

## Response of Mulch Materials on Growth and Yield of Cucumber (*Cucumis sativus* L.) Hybrid “Multistar” under Shade Net Conditions

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### ABSTRACT

A field experiment was conducted during *rabi* season, at College Farm”, College of Horticulture, Sri Konda Laxman Telangana State Horticulture University, Mojerla, Wanaparthy, Telangana State. The experiment was carried out using cucumber hybrid “Multistar” with eight treatments and three replications. Among different mulch materials, black-black polythene mulch recorded best results in all growth and yield parameters. Black-black polythene mulch has sig-

nificantly recorded the highest plant height of 55.00, 155.07, 204.53 and 223.67 cm, maximum leaf area of 195.97, 278.53, 320.07 and 322.37 cm<sup>2</sup> at 20, 40, 60 and 80 DAS respectively, maximum RGR of 0.0386, 0.0250 and 0.0026 g g d<sup>-1</sup> and NAR of 7.60, 16.00 and 2.66 mg cm<sup>-2</sup> d<sup>-1</sup> were recorded at 20-40, 40-60, 60-80 DAS respectively. Black-black polythene mulch also recorded significantly maximum number of fruits per plant (63.67), average fruit length (16.39 cm) and average fruit diameter (3.67 cm) and fruit yield/plant (8.28 kg), fruit yield/bed (496.60 kg) and fruit yield/hectare (331.07 t ha<sup>-1</sup>). There is no significant difference observed on TSS and ascorbic acid among the treatments.

**Key words** Growth, Yield, Relative growth rate, Net assimilation rate, Black- Black polythene mulch, Black-silver polythene mulch.

### INTRODUCTION

Cucumber is cultivated and consumed as salads throughout the world belongs to cruciferous family. One of the oldest and most nutritious vegetable crops belongs to India with rich source of vitamins and minerals it is having low calories 12g per 100g and water content over 90 % (Alptekin and Gurbuz 2022). It grows well in full sun, wet, well-drained soil with a high organic matter content and mild alkalinity and is frequently referred to be the world’s best fruit or vegetable. Consuming cucumbers can help with

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weight loss, maintaining a healthy level of hydration, digestive regularity, detoxification, improving brain function, preventing cancer, maintaining renal health, relieving constipation, treating intestinal worms naturally, and managing diabetes (Gough 2020, Panhwar *et al.* 2018).

Cucumber fruits are cylinder-shaped when fully grown, measuring 60 centimetres long by 10 cm wide. As the fruit ages, its color changes from green to yellow. Most of the farmers are cultivating multistar hybrid because of their high yield, disease resistance and good quality, apart from its adaptability both under plastic and open field conditions (Gao *et al.* 2021). Mulching is the practice of placing organic or inorganic materials on the soil surface to create a favorable environment for plant growth while preventing weed growth. It serves as a non-chemical weed control technique, eliminating the need for hazardous herbicides and maintaining crop quality. Additionally, mulching has been linked to early germination, increased agricultural yields, and economic benefits for the farming community. Herbicides can also be effectively replaced by mulches to improve crop health and yield. (Karki *et al.* 2020).

Weeds are major problem in cucumber cultivation which effects vegetative growth, flowering and fruiting, resulting in greater yield loss. Herbicides can control weeds effectively but harm the environment by contaminating water sources, damaging ecosystems. The residues left on the crops, can enter the food chain and potentially affect human health to hazardous. Keeping the above points into consideration study has been conducted to see the Response of cucumber (*Cucumis sativus* L.) hybrid “Multistar” to different mulching material on growth and yield under shade net conditions.

## MATERIALS AND METHODS

The experiment was conducted at the College Farm, College of Horticulture, Sri Konda Laxman Telangana State Horticulture University, Mojerla, Wanaparth, Telangana State located at the altitude of 401m above the mean sea level during late rabi season.

The variety under study was Multistar. Seeds

are sown at the Spacing of 50x50cm on the raised beds, size of 15X1m. The crop was applied with 120:60:160kg/ha NPK in the form of Urea, single super phosphate (SSP) and Murate of potash during the field preparation. The experiment was laid out in randomised Block Design with eight treatments T<sub>1</sub>-Black on Black polythene mulch, T<sub>2</sub>-Black on Silver polythene mulch, T<sub>3</sub>- Black on white polythene mulch, T<sub>4</sub>-Paddy husk mulch, T<sub>5</sub>- Paddy straw mulch, T<sub>6</sub>-Ground nutshell mulch, T<sub>7</sub>-Pre-emergence herbicide (Pendimithalin @ 1.0 kg a.i./ha<sup>-1</sup>) and T<sub>8</sub>- Control and three replications. Five days after planting T<sub>4</sub>, T<sub>5</sub>, T<sub>6</sub> beds were spread with paddy husk, paddy straw and ground nutshell respectively with thickness of 5 cm on raised beds.

The data was recorded on growth and yield parameters of five plants per treatment per bed in each replication. Observations was recorded on Plant height (cm), Relative growth rate (g g<sup>-1</sup> d<sup>-1</sup>), Leaf area (cm<sup>2</sup>), Net Assimilation Rate (mg cm<sup>-2</sup> d<sup>-1</sup>), Specific Leaf Weight (SLW), Leaf Area Ratio (LAR), Days taken for first flowering, Number of fruits/plant (no), Days taken for the first fruit harvest, Average fruit weight (grams), Fruit length (cm), Fruit diameter (cm), Fruit yield per plant (kg), Fruit yield per bed (kg), Fruit yield per hectare (tons).

## Statistical analysis

The data recorded at different growth stages were analyzed by adopting the method of analysis of variance outlined by Panse and Sukhatma (1985).

## RESULTS AND DISCUSSION

Among different mulch materials, Black-black polythene mulch recorded maximum results in all growth parameters. Black-black polythene mulch recorded the highest plant height of (55.00, 155.07, 204.53 and 223.67 cm) at 20, 40, 60 and 80 DAS respectively presented in Table 1. The highest plant height was due to increase in soil temperature and retention of soil moisture under black-black polythene mulch, this consequently improved growth of cucumber. Similar results are obtained by, Radhika Regmi *et al.* (2021).

Maximum Leaf area was observed in Black-

**Table 1.** Effect of different mulch materials on Plant height(cm), Leaf area (cm<sup>2</sup>) and Leaf Area Ratio (g cm<sup>-2</sup>) of cucumber hybrid “Multistar” at different stages of crop growth.

Treatment	Plant height(cm)				Leaf Area(cm <sup>2</sup> )				Leaf Area Ratio (g cm <sup>-2</sup> )			
	20DAS	40DAS	20DAS	40DAS	20DAS	40DAS	20DAS	40DAS	20DAS	40DAS	60DAS	80DAS
T1-Black on Black polythene mulch	55.0	155.07	204.53	223.67	195.97	278.53	195.97	278.53	82.89	61.64	34.99	25.89
T2-Black on Silver polythene mulch	52.63	144.60	187.53	213.60	187.33	267.47	187.33	267.47	75.92	58.53	33.50	24.51
T3- Black on white polythene mulch	43.70	137.80	185.93	209.33	168.77	260.97	168.77	260.97	74.03	52.90	31.98	23.44
T4-Paddy husk mulch	33.70	111.67	166.67	182.60	96.07	184.97	96.07	184.97	60.24	54.94	31.63	25.73
T5- Paddy straw mulch	31.03	95.13	143.13	169.53	83.83	188.70	83.83	188.70	42.02	49.41	30.91	24.55
T6-Ground nut shell mulch	38.43	108.60	154.13	181.40	96.50	200.87	96.50	200.87	61.93	55.50	32.52	24.79
T7-Pre-emergence herbicide (pendimithalin @ 1.0 kg a.i./ha <sup>1</sup> )	20.47	57.07	82.60	105.40	58.87	161.20	58.87	161.20	34.11	45.15	28.44	23.87
T8- Control	26.80	94.13	140.13	161.93	65.10	182.50	65.10	182.50	44.82	50.97	30.83	21.87
SE (m)‡	1.24	5.49	4.82	8.18	41.51	7.30	41.51	7.30	0.84	1.06	0.38	0.46
CD at 5%	3.77	16.65	14.63	24.82	13.68	22.14	13.68	22.14	2.56	3.22	1.17	1.39

black polythene mulch (195.97, 278.53, 320.07 and 322.37 cm<sup>2</sup>) at 20, 40, 60 and 80 days after sowing respectively. The increase in leaf area under Black-

black polythene mulch might be due to more growth which leads to high leaf area of plants, resulting to high photosynthetic rate. Similar results are reported

**Table 2.** Effect of different mulch materials on Specific Leaf Weight (g cm<sup>-2</sup>), net assimilation rate (NAR) and relative growth rate (RGR) of cucumber hybrid “Multistar at different crop growth stage.

Treatment	Specific Leaf Weight (g cm <sup>-2</sup> )				NAR (mg cm <sup>-2</sup> d <sup>-1</sup> )			RGR (g g d <sup>-1</sup> )		
	20DAS	40DAS	60DAS	80DAS	20-40DAS	40-60DAS	60-80DAS	20-40DAS	40-60DAS	60-80DAS
T1-Black on Black polythene mulch	0.037	0.065	0.083	0.076	7.60	16.00	2.66	0.0386	0.0250	0.0026
T2-Black on Silver polythene mulch	0.026	0.062	0.072	0.065	7.40	14.40	2.08	0.0375	0.0237	0.0024
T3- Black on white polythene mulch	0.030	0.061	0.066	0.063	7.20	14.10	2.07	0.0360	0.0231	0.0021
T4-Paddy husk mulch	0.026	0.059	0.063	0.046	7.03	10.40	1.73	0.0350	0.0227	0.0025
T5- Paddy straw mulch	0.028	0.053	0.059	0.040	6.90	10.50	1.72	0.0353	0.0225	0.0020
T6-Ground nut shell mulch	0.028	0.056	0.058	0.049	7.40	12.20	1.88	0.0363	0.0251	0.0024
T7-Pre-emergence herbicide (pendimithalin @ 1.0 kg a.i./ha-1)	0.027	0.051	0.049	0.046	6.40	10.90	1.80	0.0405	0.0211	0.0021
T8- Control	0.025	0.048	0.055	0.041	6.60	10.60	1.67	0.0351	0.0222	0.0023
SE (m)‡	0.0007	0.0009	0.0007	0.001	0.1	0.08	0.008	0.0003	0.0002	0.0001
CD at 5%	0.002	0.002	0.002	0.003	0.3	0.25	0.024	0.001	0.0007	0.0003

**Table 3.** Effect of different mulch materials on days taken to first flowering, average fruit length, average fruit diameter no. of fruits per plant, fruit yield per plant, fruit yield per bed, and fruit yield per hectare in cucumber hybrid "Multistar."

Treatment	Days taken to first Flowering	Average fruit length (cm)	fruit diameter (cm)	No. of fruits/plant (no)	Fruit yield / plant (kg)	Fruit yield / bed (kg)	Fruit yield/ hectare (t)
T1-Black on Black polythene mulch	18.33	16.39	3.67	63.67	8.28	496.60	331.07
T2-Black on Silver polythene mulch	19.33	16.25	3.60	61.33	7.97	478.40	318.93
T3- Black on white polythene mulch	22.33	16.15	3.53	56.33	7.32	439.40	292.93
T4-Paddy husk mulch	26.00	14.29	2.93	40.00	5.20	312.00	208.00
T5- Paddy straw mulch	25.37	15.02	2.70	40.67	5.29	317.20	211.47
T6-Ground nut shell mulch	25.33	15.73	3.40	42.00	5.46	327.60	218.40
T7-Pre-emergence herbicide (pendimethalin @ 1.0 kg a.i./ha <sup>1</sup> )	38.67	14.24	2.60	16.00	2.08	124.80	83.20
T8- Control	25.33	15.06	2.97	32.00	4.16	249.60	166.40
SE (m)‡	0.66	0.41	0.22	1.07	0.14	8.37	25.58
CD at 5%	1.82	1.23	0.65	3.26	0.42	25.40	16.93

by Aniekwe and Nwite (2013) and reported that under plastic mulches showed highest leaf area compared to bare soil (control).

Leaf area ratio at different crop growth were indicated that there was decline in LAR as growth advanced in crop growth (82.89, 61.64, 34.99, 25.89 g cm<sup>-2</sup>) at 20, 40, 60 and 80 DAS respectively presented in Table 1. Maximum RGR of (0.0386, 0.0250 and 0.0026 g d<sup>-1</sup>) and NAR of (7.60, 16.00 and 2.66 mg cm<sup>-2</sup> d<sup>-1</sup>) were recorded highest in Black-black polythene mulch and there was decline in values at 20-40, 40-60, 60-80 DAS respectively presented in table 2. The decrease was due to differing environmental factors and increasing temperatures. Specific leaf rate has higher value (0.037, 0.065, 0.083, 0.076 g cm<sup>-2</sup>) at 20, 40, 60 and 80 DAS respectively presented in table 2. Similar results were reported by Alsadon *et al.* (2016).

### Fruit parameters

Black-black polythene mulch has recorded significantly minimum number of days for first flowering (18.33 days), maximum number of fruits/plant (63.67), average fruit length (16.39 cm) and average fruit diameter (3.67 cm) however, it was on par in respect of fruit diameter in Black-silver polythene mulch (3.60 cm) and Black-white polythene mulch

(3.53 cm) respectively in table 3. The highest fruit yield/plant (8.28 kg), fruit yield/bed (496.60 kg) and fruit yield/hectare (331.07 t ha<sup>-1</sup>) in table 3 was recorded with the use of Black-black polythene mulch.

The decreased number of days to flowering under Black polythene mulch might be due to increase in soil temperature around root zone, increased water absorption and plant growth. The Black-black polythene mulch might have reduced the nutrient losses by controlling growth and thus nutrients were effectively taken up by plants resulting in increased fruit size. The increased yield under Black-black polythene mulch cover was due to increase in soil temperature on application of mulch, which resulted in enhancement of soil environment around roots of plants, which led to increasing nutrient absorption and uptake and resulted high yield. It provides better yield per meter square (Oliveira *et al.* 2021, Bharati *et al.* 2020).

Awasthi *et al.* 2022 who concluded that black plastic mulch reduces leaching of nutrients, controlled weed, reduced evaporation of soil water and increased water use efficiency, by maintaining optimum soil moisture and promoted excellent crop growth throughout the growing season.

All the above parameters are on par with Black-silver polythene mulch and lowest was noticed

in Pre-emergence herbicide (Pendimethalin @ 1.0 kg a.i./ha<sup>-1</sup>). It was due to residual effect and phototoxic effect on direct seeded plots of cucumber, leading to reduced growth and yield. The above results were found to be similar with Shanmugasundram and Kandasamy (2003).

## CONCLUSION

Significant variation was observed among the treatments. Black-black polythene mulch has recommended for the farmers for cultivation of cucumber (*Cucumis sativus* L.) hybrid "Multistar under polyhouse condition for maximum growth and yield parameters

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