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Influence of different shades of inorganic mulch and organic mulch on growth attributing traits of broccoli (*Brassica oleracea* L. var. *italica*)

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Abstract
The present investigation entitled "Influence of different shades of inorganic mulch and organic mulch on growth attributing traits of broccoli (*Brassica oleracea* L. var. *italica*)" was conducted at the Department of Horticulture, College of Agriculture, VNMKV, Parbhani (M.S.) during *Rabi* 2021-2022. The experimental design adopted was randomized block design with three replications comprising eight treatments *viz*., T1 (silver polythene mulch), T2 (black polythene mulch), T3 (white polythene mulch), T4 (blue polythene mulch), T5 (red polythene mulch), T6 (orange polythene mulch), T7 (dry leaves) and T8 (control). The results showed that the growth characters *viz*., plant height, number of leaves, length of leaf, width of leaf, leaf area, stem girth, minimum days to 1st head initiation, minimum days to 50 percent head initiation, minimum days to harvesting, weight of head and diameter of head of broccoli were recorded highest with the application of T2 (black polythene mulch) and was significantly superior than other treatments.

Keywords: Broccoli, colored mulching, inorganic mulch, organic mulch, growth

Introduction
Broccoli (*Brassica oleracea* L. var. *italica*) is an exotic and underutilized vegetable in India. It is a species of the Brassicaceae family, more resembling with cauliflower having chromosome number 2n=18. It is an annual crop, cultivated in cool season (*Maggioni et al*. 2010) [10]. Broccoli has large flower heads, usually dark green, arranged in a tree-like structure branching out from a thick stalk which is usually light green. The mass of flower heads is surrounded by large leaves. Green headed broccoli and purple sprouting broccoli are the two most common forms. It is the most nutritious vegetable among cole group.
Mulching is a process by which crops of interest are protected from environmental exposure and competition from weeds by covering or surrounding desirable plants with material that forms a barrier to light and moisture. Mulching is one of the good cultural practices for the favourable manipulation of microclimate (Kasirajan and Ngouajio. 2012) [8]. There are two types of mulches viz., organic or biodegradable made of natural materials and inorganic mainly made of plastic-based materials (Kader *et al*. 2017) [7]. These both are being popularized in recent years (Adhikari *et al*. 2016) [1]. Application of mulching in vegetable cultivation has been of much significance for plant growth characters *viz*., leaf area index and crop growth rate. Hence, keeping all the points in view, the present study was undertaken at the department of horticulture, VNMKV Parbhani.

Materials and Methods
The experiment was carried out at the Department of Horticulture, College of Agriculture, VNMKV, Parbhani (M.S.) during *Rabi* 2021-2022. The variety used for experiment was "Ganesh Broccoli" which is of early to mid-maturity class. The experiment consists of eight treatments *viz*., T1 (silver polythene mulch), T2 (black polythene mulch), T3 (white polythene mulch), T4 (blue polythene mulch), T5 (red polythene mulch), T6 (orange polythene mulch), T7 (dry leaves) and T8 (control) in randomized block design with three replications. The experimental field was thoroughly ploughed to a depth of 30 cm and harrowed thrice. Raised beds of size 7 m length, 1 m width and 25 cm height were prepared. A basal dose of half of the nitrogen @ 120 kg ha^{-1}, full dose of phosphorous @ 80 kg ha^{-1} and potash @ 80 kg ha^{-1} was applied at the time of land preparation. Nitrogen was applied into two splits, at the time of bed preparation and remaining half after 30 days of transplanting. Plastic mulching was done using

30 microns polythene films and dry leaves were spread on top soil of the beds to 5 cm thickness as a mulch. Seedlings were transplanted on mulched raised beds at the distance of 60 cm × 60 cm. Irrigation was provided through drip system. Observations were recorded on growth parameters *i.e*., plant height, number of leaves, length of leaf, width of leaf, leaf area, stem girth, minimum days to 1st head initiation, minimum days to 50 percent head initiation, days to harvesting, weight of head and diameter of head of broccoli. Least significance at 5% level was used for finding the significant differences among the treatment means. The data obtained from selected plants were subjected to analysis of variance as suggested by Panse and Sukhatme (1967) [12].

Results and Discussion

Data on influence of different treatments on growth attributing characters of broccoli are presented in Table 1. It was noted that the application of different coloured polythene mulches showed significant differences in growth of broccoli. The application of black polythene mulch (T2) recorded significantly higher growth as compared to organic mulch (dry leaves) (T7) and control (T8). However, it was found at par with silver polythene mulch (T1).

From the finding (Table 1), black polythene mulch exhibited maximum plant height (42.39 cm) and minimum plant height (30.32 cm) recorded by control plots. The results were in agreement with the findings of Kaur (2021) [9]. Significantly higher count of leaves (24.57) per plant noted in the black polythene mulch and lesser number of leaves (20.27) per plant observed in control.

It was observed that highest values of length (35.56 cm) and width (24.50 cm) of leaves were reported by plants treated with black polythene mulch and it was found superior as compared to control (31.43 cm and 22.23 cm, respectively). Lower values of leaf length and width in control plot and leaf litter treated plots might be due to the insufficient root zone temperature eventually low nutrients and moisture absorbed by plants (Bhandari and Bhandari. 2021) [3]. Plants grown on the black polythene mulch recorded largest leaf area (549.22 cm2) and lowest leaf area found in control plants. Mulching had significant influence on plant growth traits *viz*., leaf area index (LAI), crop growth rate (CGR) and relative growth rate (RGR) (Bhandari and Bhandari. 2021) [3]. Similar findings were reported by Jasim *et al*. (2014) [6] and Mohammed *et al*. (2016) [11].

The treatment black polythene mulch exhibited maximum stem girth (3.21 cm) of broccoli. However, minimum stem girth (2.30 cm) was noted in control plots. The increased stem girth observed in broccoli plants under mulch applications might have a direct impact on the microclimate surrounding the plants by changing the surface's radiation budget and reducing soil water loss, which results in more even soil moisture (Helaly *et al*. 2017) [5]. Similar conclusions also recorded by Pawar *et al*. (2019) [13] in watermelon.

Days taken to 1st head initiation, days to 50 percent head initiation and days to harvesting were significantly affected by different mulches. Least days recorded for 1st head initiation (32.33 days), 50 percent head initiation (37.00 days) and harvesting (52.00 days) in the plots treated with black polythene mulch and highest number of days were recorded in control plots (37.00 days, 44.00 days and 61.25 days, respectively). Similar results were recorded by Jasim *et al*. (2014) [6], Punetha (2020) [14], Significantly lesser number of days for 50 percent curd initiation under mulch treated plots were also noted by Bhoutekar *et al.* (2017) [4] in cauliflower. This is might be due to mulching reduces crop weed competition and maintains soil temperature and moisture beneath the surface which eventually promotes early plant growth and horticultural maturity in vegetables (Helaly *et al*. 2017) [5].

The plants under black polythene mulch showed significant impact on weight and diameter of head of broccoli as compared to all other mulches and control. Highest weight (353.45 g) and diameter (12.94 cm) was recorded in black polythene mulch and lowest values for weight
(156.83 g) and diameter (8.47 cm) of head were noticed in control plots. The results are in agreement with the findings of Punetha (2020) [14] and Sil *et al.* (2020) [15] in cauliflower. Increased size and diameter of broccoli heads under these treatments might be attributed to promote movement of carbohydrates from source to sink. Similar results have been reported by Awasthi *et al*. (2006) [2] in brinjal crop.

Table 1: Effect of different mulches on plant height, no. of leaves per plant, length of leaf, width of leaf area, stem girth, days to 1st head initiation, days to 50% head initiation, days to harvest, weight of head and diameter of head of broccoli.

Tr. No.	Mulch	Plant height (cm)	No. of leaves per plant	Length of leaf (cm)	Width of leaf (cm)	Leaf Area (sq.cm)	Stem Girth (cm)	Days to st initiation	Days to 50% head initiation	Days to Harvest	Weight of head (g)	Diameter of head (cm)
T1	Silver Polythene Mulch	40.64	24.07	34.87	24.00	527.11	3.07	33.33	37.33	53.20	327.53	11.92
T2	Black Polythene Mulch	42.39	24.57	35.56	24.50	549.22	3.21	32.33	37.00	52.00	353.45	12.94
T3	White Polythene Mulch	36.33	23.00	33.30	23.47	492.29	2.85	34.33	38.33	55.30	258.83	10.53
T4	Blue Polythene Mulch	38.71	23.40	33.83	23.70	505.26	2.92	34.00	38.00	54.50	297.48	11.47
T5	Red Polythene Mulch	35.74	22.47	32.63	23.13	475.64	2.73	34.67	40.00	55.80	235.78	9.83
T6	Orange Polythene Mulch	34.57	21.80	32.23	22.90	465.08	2.50	35.00	41.33	57.30	211.24	9.74
T7	Dry leaves	32.61	20.67	31.70	22.50	449.46	2.44	36.33	42.33	59.00	178.79	9.38
T8	Control	30.32	20.27	31.43	22.23	440.22	2.30	37.00	44.00	61.25	156.83	8.47
S.E. ± m.		0.47	0.39	0.24	0.12	4.48	0.06	0.23	0.31	0.74	1.17	0.07
CD @ 5%		1.44	1.20	0.73	0.36	13.59	0.20	0.71	0.94	2.24	3.57	0.22

Conclusion

It can be concluded from the present investigation that the influence of different shades of inorganic mulch and organic mulch on growth attributing traits of broccoli was significant. The application of black polythene mulch proved to be most effective for increment in the vegetative growth, weight and diameter of heads and reducing the number of days required for 1st head initiation, 50% head initiation and days to harvest under Parbhani conditions of Maharashtra.

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