

Effect of Different Mulches on Growth and Yield of Broccoli

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ABSTRACT

A field trial was conducted at Polytechnic in Horticulture, ACHF, NAU, Paria (Gujarat) during winter 2019-20 to study the effect of mulching on growth, yield and quality of broccoli var Pusa KTS-1. The experiment was laid out as Randomized Block Design (RBD) with three replications. The experiment includes nine treatments viz., T₁- Black polyethylene mulch: 25 µm, T₂- Black polyethylene mulch: 50 µm, T₃- Silver and black polyethylene mulch: 25 µm, T₄- Silver and black polyethylene mulch: 50 µm, T₅- Red polyethylene mulch: 25 µm, T₆-Red polyethylene mulch: 50 µm, T₇- Paddy straw mulch: 8 t ha⁻¹, T₈- Sugarcane trash: 8 t ha⁻¹ and T₉- Control: Without mulch. The result showed that the treatment T₂- Black polyethylene mulch: 50 µm was found to be best among the various mulch treatments and recorded higher values for plant height, plant spread, length of leaf, stalk length, curd length, curd diameter, marketable curd weight, net curd weight, marketable and total curd yield plot⁻¹, marketable and total curd

yield ha⁻¹ and harvest index. While, minimum days to first curd initiation and days to 50 % curd initiation were recorded with treatment T₄ (silver and black polyethylene mulch :50 µm). The growth and productivity of broccoli under the South Gujarat regions were boosted by the use of black polyethylene mulch: 50 µm as a soil cover.

Keywords Curd diameter, Growth, Harvest index, Mulch, Plant spread, Sugarcane trash, Yield.

INTRODUCTION

Vegetables are said to be the best food for our body. Broccoli (*Brassica oleracea* var. *italica*) is a cruciferous vegetable, also known as calabrese, Italian green or spear cauliflower. It is a member of the family Brassicaceae, sometimes known as the Cruciferae, which has 18 chromosome number (2n=18, x=9). Broccoli is very low in calories, providing just 34 kcal/100 g. It is rich in dietary fiber, minerals, vitamins and antioxidants that have proven health benefits (Mukherjee and Mishra 2012). It is a store house of many phytonutrients. The demand for vegetables in the market is high and competition has forced the farmers to produce more and higher quality vegetables. The practice of applying mulch for the production of vegetables is thousands of years old. To increase the production per unit area, the use of mulch is one of the suitable methods. Mulching is an agricultural cropping technique that involves placing organic or synthetic materials on soil around plants to provide a more favorable environment for growth and production. There are different types of mulch used in the field depending on the purpose of mulch. Mulches are used to control soil temperature, safe guard plant roots from heat, prevent soil evaporation, retain soil

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moisture, prevent weed growth, improve water use efficiency and affect the microclimate of the soil. By creating unfavorable conditions for weed seed germination and acting as a physical barrier for emerging weeds, mulches limit weed growth. A good mulch layer can save many hours of laborious weeding. In light of the above importance, the present experiment was carried out to study the effect of different type of mulches on growth and yield of broccoli.

MATERIALS AND METHODS

The present research work entitled “Effect of different mulches on growth, yield and quality of broccoli” was carried out in the winter of 2019–20 at the Polytechnic in Horticulture, ACHF, NAU, Paria (Gujarat). The farm is geographically located at 22° 35’ North latitude and 72° 35’ East longitude at an elevation of 16.10 m above mean sea level. The soil of the experimental plot which having pH 7.3, EC 0.42 dS m⁻¹, medium in nitrogen and phosphorus and sufficient in potash content. The experiment was laid out in a Randomized Block Design (RBD) in nine treatments and three replications. The treatment consists of: T₁ (Black polyethylene mulch: 25 µm), T₂ (Black polyethylene mulch: 50 µm), T₃ (Silver and black polyethylene mulch: 25 µm), T₄ (Silver and black polyethylene mulch: 50 µm), T₅ (Red polyethylene mulch: 25 µm), T₆ (Red polyethylene mulch: 50 µm), T₇ (Paddy straw mulch: 8 t ha⁻¹), T₈ (Sugarcane trash: 8 t ha⁻¹) and T₉ (Control: Without mulch).

Mulches were spread in the plot prior a day of transplanting as per treatment. Plastic mulch was laid by cutting into pieces of 4×4 m to cover the plot area. For the seedlings, transplanting holes were made in plastic at 60×45 cm spacing. After that, all sides of the mulch sheet were anchored at 15 cm depth of soil. Paddy straw and sugarcane trash mulch of 15 cm thickness were spread in the plot. The recommended doses of fertilizers were applied. To raise a healthy crop, all cultural and plant protection procedures were followed. The data regarding the growth and yield of broccoli were recorded. The Panse and Sukhatme (1985) approach was used to statistical analysis of the recorded data.

RESULTS AND DISCUSSION

Effect of mulching on growth attributes

The result revealed that mulching materials had a significant effect on growth attributes in broccoli over control. The data related to growth attributes of broccoli were showed in Table 1. The greater plant height (22.36 cm and 60.94 cm), plant spread (N-S = 22.56 cm, E-W = 20.68 cm and N-S = 53.34 cm, E-W = 52.05 cm), number of leaves plant⁻¹ (12.47 and 24.13), length of leaf (16.93 cm and 42.43 cm) at 30 DATP and curd harvest, respectively and stalk length (18.03 cm) at curd harvest. The increased in plant growth might be due to plastic mulches that provide

Table 1. Effect of different type of mulches on growth attributes of broccoli.

Treatments	Plant height (cm)		Plant spread (cm)			
	30 DATP	At curd harvest	N- S 30 DATP	At curd harvest	E- W 30 DATP	At curd harvest
T ₁ : Black polyethylene mulch (25 µm)	19.96	55.26	21.18	52.02	19.23	48.99
T ₂ : Black polyethylene mulch (50 µm)	22.36	60.94	22.56	53.34	20.68	52.05
T ₃ : Silver and black polyethylene mulch (25µm)	19.15	52.41	18.77	46.13	17.43	45.45
T ₄ : Silver and black polyethylene mulch (50 µm)	21.48	58.39	20.23	49.03	19.80	50.51
T ₅ : Red polyethylene mulch (25 µm)	18.89	51.65	17.81	44.88	16.88	44.14
T ₆ : Red polyethylene mulch (50 µm)	20.60	54.61	18.65	45.97	17.03	45.27
T ₇ : Paddy straw mulch (8 t ha ⁻¹)	18.12	50.49	17.50	44.60	16.13	43.05
T ₈ : Sugarcane trash (8 t ha ⁻¹)	17.42	48.74	16.18	43.69	15.66	41.73
T ₉ : Control (Without mulch)	15.49	44.77	15.32	40.03	14.97	37.98
SEm±	0.91	2.29	1.02	2.16	1.00	2.13
CD at 5%	2.74	6.87	3.07	6.48	3.00	6.38
CV %	8.21	7.49	9.50	8.03	9.89	8.11

Table 1. Continued.

Treatments	Number of leaves plant ⁻¹		Leaf length (cm)		Stalk length (cm)
	30 DATP	At curd harvest	30 DATP	At curd harvest	At curd harvest
T ₁ : Black polyethylene mulch (25 µm)	11.80	22.80	13.88	36.72	17.18
T ₂ : Black polyethylene mulch (50 µm)	12.47	24.13	16.93	42.43	18.03
T ₃ : Silver and black polyethylene mulch (25 µm)	10.93	21.40	13.67	36.52	16.29
T ₄ : Silver and black polyethylene mulch (50 µm)	11.87	23.00	15.25	40.21	17.57
T ₅ : Red polyethylene mulch (25 µm)	9.27	19.93	12.89	35.44	15.31
T ₆ : Red polyethylene mulch (50 µm)	9.60	20.27	13.28	36.29	15.57
T ₇ : Paddy straw mulch (8 t ha ⁻¹)	7.87	19.20	10.36	34.34	14.85
T ₈ : Sugarcane trash (8 t ha ⁻¹)	6.40	18.93	8.47	33.83	14.14
T ₉ : Control (Without mulch)	5.67	16.90	7.33	28.00	12.17
SEm±	0.62	1.17	0.76	1.58	0.78
CD at 5%	1.85	3.52	2.26	4.75	2.35
CV %	11.18	9.81	10.50	7.62	8.67

proper soil temperature and moisture content during the entire growth stage of broccoli and create favorable conditions essential for plant processes, which ultimately lead to an increased in photosynthetic capacity and metabolic activities of the plant. This in turn builds a high yield of carbohydrates, which gives rise to cell division and cell enlargement, which induces the growth of the plant (Regar 2017, Islam *et al* 2014 and Maida 2014).

Effect of mulching on yield and yield attributes

Yield and yield attributes were significantly affected by different mulch treatments. The data related to yield and yield attributes were showed in Table 2. Among nine treatments, black polyethylene mulch (50 µm) found best for curd length (13.55 cm), curd

diameter (15.31 cm), marketable curd weight (333.72 g), net curd weight (277 g), total curd yield plot⁻¹ (6.57 kg) and total curd yield ha⁻¹ (12.16 t). While, minimum days to first curd initiation (47.00 days) and days to 50 % curd initiation (55.33 days) were recorded with silver and black polyethylene mulch (50 µm). Incorporation of black polyethylene mulch increased yield, it might be due to increase of soil moisture, higher water use efficiency, available water to plants, higher microbial activity and weed free environment in root zone that helped in better nutrient uptake by plant resulting in better vegetative growth which increased the photosynthesis rate and translocation of photosynthates from leaves to the fruit (curd) (Regar 2017, Thentu *et al.* 2016, Islam *et al.* 2014, More *et al.* 2014 and (Moniruzzaman *et al.* 2007).

Table 2. Effect of different type of mulches on yield and yield attributes of broccoli.

Treatments	Days to first curd initiation	Days to 50 % curd initiation	Curd length (cm)	Curd diameter (cm)
T ₁ : Black polyethylene mulch (25 µm)	51.33	60.67	11.67	13.33
T ₂ : Black polyethylene mulch (50 µm)	48.67	57.00	13.55	15.31
T ₃ : Silver and black polyethylene mulch (25 µm)	50.00	58.33	12.36	12.50
T ₄ : Silver and black polyethylene mulch (50 µm)	47.00	55.33	12.73	13.82
T ₅ : Red polyethylene mulch (25 µm)	55.33	65.67	10.26	10.33
T ₆ : Red polyethylene mulch (50 µm)	53.00	64.00	10.47	11.17
T ₇ : Paddy straw mulch (8 t ha ⁻¹)	57.00	66.00	9.69	8.83
T ₈ : Sugarcane trash (8 t ha ⁻¹)	59.00	69.33	8.98	9.15
T ₉ : Control (Without mulch)	62.33	73.67	8.10	8.67
SEm±	2.22	2.73	0.79	0.69
CD at 5%	6.64	8.19	2.37	2.06
CV %	7.14	7.47	12.62	10.39

Table 2. Continued.

Treatments	Marketable curd weight (g)	Net curd weight (g)	Curd yield plot ⁻¹ (kg)	Curd yield (t ha ⁻¹)
T ₁ : Black polyethylene mulch (25 µm)	321.38	252.12	6.15	11.39
T ₂ : Black polyethylene mulch (50 µm)	333.72	277.00	6.57	12.16
T ₃ : Silver and black polyethylene mulch (25 µm)	308.77	243.88	5.66	10.48
T ₄ : Silver and black polyethylene mulch (50 µm)	324.32	266.36	6.35	11.77
T ₅ : Red polyethylene mulch (25 µm)	250.22	213.17	5.21	9.64
T ₆ : Red polyethylene mulch (50 µm)	268.16	230.83	5.41	10.01
T ₇ : Paddy straw mulch (8 t ha ⁻¹)	243.46	204.68	4.95	9.17
T ₈ : Sugarcane trash (8 t ha ⁻¹)	231.49	197.15	4.64	8.59
T ₉ : Control (Without mulch)	215.22	175.31	4.23	7.83
SEm±	10.39	9.73	0.29	0.53
CD at 5%	31.16	29.17	0.86	1.60
CV %	6.49	7.36	9.12	9.12

CONCLUSION

Based on the findings of the experiment, it could be concluded that different mulches performed better than the control. It was found that application of black polyethylene mulch : 50µm was the best treatment among all growth and yield attributes except days to first flowering and days to 50 % flowering, which was highest observed in silver polyethylene mulch: 50 µm. Thus, it was inferred that the usage of black polyethylene mulch (50 µm) was found to be both more effective and economically viable in terms of growth and yield of broccoli.

REFERENCES

- Islam M Md, Mollah DA Md, Kaium A, Amin R, Sarkar D Md (2014) Performance of different mulch materials on growth and yield of broccoli. *J Expt Biosci* 5(2): 43-48.
- Maida SK (2014) Effect of mulching on growth and curd yield of cauliflower (*Brassica oleracea* L. var. botrytis) thesis. MSc Submitted to Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, pp 1-101.
- Moniruzzaman M, Faisal SM, Sarkar MAR, Hossain MI, Ali MA, Talukder MAH (2007) Effects of irrigation and different mulches on yield of profitability of cauliflower. *Asian J Pl Sci* 6(2): 338-343.
- More SJ, Gohil JH, Bhanderi DR, Patil SJ, Tekale GS (2014) Productivity and profitability of tomato (*Lycopersicon esculentum* Mill.) influenced by various transplanting dates and mulches. *Trends Biosci* 7(17): 2376-2381.
- Mukherjee Voomika, Mishra PK (2012) Broccoli an under exploited nutraceutical. *Sci Res Rep* 2(3): 291-294.
- Panse VG, Sukhatme PV (1985) "Statistical Methods for Agricultural Workers". Indian Council of Agricultural Research, New Delhi, India, pp 152-161.
- Regar OP (2017) Effect of mulching and bio-fertilizers on growth, yield and quality of sprouting broccoli (*Brassica oleracea* var. *italica*). MSc thesis, submitted to Sri Karan Narendra Agriculture University, Jobner, pp 1-128.
- Thentu TL, Dutta D, Dutta DM, Saha A (2016) Performance of broccoli (*Brassica oleracea* var. *italica*) under drip irrigation and mulch. *J Appl Nat Sci* 8(3): 1410-1415.