The Pharma Innovation Journal 2023; 12(12): 2594-2597

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 2594-2597

www.thepharmajournal.com
Received: 07-09-2023
Accepted: 10-10-2023

Nihar A Patel
M.Sc. Scholar, Department of Vegetable Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

SS Masaye
Assistant Professor, Polytechnic in Horticulture, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

VM Chaudhari
Ph.D. Scholar, Department of Vegetable Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

ZF Khasdar
M.Sc. Scholar, Department of Vegetable Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

SS Gaikwad
Associate Professor, Polytechnic in Horticulture, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

Corresponding Author:
Nihar A Patel
M.Sc. Scholar, Department of Vegetable Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

Effect of different type of mulches on growth characteristics of cauliflower var. Pusa Snowball K-1

Nihar A Patel, SS Masaye, VM Chaudhari, ZF Khasdar and SS Gaikwad

Abstract
The present experiment was conducted during winter 2021-22 at Polytechnic in Horticulture, ACHF, NAU, Paria (Gujarat) to study the effect of different type of mulches on growth characteristics of cauliflower. The experiment was laid out in Randomized Block Design (RBD) with three replications and nine treatments *viz.*, T_1- Black polyethylene mulch, T_2- Silver polyethylene mulch, T_3- Red polyethylene mulch, T_4- Silver black polyethylene mulch, T_5- White polyethylene mulch, T_6- Paddy straw mulch (10 t ha^{-1}), T_7- Sugarcane trash (10 t ha^{-1}), T_8- Farmer's practice (Two hand weeding with flood irrigation) and T_9- Control (No mulch). The result indicated that the treatment T_1 (Black polyethylene mulch) recorded maximum plant height (28.70, 49.23, 59.66 and 64.66 cm); plant spread (N-S) (27.40, 48.10, 63.23 and 68.20 cm); plant spread (E-W) (25.66, 46.06, 59.56 and 66.30 cm); number of leaves per plant (13.40, 19.60, 24.20 and 26.20) and leaf length (19.70, 36.23, 44.66 and 51.40 cm) at 30, 60, 90 DATP and at curd harvest, respectively. The maximum stalk length (16.20 cm) and curd: plant ratio (0.42) were also recorded by black polyethylene mulch (T_1). While, minimum days to first curd initiation (65.60 days) and days to 50% curd initiation (72.40 days) were recorded with silver black polyethylene mulch (T_4). So, it can be concluded that black and silver black polyethylene mulch had a positive effect on growth characteristics of cauliflower var. Pusa Snowball K-1 under South Gujarat condition.

Keywords: Vegetables, cauliflower, mulch, growth, South Gujarat

Introduction
Vegetables play an important role in food and nutritional security of ever-growing population of the world. They are potential source of vitamins, minerals and dietary fibers. The '*Cole crops*' are one of the most popular group of vegetables grown during winter season in India. The '*Cole*' group of vegetables includes cabbage, cauliflower, knol-khol, broccoli, Brussels sprout and kale. Among cole crops, Cauliflower (*Brassica oleracea* var. *botrytis* L.) is an important vegetable crop, belongs to family Cruciferae. It is cultivated for its attractive curd which is used as a vegetable, soup and pickling. India is the second largest producer of cauliflower in the world. In India, the area under cauliflower cultivation is 468.0 thousand hectares with an annual production of 9235.0 thousand tonnes and productivity is 19.7 t ha^{-1} (Anon., 2020) [1]. Major cauliflower growing states in India are West Bengal, Bihar, Odisha, Haryana, Gujarat, Jharkhand, Assam, Chhattisgarh, Madhya Pradesh and Uttar Pradesh. Cauliflower fresh curd is highly nutritive and contains moisture 90.8 g, protein 2.6 g, fat 0.4 g, minerals 1.0 g, fiber 1.2 g, carbohydrates 4.0 g, energy 30 kcal, calcium 33 mg, phosphorus 57 mg, Iron 1.5 mg, carotene 30 mg, thiamine 0.04 mg, riboflavin, 0.10 mg, niacin 1.0 mg and vitamin-C 56 mg per 100 g of an edible portion (Jood and Khetrapaul, 2011) [9].
Among the various stresses of agriculture in India, weeds are the major problem by contributing 33% of total loss. Weeds interfere with crop plants severely and affect the growth, yield and quality of crops. Mulching is one of the important cultivation practices, which provides the opportunity to control the weeds, conserve the soil moisture as well as increasing the crop yield and income of the farmers.
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 either organic or inorganic in nature. Organic mulches are the mulch that is derived from plant and animal materials. Commonly available organic mulches include leaves, grass clippings, peat moss, bark chips, rice straw, compost, sugarcane trash, animal manures and inorganic mulches include polyethylene films, aluminium foils, stones, pebbles,

etc. The use of organic mulches not only conserves the soil moisture, but also increases the soil nutrients through organic matter addition (Kumar and Kumar, 1990) [10]. Organic mulches are produced as wastes in several forms, biodegradable in nature, economical to marginal farmers and are available locally free of cost in every part of the nation. On the other hand, plastic or polyethylene mulches have the properties of moderating the hydrothermal regimes of microclimate of crops, show positive effects on weed control, prevention of soil dryness and crusting, water saving by preventing evaporation from surface, prevention of soil erosion and reduction of nutrient loss by leaching (Singh *et al*., 2016) [17]. In addition, plastic mulch also accelerates plant height, early growth and bring satisfactory weed control without any application of herbicides (Najafabadi *et al.*, 2012) [13].

Therefore, mulching can help to regulate the soil temperature, protect the root of a plant from heat, check evaporation, conserve soil moisture, suppress weed growth and modify soil micro climate. Considering the above circumstances, this work was undertaken to study the effect of different type of mulches on growth characteristics of cauliflower var. Pusa Snowball K-1 under South Gujarat condition.

Materials and Methods

The present investigation was carried out at Polytechnic in Horticulture, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Paria (Gujarat) during the winter season, 2021-22. Geographically, it is situated on 22º 35' North latitude and 72º 35' East longitude at an elevation of 16.10 m above Mean Sea Level. According to agro-climatic zones of India, Polytechnic in Horticulture, ACHF, Paria falls in South Gujarat Heavy Rainfall zone-I and Agro-Ecological Situation-II (AES-II), which is typically characterized by humid and warm monsoon with heavy rainfall, moderately cold winter and fairly hot summer. The average rainfall of this region is 1500 to 2000 mm which is normally received from first fortnight of June to September end. The soil of experimental field was deep black having pH 7.4, EC 0.43 dS m^{-1}, medium in nitrogen and phosphorus and sufficient in potash content. The experiment was laid out in a Randomized Block Design (RBD) including three replications and nine treatments namely; T_1- Black polyethylene mulch, T_2- Silver polyethylene mulch, T_3- Red polyethylene mulch, T_4- Silver black polyethylene mulch, T_5- White polyethylene mulch, T_6- Paddy straw mulch (10 t ha^{-1}), T_7- Sugarcane trash (10 t ha^{-1}), T_8- Farmer's practice (Two hand weeding with flood irrigation) and T_9- Control (No mulch). The thickness of the all plastic mulches was 50 µ. The size of each plot was 3.60 m × 3.15 m. The distance maintained between two blocks and two plots were 1 m and 0.5 m, respectively. The experimental plots were thoroughly cultivated and levelled so as to minimize such protrusions as clods, stubble and stones in the area and to prevent the tearing of polythene sheeting. 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 cm × 45 cm spacing. After that, all sides of the mulch sheet were anchored at 15 cm depth of soil. Paddy straw and sugarcane trash were spread in the plot after the transplanting of seedlings. About one month old seedlings of cauliflower were used for transplanting. All the cultural and plant protection operations were followed to raise healthy crop. The irrigation was given by drip system except treatment T_8 (Farmer's practice: Two hand weeding with flood irrigation). Two hand weedings were done only in treatment T_8 (Farmer's practice) and no any weeding was done during entire cropping period in the treatments of different mulches (T_1, T_2, T_3, T_4, T_5, T_6, T_7) and control weedy check (T_9). Five plants were randomly selected and tagged from each plot to record the data. The observations were recorded for plant height, plant spread (N-S and E-W), number of leaves per plant, leaf length, stalk length, curd: plant ratio, days to first curd initiation and days to 50% curd initiation. The growth parameters like plant height, plant spread (N-S and E-W), number of leaves per plant and leaf length were recorded at 30, 60, 90 DATP and at the time of curd harvest. Collected data were statistically analyzed by the method described by Panse and Sukhatme, 1985 [14].

Results and Discussion

Plant height (cm)

The plant height of cauliflower at 30, 60, 90 DATP and at curd harvest is presented in Table 1. The result revealed that plant height was significantly affected by different mulch treatments at all the growth stages. The plant height increases with the advancement of growth stage in cauliflower. Among the different treatments, treatment T_1 (Black polyethylene mulch) recorded maximum plant height (28.70 cm, 49.23 cm, 59.66 cm and 64.66 cm) at 30, 60, 90 DATP and at curd harvest, respectively. While, the minimum plant height of all the growth stages were recorded under the treatment T_9 (Control). The raise in plant height might be due the better availability of moisture and optimum soil temperature provided by mulch which leads to an increase in crop growth. These results are in accordance with other researchers *viz.*, Tawfeeq and Abdulrhman (2021) [19] in cauliflower, Thentu *et al*. (2016) [20] and Char *et al*. (2020) [5] in broccoli, Verma *et al.* (2017) [21] in cabbage and Bhatt *et al.* (2011) [4] in summer squash.

Plant spread (cm)

The mean data pertaining to plant spread (N-S and E-W) of cauliflower at 30, 60, 90 DATP and at curd harvest have been presented in Table 1. The result revealed that plant spread (N-S and E-W) of cauliflower was significantly influenced by different mulch treatments at all the growth stages and all the mulches had a higher plant spread (N-S and E-W) as compared to the control. Treatment T_1 (Black polyethylene mulch) recorded maximum plant spread (N-S and E-W) at 30 DATP (27.40 cm and 25.66 cm), 60 DATP (48.10 cm and 46.06 cm), 90 DATP (63.23 cm and 59.56 cm) and at curd harvest (68.20 cm and 66.30 cm). Whereas, minimum plant spread (N-S and E-W) at all the growth stages were recorded under the treatment T_9 (Control). The obtained result might be due to reduction in evaporation and nutrient losses, control of weeds and improve of hydrothermal regimes of soil by black polyethylene mulch helps in increasing growth parameters of the plants. These findings are in line with Job *et al*. (2018) [8] in cauliflower, Bhandari and Bhandari (2021) [3] in broccoli and Verma *et al*. (2017) [21] in cabbage.

Number of leaves per plant

The data related to the number of leaves per plant at 30, 60, 90 DATP and at curd harvest are highlighted in Table 2. The

collected data showed that the mulching of soil significantly affected the number of leaves per plant. Among various treatments, the treatment T_1 (Black polyethylene mulch) recorded maximum number of leaves per plant (13.40, 19.60, 24.20 and 26.20) at 30, 60, 90 DATP and at curd harvest, respectively. The lowest number of leaves per plant at all the growth stages were recorded under the treatment T_9 (Control). It might be due to microclimatic condition improved by the mulches provided a suitable condition for producing higher number of leaves in the plant. Similar findings were confirmed to Choube *et al*. (2020) [6] in cauliflower, Punetha (2020) [15] in broccoli, Asaduzzaman *et al*. (2010) [2] in lettuce and Bhatt *et al*. (2011) [4] in summer squash.

Leaf length (cm)

Results related to the leaf length of cauliflower at 30, 60, 90 DATP and at curd harvest as affected by various mulch treatments are presented in Table 2. The leaf length was significantly affected by different mulch treatments under the study at all the growth stages. Among the all treatments, treatment T_1 (Black polyethylene mulch) found best and recorded maximum leaf length (19.70 cm, 36.23 cm, 44.66 cm and 51.40 cm) at 30, 60, 90 DATP and at curd harvest, respectively. While, the minimum leaf length at all the growth stages were recorded under the treatment T_9 (Control). The increased leaf length was probably associated with an increased growth of plant by black polyethylene mulch which is governed by optimum soil temperature with minimum fluctuations and good soil moisture retention as well. Similar findings were reported by Tawfeeq and Abdulrhman (2021) [19] in cauliflower and Mollah *et al.* (2009) [12] in broccoli.

Stalk length (cm)

The data regarding the stalk length at the time of curd harvest are presented in Table 2. Application of different type of mulches was found to be significant on the stalk length of cauliflower recorded at curd harvest stage. The outcome for stalk length showed that, the treatment T_1 (Black polyethylene mulch) recorded significantly maximum stalk length (16.20 cm) than other treatments. Whereas, treatment T_9 (Control) noted the lowest stalk length (10.26 cm) among the all treatments. The augment of stalk length might be due to the positive effect of black polyethylene mulch that improves microclimate around the rhizosphere of the crop. These findings are coincides with work done by Maida (2014) [11] in cauliflower and Jinal (2020) [7] in broccoli.

Curd: Plant ratio (w/w)

The data related to curd: plant ratio (CPR) are depicted in Table 2. It was seen that, the different mulch treatments exerted significant impact on curd: plant ratio (CPR) of cauliflower. The maximum curd: plant ratio (0.42) was recorded in treatment T_1 (Black polyethylene mulch). It might be due to black polyethylene mulch creates etiolated conditions to the rhizosphere that resulted in enhanced root growth and higher nutrient uptake which facilitated better growth of curd that ultimately resulted in higher curd: plant ratio. While, the minimum curd: plant ratio (0.31) was noted in treatment T_9 (Control).

Days to first curd initiation

The number of days taken to first curd initiation are presented in Table 2. A perusal of data reveals that the number of days taken to first curd initiation was significantly influenced by different mulch treatments. The treatment T_4 (Silver black polyethylene mulch) took minimum days (65.60) for first curd initiation. While, treatment T_9 (Control) took maximum days (83.80) for first curd initiation. The obtained result might be due to higher soil moisture content and soil temperature under plastic mulch improved the plant microclimate which leading to early growth, flowering and fruiting. These findings are in line with Maida (2014) [11] in cauliflower and Regar (2017) [16], Singh and Kumar (2017) [18] and Jinal (2020) [7] in broccoli.

Days to 50 % curd initiation

The data pertaining to the days to 50% curd initiation as influenced by different type of mulches are summarized in Table 2. The days to 50% curd initiation was significantly influenced by different types of mulch during the period of investigation. Among nine treatments, the minimum days (72.40) to 50% curd initiation was achieved in the treatment T_4 (Silver black polyethylene mulch). Whereas, the maximum days (94.40) to 50% curd initiation was recorded in treatment T_9 (Control). The obtained result might be due to higher soil moisture content and soil temperature under plastic mulch improved the plant microclimate which leading to early growth, flowering and fruiting. These findings are in line with Maida (2014) [11] in cauliflower and Jinal (2020) [7] in broccoli.

Table 1: Effect of different type of mulches on plant height and plant spread of cauliflower var. Pusa Snowball K-1

Treatments	Plant height (cm)				Plant spread (N-S) (cm)				Plant spread (E-W) (cm)			
	30 DATP	60 DATP	90 DATP	At curd harvest	30 DATP	60 DATP	90 DATP	At curd harvest	30 DATP	60 DATP	90 DATP	At curd harvest
T_1	28.70	49.23	59.66	64.66	27.40	48.10	63.23	68.20	25.66	46.06	59.56	66.30
T_2	24.46	43.00	52.10	56.53	23.86	43.30	57.83	63.10	22.40	40.66	55.40	61.70
T_3	23.06	42.13	51.26	54.33	20.90	41.86	54.10	58.10	19.43	39.10	50.66	56.26
T_4	24.93	45.70	54.30	60.13	25.70	46.26	61.30	65.60	23.50	44.60	57.96	63.26
T_5	24.63	43.73	53.73	58.80	24.16	45.13	60.50	64.50	22.80	42.83	57.30	62.63
T_6	22.80	42.03	51.13	53.43	19.83	40.20	51.53	57.86	17.86	38.60	48.06	55.56
T_7	21.93	40.66	50.76	52.76	19.40	39.40	49.66	56.03	17.36	37.90	47.26	53.76
T_8	19.86	38.70	49.43	51.36	18.20	38.20	47.83	52.20	16.46	36.33	45.96	50.73
T_9	18.93	37.63	43.16	48.10	17.43	35.26	46.40	50.93	15.46	32.50	43.40	49.50
S.Em.±	1.40	1.93	2.48	2.50	1.22	1.99	2.67	2.77	1.14	2.12	2.69	2.60
C.D. at 5%	4.21	5.79	7.45	7.49	3.67	5.99	8.01	8.33	3.42	6.35	8.08	7.81
C.V. %	10.47	7.87	8.32	7.79	9.69	8.24	8.45	8.07	9.83	9.22	9.02	7.82

Table 2: Effect of different type of mulches on number of leaves per plant, leaf length, Stalk length, curd: plant ratio, days to first curd initiation and days to 50% curd initiation of cauliflower var. Pusa Snowball K-1

Treatments	Number of leaves per plant				Leaf length (cm)				Stalk length (cm)	Curd: Plant ratio (w/w)	Days to first curd initiation	Days to 50% curd initiation
	30 DATP	60 DATP	90 DATP	At curd harvest	30 DATP	60 DATP	90 DATP	At curd harvest				
T_1	13.40	19.60	24.20	26.20	19.70	36.23	44.66	51.40	16.20	0.42	72.60	80.80
T_2	10.80	15.60	19.80	21.40	14.80	30.00	37.30	44.26	14.26	0.38	69.40	77.00
T_3	10.20	15.40	19.40	21.20	14.06	29.13	36.26	43.83	13.80	0.36	75.80	84.60
T_4	12.40	18.00	23.20	24.80	18.00	32.70	40.80	48.36	15.40	0.40	65.60	72.40
T_5	11.80	17.20	22.00	23.20	17.56	31.76	39.96	46.80	14.53	0.39	73.20	81.80
T_6	9.80	15.00	19.00	20.60	13.80	28.80	35.73	42.50	13.46	0.35	77.00	86.20
T_7	9.40	14.60	18.60	20.00	12.93	27.66	35.00	41.76	12.46	0.34	78.40	88.00
T_8	9.20	14.40	18.20	19.40	10.86	26.03	32.80	39.63	11.40	0.32	80.00	90.20
T_9	8.60	13.60	16.20	18.20	10.03	22.30	29.16	36.20	10.26	0.31	83.80	94.40
S.Em.±	0.588	0.925	1.27	1.37	0.742	1.50	1.57	1.84	0.70	0.01	3.37	3.62
C.D. at 5%	1.76	2.77	3.83	4.12	2.22	4.51	4.73	5.52	2.10	0.04	10.12	10.87
C.V. %	9.60	10.05	11.04	11.00	8.78	8.86	7.41	7.27	8.97	7.22	7.79	7.48

Conclusions

Based on the experimental results, it can be concluded that application of mulches enhanced the growth performance of cauliflower as compared to control. Application of black polyethylene mulch was beneficial for enhancing the growth parameters like plant height, plant spread, number of leaves per plant, leaf length, stalk length and curd: plant ratio. While, silver black polyethylene mulch (double coated) found superior for took minimum days to first and 50% curd initiation. Therefore, the cultivation of cauliflower using plastic mulches could bring an ample scope for enhancing the growth and production potential of vegetables.

References

1. Anonymous. National Horticulture Board. Ministry of Agriculture and Farmers Welfare, Gurgaon, India, 2020.
2. Asaduzzaman M, Sultana S, Ali MA. Combined effect of mulch materials and organic manure on the growth and yield of lettuce. Am-Euras. J. Agric. and Environ. Sci. 2010;9(5):504-508.
3. Bhandari S, Bhandari A. Effect of different mulching materials on growth and yield of broccoli. Fundam and App. Agric. 2021;6(3):265-271.
4. Bhatt L, Rana R, Uniyal SP, Singh VP. Effect of mulch materials on vegetative characters, yield and economics of summer squash (*Cucurbita pepo* L.) under rainfed mid-hill condition of Uttarakhand. Veg. Sci. 2011;38(2):165-168.
5. Char G, Singh TK, Singh S, Pusam P. Effect of bio-fertilizers and mulching on growth of broccoli (*Brassica oleracea* var. *italica* Planck) under protected condition. Chem. Sci. Rev. and Letters. 2020;9(35):613-617.
6. Choube K, Raidas DK, Jaiswal RK, Chakraborty S. Effect of different weed management practices on growth and yield of cauliflower. J Pharmacogn. and Phytochem. 2020;9(3):603-605.
7. Jinal P. Effect of different type of mulches on growth, yield and quality of broccoli var. Pusa KTS 1. Thesis M.Sc. (Hort.), Navsari Agricultural University, Navsari, India, 2020, 82 p.
8. Job M, Rusia DK, Dinmani, Singh VK. Effect of drip irrigation and plastic mulch on yield, water use efficiency of cauliflower. J Pharmacogn. and Phytochem. 2018;7(1):2556-2560.
9. Jood S, Khetarpaul N. Importance of vegetables in human nutrition and health. In: Rana, M.K. (ed.) Fundamentals of Vegetable Production, New India Publishing Agency, New Delhi, 2011, 70.
10. Kumar D, Kumar R. Importance of mulch in crop production. Indian J Soil Conserv. 1990;18:20-26.
11. Maida SK. Effect of mulching on growth and curd yield of cauliflower. Thesis M.Sc. (Hort.), Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, India, 2014, p. 101.
12. Mollah MDA, Hossain MI, Rahman MJ, Uddain J. Effect of different mulching on growth and yield of broccoli. Int. J Sustain. Agric. and Tech. 2009;5(7):48-54.
13. Najafabadi MBM, Peyvasta GH, Asila MH, Olfatia JA, Rabieeb M. Mulching effects on the yield and quality of garlic as second crop in rice fields. Int. J Plant Prod. 2012;6(3):279-290.
14. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi, India, 1985, 152-161.
15. Punetha S. Effect of different mulch materials on growth and yield attributing traits in broccoli. J Med. Plants Stud. 2020;8(5):81-85.
16. Regar OP. Effect of mulching and bio-fertilizers on growth, yield and quality of sprouting broccoli. Thesis M.Sc. (Hort.), Sri Karan Narendra Agriculture University, Jobner, India, 2017, p. 128.
17. Singh I, Awasthi O, Rai N. Mulching in Vegetable Crops, 2016.
18. Singh R, Kumar J. Impact of different shades of plastic mulch and plant geometry on yield and economics on tender stem broccoli in Punjab, India. Int. J Curr. Microbiol. App. Sci. 2017;6(11):4228-4234.
19. Tawfeeq AM, Abdulrhman HB. Effect of mulching type on growth and yield of two cauliflower varieties. Earth and Environ. Sci. 2021;1:761-766.
20. Thentu TL, Dutta D, Dutta DM, Saha A. Performance of broccoli *(Brassica oleracea* var. *italica* Planck) under drip irrigation and mulch. J App. and Natural Sci. 2016;8(3):1410-1415.
21. Verma S, Garhwal OP, Mahawar AK, Singh SP, Singh B. Response of cabbage (*Brassica oleracea* var. *capitata* L.) cultivar "Golden Acre" to irrigation intervals and different types of mulches. J Exp. Agric. Int. 2017;16(4):1-9.