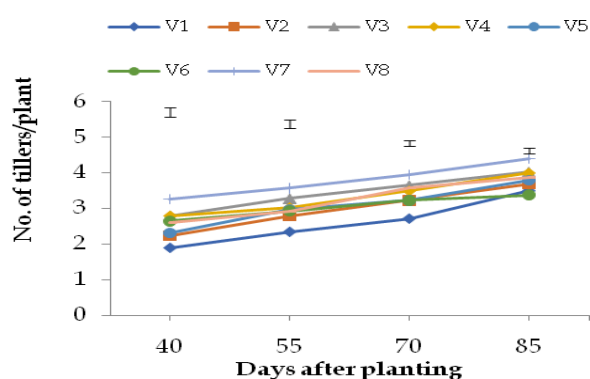


Fig. 6: Effects of different varieties of colored potato on number of tillers per plant at different days after planting. Vertical bars represent LSD at 1% level of significance. V₁ = BAU Alu-1, V₂ = BAU Alu-3, V₃ = BAU Alu-4, V₄ = BAU Alu-6, V₅ = BAU Alu-7, V₆ = AC-10062, V₇ = BARI Alu-72, V₈ = BARI Alu-77

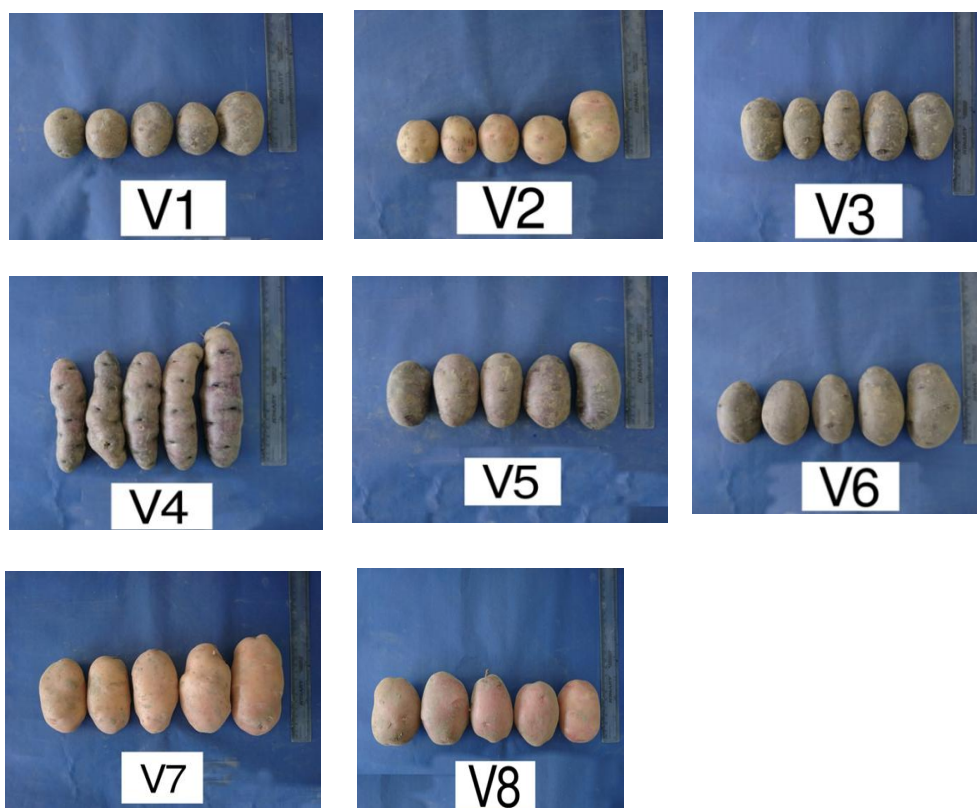


Plate 2: Pictorial views of yield of different varieties of colored potatoes, V₁ = BAU Alu-1, V₂ = BAU Alu-3, V₃ = BAU Alu-4, V₄ = BAU Alu-6, V₅ = BAU Alu-7, V₆ = AC-10062, V₇ = BARI Alu-72, V₈ = BARI Alu-77

Leaf Area

Both colored potato varieties and colored plastic mulches significantly influenced the leaf area of potato plants. Black mulch (M₁) produced the largest leaf area (139.04 cm²) and red mulch (M₂) the smallest (117.38 cm²) at 85 DAP (Figure 7). Colored potato variety BARI Alu-72 (V₇) gave the highest leaf area (192.39 cm²) and AC-10062 (V₆) the lowest (87.69 cm²) at 85 DAP (Figure 8). The combined effects of colored potato variety and colored plastic mulches were also highly significant with

respect to leaf area (Table 1). V₇M₁ produced the maximum leaf area across all stages, reaching 254.33 cm² at 70 DAP, while V₆M₂ had the minimum leaf area (47.62–55.99 cm²) at 40–85 DAP (Table 1). These results indicate that black polythene mulch combined with the BARI Alu-72 variety promoted the highest leaf area. Increased leaf area under black plastic mulch supports vegetative growth and photosynthesis, consistent with Colling (1997), Al-jubouri (2011), and Bhatt *et al.* (2020).

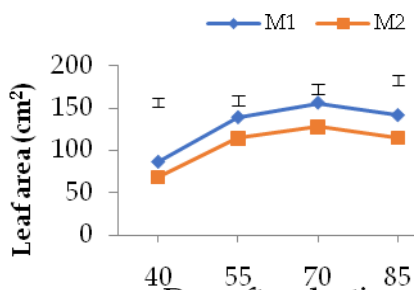


Fig. 7: The performance of colored plastic mulches on the leaf area of colored potato cultivars at different days after planting. Vertical bars represent LSD at a 1% level of significance. M₁ = Black polythene mulch, M₂ = Red polythene mulch.

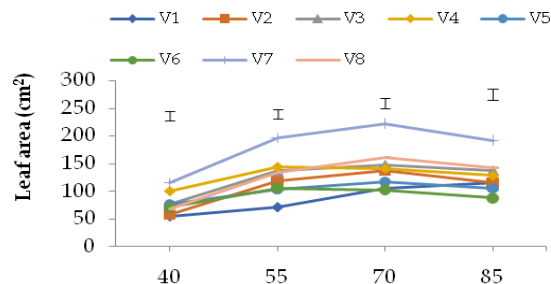


Fig. 8: Performance of different varieties of colored potato on leaf area (cm²) at different days after planting. Vertical bars represent LSD at 1% level of significance. V₁ = BAU Alu-1, V₂ = BAU Alu-3, V₃ = BAU Alu-4, V₄ = BAU Alu-6, V₅ = BAU Alu-7, V₆ = AC-10062, V₇ = BARI Alu-72, V₈ = BARI Alu-77

Table 1: Combined effects of colored potato varieties and colored plastic mulches on plant height, number of leaves/plant, number of tillers/plant, and leaf area at different days after planting of colored potatoes.

Treatment combination	Plant height (cm) at different days after planting				No. of leaves/plant at different days after planting				No. of tillers/plant at different days after planting				Leaf area (cm ²) at different days after planting			
	40	55	70	85	40	55	70	85	40	55	70	85	40	55	70	85
V ₁ M ₁	26.59	36.37	49.37	54.5	30.4	48.47	59.47	66.07	2.8	3.27	4.07	4.53	53.56	128.49	152.08	140.77
V ₁ M ₂	24.07	30.33	34.2	39.43	22.93	32.33	39.57	43.5	2.4	2.6	3.1	3.23	57.67	75.94	98.15	92.53
V ₂ M ₁	23.5	39.43	53.07	59.73	20.93	37.6	46.2	49.67	2	2.73	3.33	3.8	50.77	88.41	112.57	111.25
V ₂ M ₂	30.93	44.67	50.77	54.33	29.6	51.33	64	68.67	2.47	2.87	3.13	3.6	64.02	109.84	123.18	120.51
V ₃ M ₁	31.49	49.06	56.02	60.53	32.33	55	65.67	73.07	3.13	3.57	4.1	4.67	54.37	135.21	151.24	145.28
V ₃ M ₂	34.11	47.77	52.37	59.03	30.4	48.33	57.4	64.4	2.8	3	3.4	3.4	97.56	139.02	144.17	130.8
V ₄ M ₁	32.4	49.6	56.2	61.3	25.6	44.13	51.73	59.6	2.87	3.33	3.67	4.4	113.52	139.41	138.7	130.72
V ₄ M ₂	30.18	49.93	55.4	63.3	25.2	48.8	61.27	63.67	2.73	3.07	3.33	3.6	107.76	149.92	144.55	125.99
V ₅ M ₁	31.7	53.8	58.83	64.67	23	50.53	59.27	66	2.43	3.4	3.73	4.4	82.31	122.46	130.78	117.79
V ₅ M ₂	31.63	45.4	51.87	59	25.2	38.6	53.2	61.8	2.2	2.53	2.73	3.2	69.8	85.61	104.19	90.8
V ₆ M ₁	31.35	47.53	53.23	59.97	31.33	52.47	60.13	67.87	3.73	4.07	4.5	4.93	64.36	136.23	145.19	119.38
V ₆ M ₂	23.01	27.87	34.63	43.03	24.8	34.53	41.2	47.2	2.6	2.93	3.27	3.87	47.62	53.72	60.05	55.99
V ₇ M ₁	24.05	44.67	52.1	59.13	27.4	50.4	53.53	61.33	2.7	2.93	3.2	3.5	123.55	205.88	254.33	214.66
V ₇ M ₂	25.09	47.33	54.4	63.17	24.8	42.93	56.07	66	2.47	2.73	3.2	3.27	87.18	187.23	191.44	170.11
V ₈ M ₁	25.69	47.63	63.17	67.47	16.4	38.6	56.4	63.27	1.93	2.57	3	3.77	62.2	127.55	165.12	132.47
V ₈ M ₂	31.77	44.97	52.17	58.1	20.13	38.13	45.53	52	1.87	2.13	2.43	3.23	74.52	141.78	158.01	152.3
LSD _{0.05}	3.92	3.38	4.47	3.66	2.31	3.89	4.79	4.88	0.66	0.57	0.44	0.39	9.03	9.2	10.36	11.2
LSD _{0.01}	5.28	4.56	6.02	4.93	3.1	5.23	6.45	6.58	0.89	0.77	0.59	0.52	12.16	12.4	13.95	15.08
Level of significance	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

* = Significant at 1% level of probability

V₁ = BAU Alu-1, V₂ = BAU Alu-3, V₃ = BAU Alu-4, V₄ = BAU Alu-6, V₅ = BAU Alu-7, V₆ = AC-10062, V₇ = BARI Alu-72, V₈ = BARI Alu-77; M₁ = Black polythene mulch, M₂ = Red polythene mulch

Yield of tuber

The yield of colored potatoes per hectare was significantly influenced by both potato varieties and plastic mulches (Figure 9 and Figure 10). Yield was calculated from per-plot data (kg) and expressed in t/ha. Black polythene mulch (M₁) produced higher tuber yield (18.97 ton/ha) compared to red mulch (M₂) (15.12 ton/ha) (Figure 9). Colored potato variety BARI Alu-72 (V₇) gave the highest tuber yield (26.77 ton/ha) and BAU Alu-1 (V₁) the lowest (7.10 ton/ha) (Figure 10). The interaction between variety and mulch was also highly significant, with the V₇M₁ combination producing the maximum tuber yield (28.83 ton/ha) and V₁M₂ the minimum (3.81 ton/ha) (Table 2).

These results indicate that black polythene mulch combined with BARI Alu-72 variety maximized potato tuber yield, while red mulch with BAU Alu-1 variety resulted in the lowest yield. Challaiah and Kulkarni (1979) mentioned that, the yield of potato was higher when polythene mulch was used. Ferdoushi *et al.* (2010); Singh and Ahmed (2008), Rahman *et al.* (2005) who reported that plastic and straw mulching significantly increased potato yield. The increase in marketable yield under synthetic mulched plots can probably be associated with the conservation of moisture and improved microclimate both beneath and above the soil surface, maximum weed control, and favorable temperature for better emergence.

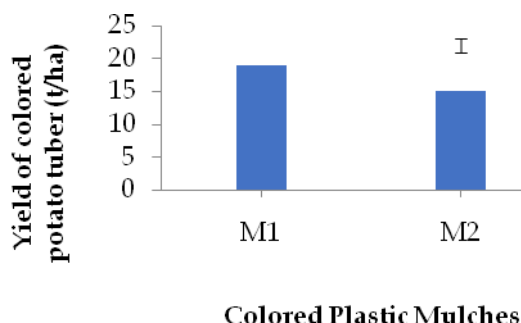


Fig. 9: The performance of colored plastic mulches on the yield of colored potato varieties. Vertical bar represents LSD at 1% level of significance. M₁= Black polythene mulch, M₂ = Red polythene mulch.

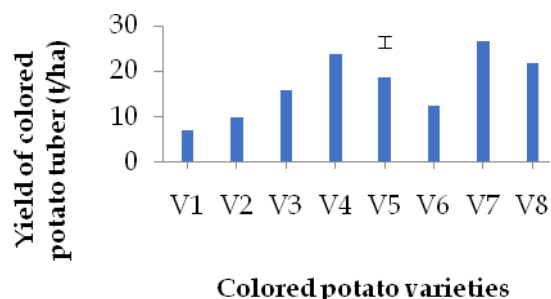


Fig. 10: The performance of different colored potato varieties on yield per hectare of colored potatoes. Vertical bars represent LSD at 1% level of significance. V₁ = BAU Alu-1, V₂ = BAU Alu-3, V₃ = BAU Alu-4, V₄ = BAU Alu-6, V₅ = BAU Alu-7, V₆ = AC-10062, V₇ = BARI Alu-72, V₈ = BARI Alu-77

Table 2. Combined effects of colored potato varieties and colored plastic mulches on weight of colored potato tubers per plot (kg), yield of colored potato tubers (t/ha), and percent weight loss at different days after storage of colored potatoes.

Treatment combination	Weight of colored potato tubers/plot (kg)	Yield (t/ha)	Weight loss (%) at different days after storage (DAS)			
			7	14	21	28
V ₁ M ₁	1.56	10.38	0.24	0.48	0.58	0.94
V ₁ M ₂	0.57	3.81	0.83	1	1.58	2.24
V ₂ M ₁	1.79	11.92	0.93	1.06	1.07	1.85
V ₂ M ₂	1.15	7.74	0.4	0.8	1.71	1.98
V ₃ M ₁	2.42	16.15	0.25	0.4	0.91	1.06
V ₃ M ₂	2.37	15.83	0.37	0.44	0.92	1.03
V ₄ M ₁	3.69	24.6	0.47	0.87	1.41	1.49
V ₄ M ₂	3.42	22.83	0.33	0.65	1.5	1.66
V ₅ M ₁	3.71	22.53	0.25	0.63	1.38	1.38
V ₅ M ₂	2.2	14.66	0.45	0.82	1.51	1.62
V ₆ M ₁	2.23	14.85	0.39	0.69	0.95	0.95
V ₆ M ₂	1.55	10.37	0.26	0.38	1.33	1.44
V ₇ M ₁	4.32	28.83	0.3	0.49	1.1	1.15
V ₇ M ₂	3.38	24.71	0.34	0.64	1.23	1.41
V ₈ M ₁	3.37	22.5	0.26	0.46	1.4	1.25
V ₈ M ₂	3.15	20.98	0.41	0.99	1.41	1.16
LSD _{0.05}	0.54	1.86	0.22	0.38	0.39	0.64
LSD _{0.01}	0.73	2.5	0.29	0.51	0.52	0.87
Level of significance	**	**	**	**	**	**

** = Significant at 1% level of probability

V₁ = BAU-1, V₂ = BAU-3, V₃ = BAU-4, V₄ = BAU-6, V₅ = BAU-7, V₆ = AC-10062, V₇ = BARI-72, V₈ = BARI-77; M₁= Black polythene mulch, M₂ = Red polythene mulch

Dry weight

Dry weight of colored potato tubers was significantly influenced by both mulching treatments and potato varieties (Table 3). Black polythene mulch (M₁) produced the highest dry weight (21.05%), while red polythene mulch (M₂) resulted in the lowest (20.71%) (Table 3). Among varieties, BARI Alu-72 (V₇) had the

maximum dry weight (23.67%) and BAU Alu-1 (V₁) the minimum (17.49%) (Table 8). The interaction between variety and mulch was also significant, with BARI Alu-72 variety under red polythene mulch (V₇M₂) yielding the highest dry weight (24.09%) and V₁M₁ (BAU Alu-1 under black polythene mulch) the lowest dry weight (16.99%) (Table 3). Ibarra-Jiménez *et al.* (2011) reported that leaf

area and shoot dry weight increased when soil temperatures were higher due to the effect of radiation transmission to the soil; however, this decrease was associated with a decrease in tuber production. Singh and Ahmed (2008) mentioned that leaf area index, dry matter accumulation, and potato tuber production were all boosted by plastic film mulching.

Weight loss

Weight loss percentage of potato tubers was influenced by both colored potato varieties and plastic mulches (Figure 11 and Figure 12). Data were recorded at 7, 14, 21, and 28 days of storage, showing that weight loss increased with storage duration (Figure 11). Among mulches, black polythene (M₁) resulted in the highest

weight loss (1.57%) and red polythene (M₂) the lowest (1.26%) at 28 days. Weight loss was highly significant at 21 and 28 days, but not at 7 and 14 days. Among varieties, V₂ (BAU Alu-3) had the highest weight loss (1.92%), while V₃ (BAU Alu-4) had the lowest (1.05%) (Figure 12). The colored potato variety and mulch interaction was also significant, with V₁M₂ showing the maximum weight loss (2.24%) at 28 days, and V₁M₁ combinations exhibiting the lowest values (0.24–0.94%) across the storage periods (Table 2). Azad et al. (2015) showed that the effect of mulch on the fresh and dry weight of weeds was significant, so that the black and double-layer mulches had the greatest impact on reducing the fresh and dry weight, respectively.

Table 3. Effects of colored potato varieties and colored plastic mulches on tuber length, tuber diameter, individual tuber weight, and dry weight percentage of colored potatoes.

Colored plastic mulches	Individual tuber wt. (gm)	Tuber length (cm)	Tuber diameter (cm)	Dry matter (%)
Treatment				
M ₁	44.62	7.9	4.68	20.71
M ₂	39.42	7.61	4.49	21.05
LSD _{0.05}	1.19	0.38	0.2	0.32
LSD _{0.01}	1.61	0.51	0.27	0.43
Level of significance	**	NS	NS	*
Variety				
V ₁	26.42	5.23	3.45	17.49
V ₂	34.81	5.49	4.24	19.05
V ₃	35.46	6.67	4.79	20.69
V ₄	46.27	9.86	4.12	20.47
V ₅	44.37	8.44	4.62	22.62
V ₆	34.93	6.4	4.52	22.54
V ₇	58.48	12.71	5.61	23.67
V ₈	55.44	7.26	5.34	20.52
LSD _{0.05}	2.39	0.76	0.41	0.64
LSD _{0.01}	3.22	1.03	0.55	0.87
Level of significance	**	**	**	**
Interaction				
V ₁ M ₁	32.97	5.58	3.47	16.99
V ₁ M ₂	19.86	4.87	3.43	17.99
V ₂ M ₁	41.96	6.03	4.13	19.74
V ₂ M ₂	27.66	4.95	4.35	18.36
V ₃ M ₁	41.22	6.5	5.02	20.26
V ₃ M ₂	29.71	6.85	4.56	21.11
V ₄ M ₁	46.47	9.45	4.33	20.31
V ₄ M ₂	46.06	10.27	3.9	20.63
V ₅ M ₁	51.33	8.73	4.89	22.27
V ₅ M ₂	37.41	8.14	4.34	22.97
V ₆ M ₁	33.2	6.99	4.85	23.09
V ₆ M ₂	36.65	5.81	4.18	21.99
V ₇ M ₁	53.64	12.67	5.54	23.25
V ₇ M ₂	63.32	12.75	5.68	24.09
V ₈ M ₁	56.19	7.25	5.24	19.76
V ₈ M ₂	54.69	7.27	5.45	21.29
LSD _{0.05}	3.38	1.08	0.58	0.91
LSD _{0.01}	4.55	1.45	0.78	1.23
Level of significance	**	**	**	**

** = Significant at 1% level of probability

V₁ = BAU-1, V₂ = BAU-3, V₃ = BAU-4, V₄ = BAU-6, V₅ = BAU-7, V₆ = AC-10062, V₇ = BARI-72, V₈ = BARI-77; M₁ = Black polythene mulch, M₂ = Red polythene mulch.

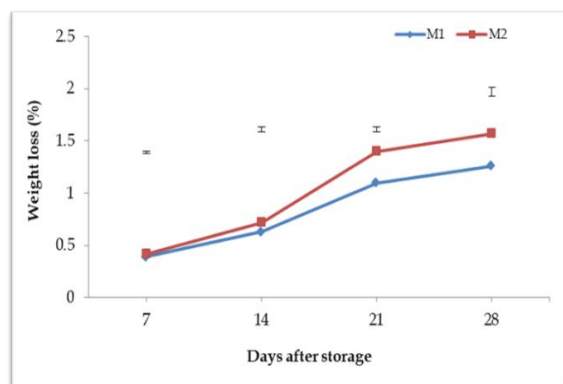


Fig. 11: The weight loss percentage on colored mulches at different days after storage of potato. Vertical bar represents LSD at 1% level of significance. M₁= Black polythene mulch, M₂ = Red polythene mulch.

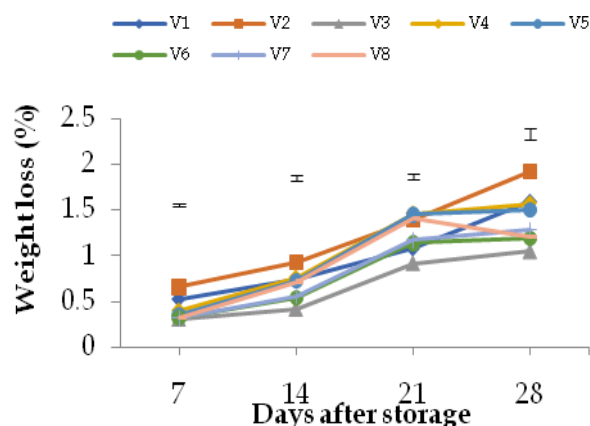


Fig. 12: The weight loss percentage on different colored potato varieties at different days after storage of potato. Vertical bar represents LSD at 1% level of significance. V₁ = BAU-1, V₂ = BAU-3, V₃ = BAU-4, V₄ = BAU-6, V₅ = BAU-7, V₆ = AC-10062, V₇ = BARI-72, V₈ = BARI-77

Conclusion

The study was undertaken to evaluate the effects of colored polythene mulches on different varieties of colored potatoes. Results showed that colored polythene mulches significantly affected the growth, yield, and yield parameters of colored potato varieties. Black polythene mulch performed best, producing greater plant height, leaf number, tiller number, leaf area, lower weight loss, and the highest tuber yield especially with the variety BARI Alu-72. Red mulch consistently produced the lowest values, particularly with BAU Alu-1 variety. Overall, black polythene mulch proved to be the most effective option for maximizing the growth and yield of colored potatoes.

Conflict of interest

The authors conducted this research and wrote the article, and there is no conflict of interest with other people.

Author's Contribution

M.H.R.M.: Performing the field and lab experiments, collection and analysis of data. M.H.A.R.: Design, formulation and supervision of experiment. M.H.R.: Co-supervision of experiment and review of manuscript. M.A.R.: Provide colored potato cultivars and review of manuscript. R.S.: Review of manuscript.

References

- Ahmed, N.U., Mahmud, N.U., Hossain, A., Zaman, A.U. and Halder, S.C., 2017. Performance of mulching on the yield and quality of potato. *International Journal of Natural and Social Sciences*, 4(2): 7-13.
- Ahmed, S.M., Sadik, S.K. and Muslah, O.H., 2009. Effect of manures and mulching on yield of potato (*Solanum tuberosum* L.) Desiree. *Al-Anbar Journal of Agricultural Science*, 2(7): 104-115.
- Al-Jubouri, A.H., 2011. The response of two cultivars of potatoes to soil mulching with different type of polyethylene under conditions of Mosul Region. *Journal of Kirkuk University for Agricultural Science*, 2(2): 9-18.
- Amare, G. and Desta, B., 2021. Colored plastic mulches: impact on soil properties and crop productivity. *Chemical and Biological Technologies in Agriculture*, 8(1): 1-9.
- Azad, B., Hassandokht, M.R. and Parvizi, K., 2015. Effect of mulch on some characteristics of potato in Asadabad, Hamedan. *International Journal of Agronomy and Agricultural Research*, 6(3): 139-147.
- Bhatta, M., Shrestha, B., Devkota, A.R., Joshi, K.R., Bhattarai, S. and Dhakal, U., 2020. Effect of plastic mulches on growth and yield of potato (*Solanum tuberosum* L.) in Dadeldhura, Nepal. *Journal of Agriculture and Natural Resources*, 3: 228-240.
- Chakraborty, S., Chakraborty, N. and Datta, A., 2000. Increased nutritive value of transgenic potato by expressing a nonallergenic seed albumin gene from *Amaranthus hypochondriacus*. *Proceedings of the National Academy of Sciences of the United States of America*, 97: 3724-3729.
- Challaiah and Kulkarni, G.N., 1979. Studies on the response of potato (*Solanum tuberosum* L.) to various soil moisture levels and mulches and its economics in relation to tuber yield. *Mysore Journal of Agricultural Sciences*, 13(1): 35-40.
- Chowdhury, M.A.H. and Hasan, M.S., 2013. *Handbook of Agricultural Technology*. Bangladesh Agricultural Research Council, Farmgate, Dhaka, Bangladesh, 230 p.
- Coling, C., 1997. Effect of plastic film mulching on increasing potato yield. *Acta Agriculturae Zhejiangensis*, 9: 83-86.
- Fageria, N.K., Gheyi, H.R. and Moreira, A., 2011. Nutrient bioavailability in salt affected soils. *Journal of Plant Nutrition*, 34(7): 945-962.

- Farrag, K., Abdrabbo, M.A.A. and Hegab, S.A.M., 2016. Growth and productivity of potato under different irrigation levels and mulch types in the North West of the Nile Delta, Egypt. *Middle East Journal of Applied Sciences*, 6(4): 774-786.
- Ferdoushi, S.N., Farooque, A.M. and Alam, M.S., 2010. Effects of organic and inorganic fertilizer management practices and mulch on the growth and yield of potato. *Journal of Agroforestry and Environment*, 3(2): 175-178.
- Fortnum, B.A., Decoteau, D.R., Kasperbauer, M.J. and Bridges, W., 1995. Effect of colored mulches on root-knot of tomato. *Phytopathology*, 85: 312-315.
- Gomez, K.A. and Gomez, A.A., 1984. *Statistical Procedures for Agricultural Research*, 2nd Edn. John Wiley & Sons, New York, USA, 680 p.
- Haas, B.J., Kamoun, S., Zody, M.C., Jiang, R.H.Y., Handsaker, R.E., Cano, L.M., Grabherr, M., Kodira, C.D., Raffaele, S. and Torto-Alalibo, T., 2009. Genome sequence and analysis of the Irish potato famine pathogen *Phytophthora infestans*. *Nature*, 461: 393-398.
- Haynes, K.G., Yencho, G.C., Clough, M.E., Henninger, M.R. and Sterrett, S.B., 2012. Genetic variation for potato tuber micronutrient content and implications for bio-fortification of potatoes to reduce micronutrient malnutrition. *American Journal of Potato Research*, 89: 192-198.
- Hidayat, H., Hassan, G., Khan, I., Khan, M.I. and Khan, I.A., 2013. Effect of different mulches and herbicides on potato and associated weeds. *Pakistan Journal of Weed Science Research*, 19.
- Hossain, M.B., Jahiruddin, M., Chowdhury, M.A., Naser, H.M., Anwar, M.M., Islam, A., Haque, M.A., Alim, M.A., Hossain, G.M.A., Islam, M.A., Hossain, A., Satter, M.A. and Alam, F., 2024. *Fertilizer Recommendation Guide-2024*. Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka-1215, Bangladesh.
- Ibarra-Jiménez, L., Lira-Saldivar, R.H., Valdez-Aguilar, L.A. and Río, J.L.D., 2011. Colored plastic mulches affect soil temperature and tuber production of potato. *Acta Agriculturae Scandinavica, Section B—Soil & Plant Science*, 61: 365-371.
- Islam, M.T., Hossain, M.M., Rahim, M.A., Rana, M.A.R. and Rahman, M.M., 2020. Plant growth and tuber yield of several exotic potato genotypes. *Journal of Tropical Crop Science*, 7(3).
- Jalil, M.A., Azad, M.A.K. and Farooque, A.M., 2004. Effect of different mulches on the growth and yield of two potato varieties. *Journal of Biological Sciences*, 4(3): 331-333.
- Lachman, J., Hamouz, K., Hejtmánková, A., Dudjak, J., Orsák, M. and Pivec, V., 2003. Effect of white fleece on the selected quality parameters of early potato (*Solanum tuberosum* L.) tubers. *Plant, Soil and Environment*, 49(8): 370-377.
- Lee, S.H., Oh, S.H., Hwang, I.G., Kim, H.Y., Woo, K.S., Woo, S.H. and Jeong, H.S., 2016. Antioxidant contents and antioxidant activities of white and colored potatoes (*Solanum tuberosum* L.). *Preventive Nutrition and Food Science*, 21(2): 110.
- Luo, W., Li, H., Xu, G., Xu, Y., Ji, R., Qiu, S. and Tang, H., 2019. Introduction and evaluation of colored potato germplasms. *Fujian Journal of Agricultural Sciences*, 34(3): 278-283.
- Matsoukis, A., and Gasparatos, D.C.S.A., 2015. Impact of shading and chlormequat chloride on lantana specific leaf area and mineral content. *Journal of Animal and Plant Sciences*, 25: 1371-1376.
- Moreno, M.M. and Moreno, A., 2008. Effect of different biodegradable and polyethylene mulches on soil properties and production in a tomato crop. *Scientia Horticulturae*, 116: 256-263.
- Park, S.U., Park, K.Y., Kang, Y.K. and Jong, S.K., 1987. Effect of polythene mulching and tunnel on the growth and yield of early produced sweet corn. *Researches and Development of New Forage Green Manure Crops*, 29: 245-250.
- Petrov, K.H. and Al-Amiri, M., 1976. Soil mulching in early field tomato production. *Grandinarstvo*, 57: 17-20.
- Rahman, M.A., Jiro, C., Saifizzaman, M. and Lauren, J.G., 2005. Rice straw mulching and nitrogen response of no-till wheat following rice in Bangladesh. *Field Crops Research*, 91(1): 71-81.
- Rashid, A., Ahmad, K.U. and Habib, A.K.M.A., 1981. Effect of artificial mulching on the performance of potato. *Bangladesh Horticulture*, 9(1/2): 24-27.
- Singh, N. and Ahmed, Z., 2008. Effect of mulching on potato production in high altitude cold arid zone of Ladakh. *Potato Journal*, 35(3-4): 118-121.
- Suwon, M.A. and Judah, O.M., 1985. Influence of plastic mulching on growth and yield and soil moisture conservation in plastic house tomatoes. *Dirasat*, 12: 21-23.
- Zhang, X.L., Zhao, Y.Y., Zhang, X.T., Shi, X.P., Shi, X.Y. and Li, F.M., 2022. Re-used mulching of plastic film is more profitable and environmentally friendly than new mulching. *Soil and Tillage Research*, 216: 105256.