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A comparison study of various mulches on growth and yield of summer squash

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ABSTRACT

Mulching is being widely utilized for production of various crops worldwide and it has a great impact on crop growth and yield. In this regard, the present investigation was carried out to determine the effects of various mulch materials on growth and yield of summer squash (*Cucurbita pepo* L.) during, 2021 in Agricultural fields of Lovely Professional University, Punjab. Different mulch materials *viz.,* compost, dry leaves, paddy straw, saw dust, sugarcane trash, black polyethylene mulch, transparent mulch and without mulch as control were used for the investigation. Among the different mulches, black polyethylene mulch recorded significantly highest plant height, number of leaves per plant, plant spread and days to 50% female flower. Correspondingly, the highest yield attributes viz., average fruit length, average fruit width, average fruit weight and number of fruits per plant with the highest yield per plant (3.82 kg), yield per plot (68.14 kg) and total fruit yield (27.25 t ha^{-1}) were recorded by black polyethylene mulch compare to the control. Based on the study, it is revealed that black polyethylene mulch is the most eco-friendly method for growing and developing of summer squash.

Key words: *Summer squash, Mulch material, Growth, and Crop yield.*

Introduction

Cucurbita pepo L. commonly known as summer squash is a popular seasonal vegetable in the new world of cucurbits, and it is also known as Bush squash, Vegetable marrow, Chappan Kaddu, and Vilayati Kaddu in different parts of the nation (Thamburaj and Singh, 2001). It thrives in cool, humid climates and requires a temperature range of 16 to 27 ^{0}C for its growth and development (Albert, 2018). The fruit has high levels of nutrients and bioactive substances such as phenolics, carotene, flavonoids, vitamins (viz., vitamin A, B2, C, and E), carbohydrates, amino acids, and minerals (notably potassium). In addition to this, it has a low-calorie accounting of 17 calories per 100 grams of fresh squash (Tamer, 2010). The fruits of summer squash are consumed as a cooked vegetable and can also be used as a raw in salads and sandwiched. It had a very little flavour of their own and are therefore, used as a base for making savoury dishes. The immature fruits are also sometimes utilized as a pickle preparation. Summer squash is a native of North America, where Native Americans grew it in large quantities. India mainly contributes 14.42% of the world's total pumpkins, gourds and squashes production, which stands second position after China (21.11%) (Anonymous, 2020). China is the leading

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producer of summer squash followed by Ukraine, Afghanistan and Turkey. Altogether 45% of the world's gross supply comes from these countries. In India, summer squash is mainly cultivated in Uttar Pradesh, Punjab and Haryana.

Mulching practice has a great positive impact in crop production of many crops. The use of mulch can prevent water loss from the soil due to evaporation, reducing the need for water, suppressing weeds, and so preserving soil moisture for the following season in order to produce squash effectively, especially if rainfall and irrigation facilities are limited. Organic mulch built-in essential nutrients to soil when deteriorated by organisms and make a difference in carbon restoration (Chattopadhyaya and Mukherjee, 1990). Organic mulch viz., paddy straw, plant leaves or dry leaves, compost, sawdust, bark chips etc. undergo rapid decaying process and results in increases water holding capacity of soil. It initially adds nutrients to the soils and reduces weed growth. Apart from, organic mulches, inorganic i.e., synthetic materials like polyethylene sheet and rocks are used as a mulching material.Mulches have been shown to have an essential function in vegetable production and yield enhancement. It has the further benefit of reducing labour requirements as well as drudgery in crop production (Singh and Singh, 2010). Based on the above benefits of mulching in production, a comparison study was conducted to determine the ideal mulches for growing and producing of summer squash.

Materials and Methods

The present investigation was conducted in the Agri-fields of Lovely Professional University, Punjab (31.2554°N latitude and 75.7058°E longitude) during Rabi season of 2021 on summer squash. This area has an annual rainfall of about 554.5 mm, with temperatures ranging between 22 to 40 °C. The experiment was laid out in randomized block design with three replications and 8 different mulches *viz.*, compost, dry leaves, paddy straw, sugarcane trash, saw dust, black polyethylene mulch, transparent mulch and control. The geography and fertility of the sandy loam soil used in the experiment are kept very uniformly. A recommended fertilizer dose of FYM @15 t/acre and N:P: K@40:20:15kg/acre were applied to crops. The prescribed cultural practices were followed throughout the growing period. Direct sowing method was practised, before sowing seeds were soaked in the water for twelve hours. The field was laid down to a raised bed with an area of 5×3m. The space between plants to plant 90 cm was followed. The different mulches were used in all the replicated plots randomly. Five randomly selected plants were observed in each replication to determine the growth and yield parameters and the statistical analysis was carried out by using OPSTAT software package.

Results

The data pertaining growth parameters of summer squash was significantly influence by different mulching materials (Table 1). Among the different mulches significantly highest plant height (18.88 cm), number of leaves/plant (7.60) and plant spread (35.56 cm) was recorded by black polyethylene mulch followed by transparent mulch (17.91 cm, 7.03 and 33.46 cm) and compost (12.79 cm, 5.80 and

Table 1. Effect of various mulches on vegetative parameters of summer squash

Treatments	Plant height (cm)	Number of leaves/ plants	Plant spread (cm)	Days to 50% female flower initiation
T_1-Control	11.19	5.00	29.51	38.67
T_2-Sugar cane trash	11.72	4.40	29.62	36.53
T_3-Compost	12.79	5.80	31.97	39.13
T_4-Dry leaves	12.48	5.07	29.02	35.73
T_5-Black polyethylene mulch	18.88	7.60	35.56	40.60
T_6-Saw dust	12.84	5.13	31.36	39.27
T_7-Transparent mulch	17.91	7.03	33.46	38.87
T_8-Paddy straw	12.11	4.73	31.14	39.40
C.D. @ 5%	3.25	1.89	2.34	4.09
SE(m)	1.06	0.62	0.77	1.35
CV	13.36	19.05	4.21	6.06

Table 2. Effect of various mulches on yield and yield attributes of summer squash

Treatment	Average fruit length (cm)	Average fruit width (cm)	Average fruit weight (g)	Number of fruits/ plants	Yield/ plant (kg)	Yield/ plot (kg/15 m^2)	Estimated total yield (tha^{-1})
T_1-Control	5.08	6.49	286.10	9.40	2.42	43.20	17.28
T_2-Sugar cane trash	5.67	7.05	342.40	9.80	3.03	53.91	21.56
T_3-Compost	5.97	7.95	359.24	9.93	3.21	57.33	22.93
T_4-Dry leaves	5.15	7.32	339.58	9.47	2.97	53.06	21.23
T_5-Black polyethylene mulch	7.67	8.72	410.44	10.33	3.82	68.14	27.25
T_6-Saw dust	5.75	7.44	329.73	9.50	2.81	50.15	20.06
T_7-Transparent mulch	6.22	7.63	348.91	10.20	3.12	55.64	22.26
T_8-Paddy straw	5.42	7.20	334.43	9.73	2.93	52.29	20.92
C.D. @ 5%	1.29	0.80	13.55	0.41	0.12	3.72	0.75
SE(m)	0.42	0.26	4.47	0.13	0.04	1.23	0.25
CV	12.44	6.04	2.25	2.37	2.21	3.92	1.99

31.97 cm). However, days to 50% female flower (40.60) was recorded by black polyethylene mulch followed by paddy straw (39.40) and saw dust (39.27) and the lowest was recorded by dry leaves (35.73).

Correspondingly, the yield and yield attributes of summer squash were significantly influence by the different mulch materials (Table 2). The highest yield attributes *viz.,* average fruit length(7.67 cm), average fruit diameter (8.72 cm), average fruit weight(410.44 g) and number of fruits/plant (10.33)of summer squash was recorded in black polyethylene mulch followed by compost (5.97 cm, 7.95 cm, 359.24 g and 9.93), transparent mulch (6.22 cm, 7.63 cm, 348.91 g and 10.20) and lowest was in control (5.08 cm, 6.49 cm, 286.10 g and 9.40). Similarly, the highest yield per plant, yield per plot and the estimated total yield was recorded in black polyethylene mulch (3.82 kg, 68.14 kg/15 m^2 and 27.25 tha^{-1}) followed by compost (3.21 kg, 57.33 kg/15 m^2 and 22.93 tha^{-1}), transparent mulch (3.12kg, 55.64 kg/15 m^2 and 22.26 tha^{-1}) and the lowest was in control (2.42 kg, 43.20kg/15 m^2 and 17.28 tha^{-1}).

Discussion

Mulch induced improvements in growth characteristics could be attributed to increased photosynthesis and other metabolic activities. The improved plant microclimate caused by the increase soil temperature beneath black polyethylene mulch resulted in early growth and development, which accelerated flowering and fruiting. Regmi *et al.* (2021) reported that the highest number of leaves per plant recorded in black polyethylene mulch and have concluded that the development of microclimatic condition under black polyethylene mulch might have created a suitable condition for increasing higher number of leaves per plants. Besides the absence of light within the black polyethylene mulch had the added benefit of stopping photosynthesis under the film, which inhibited weed growth. Moreover, mulching helps to minimizing the evaporation loss and contributes to sufficient level of soil moisture at root zone. The prolonged retention and availability of moisture also resulted in increased nutrient uptake, which resulted in a higher growth rate for the plants, as compared to the control. The result is supported by earlier findings Mahadeen (2014), Chaurasia and Sachan (2020), and Regmi *et al.* (2021) in summer squash.

The black polyethylene mulch has the ability to induce soil temperature changes, enhance water holding capacity, smother weed populations, and create favourable conditions for plant growth and development which might be reflect the increased in production. The increase of fruit weight and yield under polythene mulch was attributable to more efficient water utilization, greater intake of nutrients, and a better relationship between soil and water which ultimately create an excellent oxygen concentration at root zone (Bhujbal *et al.,* 2015). The present study proved with the findings of previous works by Saeid and Mohammed (2015); Attallah (2016); Akhter *et al.* (2018), and Regmi *et al.* (2021) in summer squash.

Conclusion

The study revealed that black polyethylene mulch had a significant impact on growth and yield of summer squash compared to the other treatment. The black polyethylene mulch minimizes soil water evaporation and improved soil water retention. Furthermore, the use of black polyethylene mulch resulted earlier flower initiation, avigorous plant and produce higher yield as compared to control.

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Conflict of interest

The authors declare that this publication has no conflict of interest

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