EFFECT OF COLOUR PLASTIC MULCHING ON PLANT GROWTH PARAMETERS OF OKRA (*Abelmoschus esculentus)* UNDER DRIP IRRIGATION

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Abstract: An experiment was conducted on the effect of colour plastic mulches on plant height, days to fifty per cent flowering, leaf area index under different irrigation levels. The treatments were laid out in split plot design with three replications and a non-mulched treatment as control. The plastic coloured mulches used were white on black, silver on black and black. Their rogation levels used were 60, 80, 100 and 120 per cent ET. The results indicated that the growth components of plant height, days to fifty per cent flowering and leaf area index were significantly influenced by drip irrigation levels. The maximum plant height (210 cm), least days to 50 per cent flowering (42 days) and highest leaf area index (3.60) were recorded under drip irrigation at 80 per cent ET with white on black plastic colour mulch when compared to other treatments throughout the growing period. This was followed by drip irrigation at 60 per cent ET with white on black plastic colour mulch (200 cm, 42.67 days and 3.45 respectively).

Key words: Colour plastic mulch, okra, drip irrigation.

I. INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is the only vegetable crop of significance in the Malvaceae family and is very popular in the Indo-Pak subcontinent. It is one of the oldest cultivated crops and presentlycultivated throughout the tropical, subtropical and warm temperate regions of the world for its fibrous fruits or pods containing round white seeds. Okra plants are among the extremely drought tolerant, heat resistant and pest free vegetable species.These fruits are rich in vitamins, calcium, potassium andother mineral matters. The matured okra seed is a good source of oiland protein and has been known to have superior nutritional quality.

Plastic mulch was first noted for its ability to increase soil temperature in the 1950s. It is beneficial to adjust the soil microclimate to prolong the growing season and increase plant growth (Tarara, 2000). Plant growth requires radiation as a source of energy for photosynthesis, the means by which the radiation from the sun is converted to chemical energy. A variety of colour mulches has been used by growers and researchers in vegetable production. White plastic mulch has been shown to generate cooler soil temperatures than black plastic (Diaz-Perez and Batal, 2002). Therefore, the use of white plastic mulch is preferred during the summer growing season in warmer climates globally compared to black plastic. Silver plastic mulch has resulted in less disease incidence. The use of red plastic mulch has been found to result in

higher yields in tomato and to generate a positive phytochrome compared to the use of black plastic or no plastic. Mulch is a protective cover placed over the soil surface, which can play an important role for sustainable fruit production. Beneficial aspects of plastic mulch include conservation of moisture, weed control and maintaining moderate soil temperature for better root growth and higher crop yield.

Drip irrigation was practised all over the world towards the later part of the last century. This system has gained wide popularity in areas of acute water scarcity and in areas where horticultural and commercial crops are grown. Drip irrigation can help to use water efficiently. A well designed drip irrigation system loses practically no water to runoff, deep percolation and evaporation. Irrigation scheduling can be managed preciously to meet crop demands, holding the promise of increased yield and quality.

Okra is one of the important vegetables most consumed in this part. As the studies on the effect of colour mulching on horticultural crops were not undertaken in this region, such studies would provide much needed information for boosting their productivity and production. Thus, the results of the present project on the test crop okra would lead to the outcome of providing the appropriate technological information on the effect of colour mulching in combination with drip irrigation, which would give quality and maximum okra yield.

II. MATERIAL AND METHODS

A field experiment was undertaken to observe the effect of different colour plastic mulches on the growth and yield of okra (MAHY 28, hybrid) against without mulch. This experiment was conducted at UAS-Raichur, which is situated in Karnataka of India. The highest maximum temperature of 33.4°C was recorded in the month of October, 2015 and lowest temperature of 14.0°C was recorded in the month of December, 2015.The Treatments were tested insplit plot design with three replications. Each replication has 16beds. The main treatments were I_1- Water application at 60 per cent ET using drip irrigation, I_2- Water application at 80 per cent ET using drip irrigation, I_3- Water application at 100 per cent ET using drip irrigation and I_4- Water application at 120 per cent ET using drip irrigation and sub treatments were M_0 – Without mulch (control), M_1 – White on black plastic mulch, M_2 – Silver on black plastic mulch and M_3 – Black plastic mulch.

The experimental plots of 5 m x 1m were prepared for sowing of okra seeds. The plant to plant and row to row spacing were 0.30 and 0.45 m respectively. The different plastic colour mulches of 30-micron thickness arewhite on black, silver on black and black was cut as per the size of the plots.The data was recorded at intervals of 30, 45, 60, 75 and 90 days after sowing (DAS).The observations were recorded onfive randomly selected plants in each plot.

Data were recorded on plant height, days to fifty per cent flowering, leaf area index. Plant height was measured in cm from the base of the plant to the top of the plant with the help of metre scale. Number of days taken from the DAS to the initiation of flowering in fifty per cent of the total plants in entire plot was

considered as days to fifty per cent flowering and expressed in days. The leaf area index (LAI) was measured with an AccuPAR 80 Ceptometer (Decagon Devices, Inc., Pullman, WA, USA) between 11:30 am and 3:30 pm.

III. RESULTS AND DISCUSSION

3.1Plant height

The effect of irrigation levels, mulch colours and their interactions on plant height recorded in different dates *i.e.* 30, 45, 60, 75 and 90 DAS are presented in Table 3.1(a) and table 3.1(b). Among the irrigation levels, drip irrigation at 80 per cent ET (195.25 cm) resulted in significantly taller plants followed by drip irrigation at 100 per cent ET (184.17 cm) and 60 per cent ET (182.00 cm). The plant height was markedly lower in case of drip irrigation at 120 per cent ET (173.08 cm). Significantly tallest plants were observed with white on black plastic mulch (198.00 cm) followed by silver on black plastic mulch (192.75 cm) and black plastic mulch (184.00 cm) at all the intervals in different DAS. Smaller plants were recorded under the control (no mulch) treatment (159.75 cm). In

Table 3.1(a) Effect of different levels of irrigation and plastic mulch colours on plant height, cm

Treatment	30 DAS					45 DAS					60 DAS				
	I_1	I_2	I_3	I_4	Mean	I_1	I_2	I_3	I_4	Mean	I_1	I_2	I_3	I_4	Mean
M_0	18.67	31.33	28.00	30.00	27.00	62.00	69.33	65.00	64.33	65.17	88.33	116.00	92.00	83.00	94.83
M_1	31.67	32.33	32.33	30.00	31.58	92.33	93.33	89.00	83.00	89.42	134.33	144.00	144.00	133.67	139.00
M_2	30.67	35.00	34.00	31.00	32.67	91.67	91.67	73.33	74.00	82.67	137.67	144.33	114.67	110.67	126.83
M_3	29.00	31.33	31.67	29.67	30.42	70.33	76.00	61.67	70.33	69.58	109.00	124.67	90.00	110.00	108.42
Mean	27.50	32.50	31.50	30.17		79.08	82.58	72.25	72.92		117.33	132.25	110.17	109.33	
	SEM ±			CD at 5 per cent		SEM ±			CD at 5 per cent		SEM ±			CD at 5 per cent	
Main treatment	0.98			3.40		1.95			6.74		4.85			16.79	
Sub treatment	1.22			3.56		3.48			10.17		4.42			12.89	
I at same M	2.43			NS		6.97			NS		8.83			NS	
M at same or different I	2.32			NS		6.34			NS		9.06			NS	

Main treatments:

Sub treatments:

I_1: Drip irrigation at 60% ET

M_0: Without mulch condition

I_2: Drip irrigation at 80% ET

M_1: White on black plastic mulch

I_3: Drip irrigation at 100% ET

M_2: Silver on black plastic mulch

I_4: Drip irrigation at 120% ET

M_3: Black plastic colour mulch

Table 3.1(b) Effect of different levels of irrigation and plastic mulch colours on plant height, cm

Treatment	75 DAS					90DAS				
	I_1	I_2	I_3	I_4	Mean	I_1	I_2	I_3	I_4	Mean
M_0	118.67	145.00	128.67	111.00	125.83	143.67	182.67	167.67	145.00	159.75
M_1	165.00	180.33	162.67	162.33	167.58	200.00	210.00	195.33	186.67	198.00
M_2	167.67	176.33	154.67	145.67	161.08	196.00	197.33	193.67	184.00	192.75
M_3	146.67	155.33	138.00	150.67	147.67	188.33	191.00	180.00	176.67	184.00
Mean	149.50	164.25	146.00	142.42		182.00	195.25	184.17	173.08	
		SEM ±		CD at 5 per cent			SEM ±		CD at 5 per cent	
Main treatment		4.56		NS			5.26		NS	
Sub treatment		5.57		16.27			5.69		16.61	
I at same M		11.14		NS			11.38		NS	
M at same or different I		10.67		NS			11.17		NS	

Main treatments:

Sub treatments:

I_1: Drip irrigation at 60% ET

$M_{0:}$ Without mulch condition

I_2: Drip irrigation at 80% ET

M_1: White on black plastic mulch

I_3: Drip irrigation at 100% ET

M_2: Silver on black plastic mulch

I_4: Drip irrigation at 120% ET

M_3: Black plastic colour mulch

combination of treatment, the maximum plant height (210 cm) were recorded under drip irrigation at 80 per cent ET with white on black plastic colour mulch when compared to other treatments throughout the growing period. Positive influence of white on black plastic mulch on plant height might be due to the fact that the incident radiation entered through the white polythene mulch, but very little amount of outgoing radiation could go back to the environments, which slightly improved the soil temperature underneath the white mulch. Similar trend was also reported by Kumar *et al.* (2010).

b) Days to fifty per cent flowering

The effect of irrigation levels and coloured mulches and their interaction on number of day to 50per cent flowering are presented in Table 3.2 and shown in Fig. 3.1. Drip irrigation at 80 per cent ET (43.33 days) was more effective to induce early flowering as compared to drip irrigation at 120 per cent ET (44.17 days). In combination of treatment, minimum days to fifty per cent flowering (42 days) were recorded under drip irrigation at 80 per cent ET with white on black plastic colour mulch when compared to other treatments throughout the growing period. Among mulch colours, white on black plastic mulch was effective for earliness in 50 per cent flowering as compared to control. The results were in agreement with the findings of Chakraborty *et al.* (1994) and Hooda *et al.* (1998).

c) Leaf area index (LAI)

The effect of irrigation levels, mulch colours and their interactions on leaf area index recorded) in different dates *i.e.* 30, 45, 60, 75 and 90 DAS are presented in Table 3.3(a) and Table 3.3(b). The able showed that the leaf area index values recorded at 30, 45, 60, 75 and 90 DAS were significantly influenced by irrigation levels and mulch colours. Among the irrigation level LAI was more in I_2 (0.44, 0.99,1.54,2.38 and 3.33 respectively) followed by I_3, I_4 and I_1. The LAI recorded in afternoon hours was higher in mulched plot as compared to plot without mulch. The LAI was more in M_1 (0.35, 0.99 1.59, 2.43 and 3.40) followed by M_2, M_3 and M_0at 30, 45, 60, 75 and 90 DAS respectively. The leaf area index ranged from (0.40to 0.39), (1.06 to 0.74), (1.60 to 1.12), (2.43 to 1.67) and (3.60 to 2.70) under the treatments I_2M_1 and I_1M_0 due to the interaction effect at 30, 45, 60, 75 and 90 DAS respectively. The LAI increased from emergence and reached its peak at crop maturity.These results were in line and agreement with the findings by Konyeha *et al.* (2013).

Table 3.2 Effect of different levels of irrigation and plastic mulch colours on number of days to fifty per cent flowering

Treatment	I_1	I_2	I_3	I_4	Mean
M_0	45.33	44.33	45.00	45.67	45.08
M_1	42.67	42.00	43.33	43.00	43.75
M_2	43.00	43.00	43.67	43.33	43.25
M_3	44.00	44.00	44.00	44.67	44.17
Mean	43.75	43.33	44.00	44.17	
		SEM ±		CD at 5 per cent	
Main treatment		0.11		0.37	
Sub treatment		0.13		0.38	
I at same M		0.26		NS	
M at same or different I		0.25		NS	

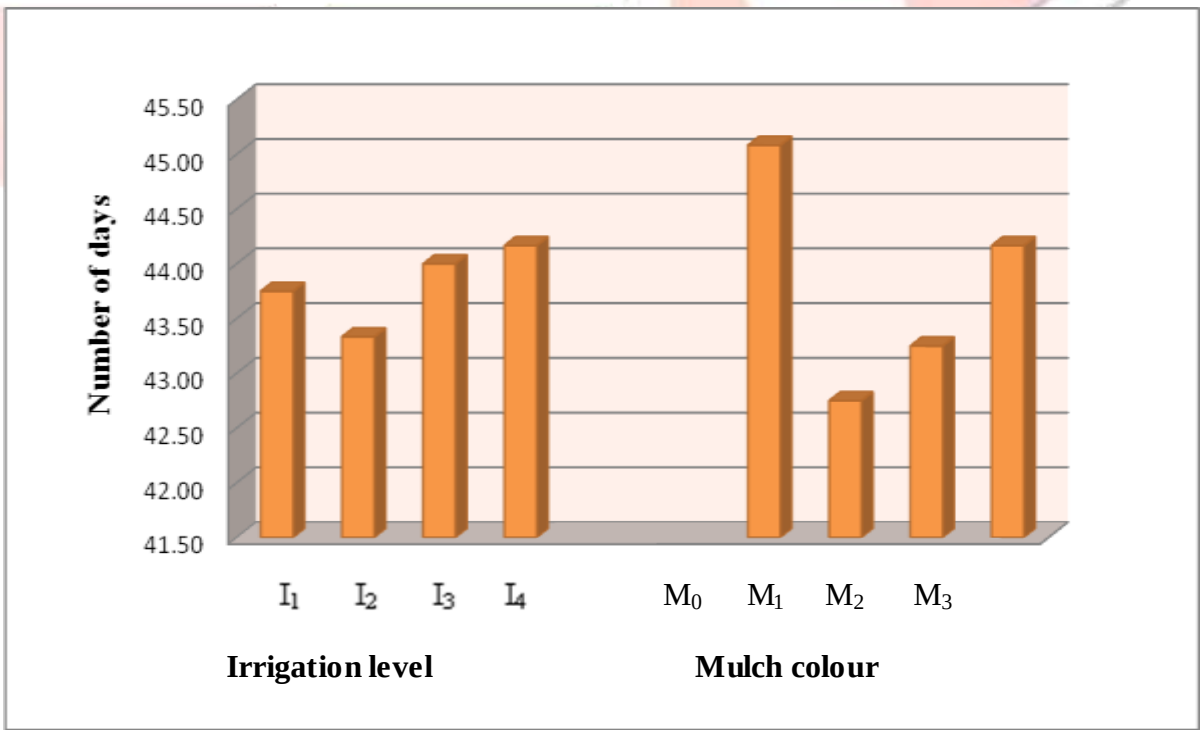

Fig. 3.1 Effect of different levels of irrigation and plastic mulch colours on number of days to fifty per cent flowering

Table 3.3(a) Effect of different levels of irrigation and plastic mulch colours on leaf area index

Treatment	30 DAS					45 DAS					60 DAS				
	I_1	I_2	I_3	I_4	Mean	I_1	I_2	I_3	I_4	Mean	I_1	I_2	I_3	I_4	Mean
M_0	0.39	0.52	0.43	0.33	0.42	0.74	0.88	0.87	0.86	0.84	1.12	1.43	1.45	1.47	1.37
M_1	0.36	0.40	0.29	0.36	0.35	0.95	1.06	0.97	0.98	0.99	1.63	1.60	1.58	1.55	1.59
M_2	0.36	0.46	0.42	0.39	0.41	0.94	1.05	0.95	0.95	0.97	1.60	1.59	1.57	1.53	1.57
M_3	0.31	0.37	0.36	0.31	0.34	0.75	0.98	0.96	0.95	0.91	1.51	1.55	1.53	1.48	1.52
Mean	0.35	0.44	0.38	0.35		0.85	0.99	0.94	0.94		1.47	1.54	1.53	1.51	
		SEM ±		CD at 5 per cent			SEM ±		CD at 5 per cent			SEM ±		CD at 5 per cent	
Main treatment		0.01		0.05			0.02		0.08			4.85		16.79	
Sub treatment		0.02		0.04			0.03		0.08			4.42		12.89	
I at same M		0.031		NS			0.053		NS			0.087		NS	
M at same or different I		0.030		NS			0.051		NS			0.077		NS	

Main treatments:

Sub treatments:

I_1: Drip irrigation at 60% ET

$M_{0:}$ Without mulch condition

I_2: Drip irrigation at 80% ET

M_1: White on black plastic mulch

I_3: Drip irrigation at 100% ET

M_2: Silver on black plastic mulch

I_4: Drip irrigation at 120% ET

M_3: Black plastic colour mulch

Table 3.3(b) Effect of different levels of irrigation and plastic mulch colours on leaf area index

Treatment	75 DAS					90DAS				
	I_1	I_2	I_3	I_4	Mean	I_1	I_2	I_3	I_4	Mean
M_0	1.67	2.30	2.20	2.23	2.10	2.70	3.00	3.13	3.14	2.99
M_1	2.45	2.43	2.42	2.41	2.43	3.45	3.60	3.32	3.23	3.40
M_2	2.42	2.40	2.40	2.37	2.40	3.34	3.41	3.29	3.16	3.30
M_3	2.40	2.40	2.40	2.33	2.38	3.22	3.30	3.27	3.03	3.21
Mean	2.23	2.38	2.35	2.34		3.18	3.33	3.25	3.14	
		SEM ±		CD at 5 per cent		SEM ±			CD at 5 per cent	
Main treatment		0.02		0.09		0.03			0.11	
Sub treatment		0.04		0.13		0.05			0.14	
I at same M		0.08		0.25		0.09			0.27	
M at same or different I		0.08		0.23		0.08			0.25	

Main treatments:

Sub treatments:

I_1: Drip irrigation at 60% ET

M_0: Without mulch condition

I_2: Drip irrigation at 80% ET

M_1: White on black plastic mulch

I_3: Drip irrigation at 100% ET

M_2: Silver on black plastic mulch

I_4: Drip irrigation at 120% ET

M_3: Black plastic colour mulch

IV. CONCLUSION

In the present study, drip irrigation at 80 per cent ET with white on black plastic mulch enhanced better plant growth, which facilitated in accumulation of more photosynthates and conservation of optimum temperature resulting in increased size and weight of fruits. The maximum plant height (210 cm), least days to 50 per cent flowering (42 days) and highest leaf area index (3.60) were recorded under drip irrigation at 80 per cent ET with white on black plastic colour mulch when compared to other treatments throughout the growing period.

V. REFERENCES

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