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# Impact of Various Mulch Materials on Growth, Yield and Quality of Summer Squash (*Cucurbita pepo* L.) cv. Pusa Alankar

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**ABSTRACT**
A field experiment using 5 treatments *viz*., $T_1$ -Dark blue polythene mulch, $T_2$ - Light blue polythene mulch, $T_3$- Black polythene mulch, $T_4$ -Paddy straw mulch and $T_5$ – control was conducted to investigate the impact of various types of mulch material on growth, yield, and quality of Summer Squash (*Cucurbita pepo* L.) Cv. Pusa Alankar under the valley conditions of Srinagar Garhwal. The experiment was laid out in a randomised complete block design with five replications. The effect of mulching materials on almost all the growth, yield, and quality parameters under study was found to be statistically significant. The results revealed that the treatment $T_2$ had maximum plant height (81.33 cm) and plant spread (61.12 cm) at harvest. It also showed the maximum collar diameter (1.92 cm) and the minimum days taken for the appearance of the first female flower (30.29 days). Moreover, it exhibited a higher fruit setting percentage of 78.52%, the minimum days taken to the first fruit harvesting (41.28 days) and the maximum number of fruits per plant (7.38), average fruit length (25.26 cm), and yield per plant (3.46 kg). In contrast, the treatment $T_4$ resulted in the maximum plant height at 15 DAT (21.21 cm), average fruit weight (484 g) and fruit diameter (4.68 cm). On the other hand, treatment $T_1$ demonstrated significant effects in terms of plant height at 45 DAT (46.73 cm), plant spread at 30 DAT (32.08 cm), and the number of harvestings (5.05). The experimental findings were diverse, with each treatment showing its influence on different parameters. However, considering the results, the treatment $T_2$ - Light blue polythene mulch appears to be the most suitable option for enhancing the production of summer squash under the valley conditions of Srinagar Garhwal.

**Key words:** Summer squash, dark blue, light blue, black polythene mulch, paddy straw mulch

## INTRODUCTION

Summer squash (*Cucurbita pepo* L.) is an important cucurbitaceous vegetable known for its quick growth and early yield. It goes by various names such as Vilayati-Kaddu, Chappan-Kaddu, Bush Squash, Common Field Pumpkin, and Vegetable Marrow, owing to its diverse shapes and sizes (Thamburaj and Singh 2001). It is said to be originated from America, probably in North-Eastern Mexico. It contains carbohydrates, fiber, potassium, vitamin B and vitamin C that make it higher in food value. Summer squash grow well in cool and moist weather condition and requires 16-27°C temperature for its normal growth and development. Short days, low temperature, high relative humidity and bright sunshine are ideal for its cultivation. Its ease of cultivation, rapid growth, and high yield contribute to its attractiveness to vegetable growers. Moreover, its ability to be cultivated in off-seasons leads to higher returns per unit area, making it particularly appealing for farmers with small and scattered rainfed land holdings (Bhatt et al. 2011).

Despite its popularity, summer squash production in India faces challenges resulting in low overall productivity. These challenges include weed infestation, insect pests, and moisture stress, which are particularly concerning for commercial cultivation. To address these issues in an environmentally friendly manner, mulching emerges as a promising solution. The use of intensive chemical measures can disrupt the ecological balance, making mulching an attractive and sustainable alternative. By employing various types of mulch materials, farmers can effectively conserve soil and water while managing weed growth, providing an efficient approach to tackle these challenges (Bobby et al. 2017).

Considering the importance of popularizing summer squash cultivation due to its rich nutrient composition and significance as a vegetable source, the present experiment was undertaken. The

objective was to assess the influence of different types of mulch materials on various quantitative traits of summer squash and to identify the best mulching material to improve the yield of summer squash in the valley conditions of Srinagar Garhwal.

## MATERIALS AND METHODS

The experiment was conducted during the summer season of 2022 at the Horticultural Research Centre, Department of Horticulture, H.N.B. Garhwal University, Srinagar Garhwal, Uttarakhand (India), which is situated in the Alaknanda valley at 78°47'30'' E longitude and 30°13'0'N latitude right in the heart of Garhwal region at an elevation of 540 m above MSL in the lesser Himalaya region. The area is characterized with humid sub-tropical climate, with both the extremes in temperature, *i.e.,* winter and summer seasons. The experiment was carried out in a Randomized Block Design with 5 treatments viz., $T_1$ -Dark blue polythene mulch, $T_2$ - Light blue polythene mulch, $T_3$-Black polythene mulch, $T_4$ - Paddy straw mulch and $T_5$ – control and 5 replications. Different colored plastic mulches of 25 microns and paddy straw mulch (10cm thickness) were laid down on the beds and holes were opened at 1.50 m x 1m for planting of the seedlings. The 25 days old, healthy and uniform seedlings of Summer Squash variety Pusa Alankar at two to three leaf stages were transplanted in the holes. All the recommended packages of practices suggested by Bose and Som (1986) were followed to raise the healthy crop. Data were recorded on different growth parameters viz., Plant height at 15, 30, 45 DAT and at harvest (cm), Plant spread at 15, 30, 45 DAT and at harvest (cm), Collar diameter (cm), Days taken to appearance of first male flower and Days taken to appearance of first female flower, Yield parameters viz., Sex ratio (F:M), Fruit setting (%), Days taken to first fruit harvesting, Number of fruits/plant, Average fruit weight (g), Average fruit length (cm), Average fruit diameter (cm), Number of harvestings, Fruit yield/plant (kg) and Fruit yield (t/ha), and quality parameter viz., Total soluble solid (°Brix). Five plants from each treatment per replication were randomly selected and tagged for recording the data. The data collected from the experiment was analyzed statistically as suggested by (Panse and Sukhatme 1961). The significance of variation among the treatments was observed by applying analysis of variance (ANOVA) and Critical Difference (CD) test at 5% level of probability.

## RESULTS AND DISCUSSION

At a 5% level of significance, the impact of mulching material on summer squash growth, yield, and quality metrics was statistically significant.

### Growth parameters

Effect of different mulching materials on average plant height and plant spread at 15, 30, 45 DAT and at harvest is presented in Table 1. At harvest, the plant height was found to be maximum in treatment $T_2$ (Light blue polythene mulch) with 81.33 cm, followed by treatment $T_1$ (Dark blue polythene mulch) with 79.74 cm, whereas the minimum height of 73.15 cm was observed in treatment $T_4$ (Paddy straw mulch). Similarly, the plant spread at harvest was highest in treatment $T_2$ with 61.12 cm, followed by treatment $T_1$ with 57.46 cm, while the minimum spread of 52.37 cm was found in treatment $T_4$. This finding aligns with studies on summer squash by Bhatt et al. (2011) and Regmi et al. (2021) and on tomatoes by Rao et al. (2016). The $T_2$ treatment also displayed maximum collar diameter of the plant, shortest time for the first appearance of male (18.69) and female flowers (30.29) (Table 1), resulted in the highest number of fruits per plant (7.38) (Table 2) and greatest fruit length (25.26cm) (Table 2). Light blue mulches seemed to provide favorable environmental conditions that promoted early flowering. Prakash et al. (2003) also found positive effect of plastic mulch on soil health and plant growth in pointed gourd, leading to better results in mulched plots compared to non-mulched ones.

### Yield parameters

The fruit setting percentage was found to be highest (78.52) in treatment $T_2$ (Light blue mulch), while the lowest (65.85) was observed in treatment $T_3$ with black polythene mulch. The light blue mulch likely created favorable conditions for photosynthetic activity, proper translocation of photosynthesis, and better growth, leading to improved fruit setting.

The time taken to harvest the first fruit was

Table 1. Impact of various type of mulch material on different growth parameters in summer squash Cv. Pusa Alankar

| Treatments | Plant height (cm) | | | | Plant spread (cm) | | | | Collar diameter (cm) | Days taken for appearance of first male flower | Days taken for appearance of first female flower |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 DAT | 30DAT | 45 DAT | At harvest | 15 DAT | 30DAT | 45 DAT | At harvest | | | |
| **Dark blue polythene mulch ($T_1$)** | 20.93 | 32.72 | 46.73 | 79.74 | 20.07 | 32.08 | 47.06 | 57.46 | 1.76 | 19.72 | 31.82 |
| **Light blue polythene mulch ($T_2$)** | 21.02 | 33.07 | 42.04 | 81.33 | 21.49 | 30.92 | 47.62 | 61.12 | 1.92 | 18.69 | 30.29 |
| **Black polythene mulch ($T_3$)** | 21.01 | 31.33 | 40.58 | 79.73 | 20.96 | 31.19 | 47.01 | 53.89 | 1.56 | 21.36 | 33.11 |
| **Paddy straw mulch ($T_4$)** | 21.21 | 30.57 | 39.23 | 73.15 | 20.18 | 30.30 | 46.45 | 52.37 | 1.74 | 24.51 | 32.25 |
| **Control ($T_5$)** | 17.17 | 27.06 | 35.45 | 78.32 | 17.14 | 27.08 | 36.24 | 52.81 | 1.65 | 30.56 | 35.31 |
| **S.E.m±C.D. @ 5%** | 0.59 | 0.60 | 0.91 | 1.27 | 0.320 | 0.46 | 0.56 | 0.96 | 0.03 | 0.51 | 0.80 |
| | ±1.80 | ±1.83 | ±2.77 | ±3.86 | ±0.968 | ±1.39 | ±1.72 | ±2.92 | ±0.09 | ±1.55 | ±2.43 |

Table 2. Impact of various type of mulch material on different yield and quality parameters in summer squash Cv. Pusa Alankar

| Treatments | Sex ratio (F:M) | Fruit setting (%) | Days taken to first fruit harvesting | Number of fruits/plant | Average fruit weight (g) | Average fruit length (cm) | Average fruit diameter (cm) | Number of harvestings | Fruit yield /plant (kg) | Fruit yield (t/ha) | TSS (°Brix) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dark blue polythene mulch ($T_1$)** | 1:2.16 | 73.98 | 42.43 | 6.14 | 431 | 24.92 | 4.16 | 5.05 | 2.64 | 8.76 | 3.74 |
| **Light blue polythene mulch ($T_2$)** | 1:2.29 | 78.52 | 41.28 | 7.38 | 470 | 25.26 | 4.25 | 4.61 | 3.46 | 11.28 | 3.81 |
| **Black polythene mulch ($T_3$)** | 1:2.11 | 65.85 | 44.45 | 7.22 | 412 | 21.10 | 3.61 | 4.92 | 2.97 | 13.66 | 5.21 |
| **Paddy straw mulch ($T_4$)** | 1:2.07 | 73.45 | 41.61 | 6.88 | 484 | 22.85 | 4.68 | 4.38 | 3.32 | 13.13 | 3.62 |
| **Control ($T_5$)** | 1:2.97 | 74.42 | 50.65 | 4.50 | 393 | 21.31 | 4.44 | 3.25 | 1.79 | 6.80 | 3.23 |
| **S.E.m±C.D. @ 5%** | 0.026 | 1.98 | 1.10 | 0.30 | 19.59 | 0.82 | 0.17 | 0.13 | 0.052 | 0.31 | 0.12 |
| | +0.078 | +0.65 | +3.34 | +0.93 | +59.23 | +2.49 | +0.52 | +0.39 | +0.15 | +0.94 | +0.38 |

shortest (41.28) in treatment $T_2$ with light blue polythene mulch, and longest (50.65) in treatment $T_5$ (Control). The use of light blue mulch accelerated the harvesting time, likely due to increased air and soil temperature under the plastic mulch, promoting faster plant developments. Treatment $T_4$ (paddy straw mulch), showed a narrow sex ratio (1:2.07), highest average fruit weight (484g) and the maximum fruit diameter (4.68 cm). This was likely due to improved water conservation, nutrient uptake, and soil temperature in the paddy straw mulch treatment, which corresponds with the findings from earlier investigations on tomatoes by Kayum et al. (2008).

The highest number of harvesting (5.05) was recorded with treatment $T_1$ (Dark blue polythene mulch) which was found to be significantly superior over rest of the treatments followed by 4.92 in treatment $T_3$ (Black polythene mulch), while the minimum (3.25) was found in $T_5$ (Control) (Table 2). Highest yield per plant was obtained from $T_2$ (Light blue polythene mulch) (3.46 kg) followed by 3.32 kg in treatment $T_4$ (Paddy straw mulch).On the other hand, minimum (1.79 kg) fruit yield per plant was recorded in treatment $T_5$ (Control) (Table 2). The mulch likely played a role in conserving soil moisture, providing water at different growth stages, and maintaining warm soil conditions, thereby increasing fruit production. Similar results were reported by Ravinder et al. (1997) in winter tomatoes. Moreover, treatment $T_3$ (Black polythene mulch) showed the highest fruit yield per hectare (13.66 tonnes), while the control group ($T_5$) again had the lowest yield (6.80 tonnes). The positive effects of the mulch treatments were attributed to improved soil microclimate, weed control, lower evaporation, and increased moisture availability, leading to better nutrient uptake, enhanced vegetative growth, and improved photosynthesis and translocation of food from leaves to fruits. In contrast, the unmulched control group ($T_5$) recorded the lowest fruit yield per hectare due to lower soil moisture availability during critical growth periods, insufficient nutrient availability, and high weed infestation.

**Quality parameter**

Regarding total soluble solids (TSS), treatment $T_3$ (Black polythene mulch) exhibited the maximum TSS content (5.21), while the control group ($T_5$) had the minimum TSS (3.23) (Table 2). These results were consistent with findings from studies conducted by Deoraoji and Chandrashekhar (2003), Ekinci and Dursun (2009), Pandey et al. (2016) and Mounika et al. (2019).

## CONCLUSION

The widespread adoption of mulching practices, especially the use of inorganic mulches, can significantly improve agricultural productivity and sustainability by conserving water, improving soil conditions, and providing better weed control. On the basis of obtained findings from the present research work, it may be concluded that, the treatments $T_2$ (Light blue polythene mulch) showed the superiority in terms of plant height at 30 DAT and at harvest (cm), plant spread at 15, 45 DAT and at harvest (cm), collar diameter (cm), fruit setting percentage (%), number of fruits per plant, fruit length (cm) and fruit yield per plant (kg). Hence, this treatment could be suggested to enhance the production of summer squash under valley condition of Srinagar Garhwal, Uttarakhand, India.

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**Authors' contributions:** All authors contributed equally

**Conflict of interest:** Authors declare no conflict of interest

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