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## Effect of different type of mulches on soil properties and weed biomass in broccoli var. Pusa KTS 1

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#### Abstract

The present experiment was conducted during winter 2019-20 at Polytechnic in Horticulture, ACHF, NAU, Paria (Gujarat). Soil properties and weed biomass were studied under different mulches and compared with control. The experiment was laid out as Randomized Block Design (RBD) with nine treatments and three replications. The result indicated that the maximum soil temperature at morning (26.8 °C, 25.6 °C, 26.7 °C, 23.7 °C, 25.6 °C, 26.2 °C and 26.8 °C), afternoon (34.9 °C, 34.4 °C, 30.5 °C, 30.7 °C, 32.00 °C, 36.4 °C and 36.8 °C) and evening (32.7 °C, 32.8 °C, 27.9 °C, 27.7 °C, 31.7 °C, 33.4 °C and 33.9 °C) at 14, 28, 42, 56, 70, 84 and 98 DATP, respectively, soil moisture content at 10, 20, 30 DATP and at first harvest (22.60, 20.97, 22.25 and 21.58 %, respectively) and minimum weed biomass at 20, 40 DATP and at first harvest (5.25, 6.49 and 7.20 g m<sup>-2</sup>, respectively) were recorded with black polyethylene mulch (50 µm), among all the treatments. This indicated that the black polyethylene mulch (50 µm) had a positive effect on soil properties and weed biomass in broccoli var. Pusa KTS 1.

**Keywords:** Mulch, soil moisture, soil temperature, weed biomass

#### Introduction

Vegetables play a crucial role in food and nutritional security of ever growing population of our country. The 'Cole crops' group of vegetables includes cauliflower, cabbage, knol-khol, broccoli, brussels sprouts, kale and chinese cabbage. Among all cole crops, Broccoli (*Brassica oleracea* var. *italica*) is an important nutritive underexploited exotic vegetable. The centre of origin of broccoli is Mediterranean region. It belongs to family Brassicaceae or Cruciferae which having 18 chromosome number (2n=18, x=9). The edible part of broccoli is curd. It contains vitamin A (130 times and 22 times more than cauliflower and cabbage, respectively), vitamin C thiamine, riboflavin, niacin and minerals like Ca, P, K and Fe. It is also a rich source of sulforaphane compound which is related with reducing the risk of cancer (Kalia, 1995) [4]. The important broccoli growing countries include Europe, North America, USA, China, England, Japan and Italy. In India, the cultivation of broccoli is not popular but now gaining popularity with Indian growers for the previous couples of year due to high nutritive value. In India, it is mainly grown within the hilly areas of Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Nilagiri Hills and Northern plains of India. The practice of applying mulch for the production of vegetables is thousands of years old. Mulching is an agricultural cropping technique that involves placing organic or synthetic materials on soil around plants to provide a more favourable environment for growth and production. Mulches are used to regulate the soil temperature, protect the root of a plant from heat, check evaporation, conserve soil moisture, suppress weed growth, increase water use efficiency and modify soil micro climate. Mulches reduced weed growth by making conditions unfavorable for germination of weed seeds and providing a physical barrier for emerging weeds.

#### Materials and Methods

A field experiment was carried out at Polytechnic in Horticulture, ACHF, NAU, Paria (Gujarat) during the winter season, 2019-20. The soil of the experimental plot having pH 7.3, EC 0.42 dS m<sup>-1</sup>, 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: T<sub>1</sub> (Black polyethylene mulch: 25 µm), T<sub>2</sub> (Black polyethylene mulch: 50 µm), T<sub>3</sub> (Silver and black polyethylene mulch: 25 µm), T<sub>4</sub> (Silver and black polyethylene mulch: 50 µm), T<sub>5</sub> (Red polyethylene mulch: 25 µm), T<sub>6</sub> (Red polyethylene mulch: 50 µm), T<sub>7</sub> (Paddy straw mulch: 8 t ha<sup>-1</sup>), T<sub>8</sub> (Sugarcane trash: 8 t ha<sup>-1</sup>) and T<sub>9</sub> (Control: Without mulch).

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Mulches were spread in plot before a day of transplanting as per treatment. Plastic mulch was laid by cutting into pieces of 4 m × 4 m to cover the plot area. For the seedling, 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. All the cultural and plant protection operations were followed to raise healthy crop. Data were recorded on soil properties and weed biomass. Recorded data were analyzed by the method advocated by Panse and Sukhatme, 1985 [7].

#### Soil temperature (°C)

Soil temperature was recorded with the use of soil thermometers at depth of 0-15 cm. Observations were recorded at 14, 28, 42, 56, 70, 84 and 98 DATP in morning (8:00 am), afternoon (2:00 pm) and evening (6:00 pm) in each treatment and expressed in degree Celsius (°C).

#### Soil moisture content (%)

The soil moisture content was determined at 10, 20, 30 DATP and at first harvest. Soil moisture content (0-15 cm depth) was determined by gravimetric method (Jalota *et al.*, 1998) [2]. Sample dried in oven at 105°C until constant weight. It was estimated in percentage by using following formula:

$$\text{Soil moisture content (\%)} = \frac{W_1 - W_2}{W_2} \times 100$$

#### Where

W<sub>1</sub> = Weight of moist soil (g)

W<sub>2</sub> = Weight of oven dry soil (g)

#### Weed biomass (g m<sup>-2</sup>)

The weeds were taken from the sampling area (1 m<sup>2</sup>) and dried in oven at 65° ± 5 °C to a constant dry weight. Dry weight of weeds were recorded for each treatment and expressed in g m<sup>-2</sup>. The observations were recorded at 20, 40 DATP and at first harvest.

### Results and Discussion

#### Soil temperature (°C)

The soil temperature was positively influenced by different types of mulch. Among nine treatments, maximum soil temperature at morning (26.8 °C, 25.6 °C, 26.7 °C, 23.7 °C, 25.6 °C, 26.2 °C and 26.8 °C), afternoon (34.9 °C, 34.4 °C,

30.5 °C, 30.7 °C, 32.00 °C, 36.4 °C and 36.8 °C) and evening (32.7 °C, 32.8 °C, 27.9 °C, 27.7 °C, 31.7 °C, 33.4 °C and 33.9 °C) were recorded at 14, 28, 42, 56, 70, 84 and 98 DATP, respectively with black polyethylene mulch: 50 µm. The lower soil temperatures were recorded in the control. The soil temperature under black polyethylene mulch was observed to be higher followed by the silver polyethylene mulch, while the lowest soil temperature was observed in control. The soil temperature was obtained higher under the plastic mulch than the other treatments of mulching. Plastic mulches absorb comparatively large amount of the incoming radiation and transmit a considerable part of the soil underneath. A similar result was reported by Job *et al.* (2018) [3] in cauliflower and Sarkar *et al.* (2019) [8] in onion.

#### Soil moisture content (%)

The soil moisture content was influenced by different mulch treatments. Results revealed that all the mulches had a higher amount of moisture as compared to the control. The higher soil moisture content 22.60, 20.97, 22.25 and 21.58 % were recorded with Black polyethylene mulch: 50 µm at 10, 20, 30 DATP and at first harvest, respectively. The lowest soil moisture content was recorded in the control plot. The obtained result might be due to maximum precipitation and lower evaporation from the soil surface of the mulch treated zone. Similar finding confirms to Mahadeen (2014) [5] in summer squash and tomato and Singh and Singh (2018) [9] in bitter gourd.

#### Weed biomass (g m<sup>-2</sup>)

The collected data showed that the mulching of soil significantly influenced the weed biomass. Among various treatments, the minimum weed biomass 5.25, 6.49 and 7.20 g m<sup>-2</sup> were recorded with Black polyethylene mulch: 50 µm at 20, 40 DATP and first harvest, respectively. While the highest weed biomass was observed in control. Weed biomass was significantly lower under the plastic mulches than organic mulch and control. The lowest weed biomass under plastic mulch may have resulted from better soil coverage which prevented weed growth through prevention of photo induction needed for weed seed germination and acting as a mechanical hindrance. Similar findings have also been obtained by Olabode *et al.* (2007) [6] in okra, Gunasekaran and Arumugam Shakila (2014) [1] in medicinal coleus and Tesfaye *et al.* (2016) [10] in tomato.

**Table 1(a):** Effect of different type of mulches on soil temperature (°C) in broccoli var. Pusa KTS 1

Treatments	Soil temperature (°C)											
	14 Datp			28 Datp			42 Datp			56 Datp		
	Morning	After-noon	Evening	Morning	After-noon	Evening	Morning	After-noon	Evening	Morning	After-noon	Evening
T <sub>1</sub>	26.3	34.0	32.0	25.0	33.6	32.0	26.0	29.8	27.2	22.5	30.3	26.7
T <sub>2</sub>	26.8	34.9	32.7	25.6	34.4	32.8	26.7	30.5	27.9	23.7	30.7	27.7
T <sub>3</sub>	26.1	33.5	31.6	24.7	33.4	31.7	25.5	29.5	26.8	22.8	29.7	26.5
T <sub>4</sub>	26.4	34.7	32.2	24.9	34.1	32.5	26.2	30.2	27.5	23.3	30.5	27.0
T <sub>5</sub>	25.7	32.6	30.8	23.8	32.7	31.2	24.7	29.0	25.8	21.3	29.0	25.7
T <sub>6</sub>	26.0	33.1	31.4	24.1	33.1	31.4	25.0	29.2	26.5	21.8	29.3	26.3
T <sub>7</sub>	25.2	32.4	30.4	23.6	32.6	30.5	24.5	28.7	25.0	20.9	28.6	24.8
T <sub>8</sub>	24.5	31.8	30	23.1	31.9	29.7	23.8	28.2	24.3	20.7	28.0	24.5
T <sub>9</sub>	24.2	31.1	29.8	22.5	31.4	29.2	23.2	27.5	24.0	20.0	27.2	24.0

**Table 1(b):** Effect of different type of mulches on soil temperature (°C) in broccoli var. Pusa KTS 1

Treatments	Soil temperature (°C)								
	70 DATP			84 DATP			98 DATP		
	Morning	Afternoon	Evening	Morning	Afternoon	Evening	Morning	After-noon	Evening
T <sub>1</sub>	24.6	31.6	31.2	25.4	36.0	32.5	26.0	36.3	33.1
T <sub>2</sub>	25.6	32.0	31.7	26.2	36.4	33.4	26.8	36.8	33.9
T <sub>3</sub>	24.2	31.2	31.0	25.2	35.3	32.3	25.9	35.7	32.7
T <sub>4</sub>	25.3	31.8	31.5	25.8	36.1	32.7	26.3	36.6	33.5
T <sub>5</sub>	23.8	30.5	29.8	24.9	35.1	31.8	25.5	35.0	31.7
T <sub>6</sub>	24.0	30.8	30.5	25.0	35.8	32.0	25.6	35.4	32.3
T <sub>7</sub>	23.5	30.4	29.5	24.4	34.7	31.2	25.2	34.8	31.2
T <sub>8</sub>	23.2	30.3	29.1	24.1	34.4	30.7	25.0	34.0	30.9
T <sub>9</sub>	21.9	29.9	28.3	23.5	33.7	30.4	24.5	33.2	30.2

**Table 2:** Effect of different type of mulches on soil moisture content (%) in broccoli var. Pusa KTS 1

Treatments	Soil moisture content (%)			
	10 DATP	20 DATP	30 DATP	At first harvest
T <sub>1</sub> : Black polyethylene mulch (25 µm)	21.23	18.88	21.02	20.35
T <sub>2</sub> : Black polyethylene mulch (50 µm)	22.60	20.97	22.25	21.58
T <sub>3</sub> : Silver and black polyethylene mulch (25 µm)	20.29	19.53	21.12	20.12
T <sub>4</sub> : Silver and black polyethylene mulch (50 µm)	21.87	20.34	21.96	20.82
T <sub>5</sub> : Red polyethylene mulch (25 µm)	17.80	17.90	19.10	18.85
T <sub>6</sub> : Red polyethylene mulch (50 µm)	19.18	18.05	19.32	18.99
T <sub>7</sub> : Paddy straw mulch (8 t ha <sup>-1</sup> )	18.15	17.46	18.29	17.80
T <sub>8</sub> : Sugarcane trash (8 t ha <sup>-1</sup> )	16.30	16.79	17.74	17.26
T <sub>9</sub> : Control (Without mulch)	15.90	14.98	16.46	16.07
S.Em.±	0.83	0.82	0.88	0.83
C.D. at 5%	2.50	2.46	2.64	2.48
C.V. %	7.50	7.75	7.73	7.51

**Table 3:** Effect of different type of mulches on weed biomass (g m<sup>-2</sup>) in broccoli var. Pusa KTS 1

Treatments	Weed biomass (g m <sup>-2</sup> )		
	20 DATP	40 DATP	At first harvest
T <sub>1</sub> : Black polyethylene mulch (25 µm)	8.19	9.29	10.24
T <sub>2</sub> : Black polyethylene mulch (50 µm)	5.25	6.49	7.20
T <sub>3</sub> : Silver and black polyethylene mulch (25µm)	8.33	10.46	10.69
T <sub>4</sub> : Silver and black polyethylene mulch (50 µm)	6.13	7.75	8.00
T <sub>5</sub> : Red polyethylene mulch (25 µm)	10.17	12.51	13.27
T <sub>6</sub> : Red polyethylene mulch (50 µm)	9.16	11.57	11.86
T <sub>7</sub> : Paddy straw mulch (8 t ha <sup>-1</sup> )	12.61	14.69	14.94
T <sub>8</sub> : Sugarcane trash (8 t ha <sup>-1</sup> )	14.31	14.55	16.28
T <sub>9</sub> : Control	22.49	24.15	26.35
S.Em.±	0.75	0.80	0.58
C.D. at 5%	2.25	2.41	1.74
C.V. %	12.10	11.24	7.60

## Conclusions

On the basis of the result obtained in the present investigation, it may be concluded that application of mulching influenced the soil properties and weed biomass in broccoli field as compared to control. Application of black polyethylene mulch: 50 µm was beneficial for soil temperature, soil moisture content and weed biomass of broccoli field, which leads to increase in growth, yield and quality parameters of broccoli cultivation under South Gujarat conditions.

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