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Yashashri R. Landge
PG scholar, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

S. B. Amarshettiwar
Senior Scientist and Head, Agriculture Research Station, Ekarjuna, Warora, Maharashtra, India

Sapana B. Baviskar
Assistant Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

B. G. Gondane
Assistant professor, Agriculture Research Station, Ekarjuna, Warora, Maharashtra, India

P. N. Tayade
PG scholar, Agricultural Extension Education Section, College of Agriculture, Nagpur, Maharashtra, India

Corresponding Author:
Yashashri R. Landge
PG scholar, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

Effect of different canopy management and mulching practices on yield parameters and fiber quality parameters of Bt cotton under drip fertigation

Yashashri R. Landge, S. B. Amarshettiwar, Sapana B. Baviskar, B. G. Gondane and P. N. Tayade

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Abstract
A field experiment was conducted at Agriculture Research Station, Ekarjuna under Dr. PDKV Akola, during 2023-24, to find out the effect of different canopy management and mulching practices on yield contributing parameters and fiber quality parameters of Bt Cotton under drip fertigation. The experiment was laid out in factorial randomized block design with three replications. Results indicated that Monopodia removal at 60 DAS and spraying of Mepiquat Chloride 5% w/w at 75 DAS was observed significantly superior for number of bolls plant^{-1} (37.33), average boll weight (5.28 g), seed cotton yield plant^{-1} (197.54 g), seed index (7.90), lint index (5.02), fibre fineness (3.78 microgram/inch), fibre length (31.66 mm) and fibre uniformity (86.84) over all other canopy management treatments. Polythene mulching practices significantly influenced the number of bolls plant^{-1} (37.33), average boll weight (4.88 g), seed cotton yield plant^{-1}(182.90 g), seed index (7.72), lint index (4.76), fibre fineness (3.68 microgram/inch), fibre length (31.36 mm) and fibre uniformity (86.73) than all other mulching practices. Among the interactions of different canopy management and mulching practices, treatment combination of Monopodia removal at 60 days after sowing and spraying of Mepiquat Chloride 5% w/w at 75 days after sowing + Polythene mulching recorded significantly higher number of bolls plant^{-1} (40.67), average boll weight (5.64 g), seed cotton yield plant^{1} (229.24 g), seed index (8.06), lint index (5.21), fibre fineness (3.87 microgram/inch), fibre length (32.17 mm) and fibre uniformity (87.04) than all other treatment combinations. Hence polythene mulching accompanied with removal of monopodia at 60 days after sowing and spraying of Mepiquat Chloride 5% w/w at 75 days after sowing can be used for higher yield and quality fibre.

Keywords: Canopy management, mulching practice, drip fertigation, yield, fibre quality

1. Introduction
Cotton, the "white gold or the king of fibres" is one of the most important commercial crops in India. Cotton is known for the fibre and oil from seed, which plays a prominent role in the national and international economy. It is not only an excellent source of natural fiber but also an edible oilseed crop, in addition to this, the cotton plant can be used for livestock feed and medicinal products. It is one of the most widely cultivated cash crops in tropical and subtropical regions of the world (Awan *et al*. 2022) [1].

In India, cotton is cultivated in an area of 129.27 lakh/ha with a production of 336.60 lakh bales of lint cotton (170 kg/bale) with a productivity of 442.65 kg/ha. Most of the area is rain-dependent and farmers practice intensive and frequent tillage operations to control the weeds in between the cotton rows that are planted at wide-row spacing. Frequent tillage on a long-term basis with very limited manure application can result in soil structural degradation. Poor soil structure in combination with heavy rains received during the rainy season causes accelerated erosion of topsoil leading to a decline in soil organic matter and nutrients. Alternative tillage practices and cropping systems such as minimum and no tillage, and mulching with retained crop residues, plastic and geotextiles are reported to reduce soil erosion, overcome water stress caused by dry spells during the rainy season and improve soil organic carbon concentration (Blaise *et al*. 2021) [2].

Growth modification practice becomes important by converting the vegetative phase of the cotton crop to the reproductive phase. This can be regulated by topping practice (Removal of apex). This reduces the height of the plant to prevent apical dominance and further vegetative growth. Many scientists have observed a positive correlation between vegetative growth and the yield attributes of cotton crop (Chaudhari *et al*. 2021) [3]. Hence, an experiment was carried out to study the effect of different canopy management and mulching practices on yield contributing parameters and fiber quality parameters of Bt Cotton under drip fertigation.

2. Materials and Methods

The experiment was conducted during Kharif season of 2023 at cotton research unit, Agricultural Research Station (ARS), Ekarjuna farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Geographically, Ekarjuna is situated on latitude 20.217620 North, longitude of 79.017230 East and at an altitude of 231.08 m above the mean sea level. The Experiment was laid out in factorial randomized block design (FRBD) with three replications. There were twenty treatment combinations comprised of four treatments of canopy management (Factor A) *i.e.,* C1-Canopy management control, C2- Monopodia removal at 60 days after sowing and detopping at 75 days, C3- Monopodia removal at 60 days after sowing and spraying of Mepiquat Chloride 5% w/w at 75 days after sowing and C4- Spraying of Mepiquat Chloride 5% w/w at 75 days after sowing and five different mulching practices (Factor B) *i.e.,* M1- No mulching control, M2- Polythene mulching, M3- Wheat straw mulching, M4- Linseed straw mulching and M5- Sunhemp mulching. The observations related to yield contributing parameters and fibre quality parameters were recorded and subjected to statistical analysis.

3. Results and Discussion

The data presented in the Table 1 and 2 revealed that yield contributing parameters and fibre quality parameters were significantly affected due to canopy management treatment except for ginning percentage. However Significantly the highest number of bolls plant^{-1} (37.33), average boll weight (5.28 g), seed cotton yield plant^{-1} (197.54 g), seed index (7.90), lint index (5.02), fibre fineness (3.78 microgram/inch), fibre length (31.66 mm) and fibre uniformity (86.84) was recorded by treatment C3- (Monopodia removal at 60 days after sowing and spraying of Mepiquat Chloride 5% w/w at 75 days after sowing) than C1 (no canopy management control) which was 11.10, 21.93, 35.67, 6.90, 12.30, 10.20, 2.82 and 0.49 per cent higher, respectively. The significant increase in these parameters must be due to spraying of Mepiquat Chloride which is a plant growth regulator which must have helped in increasing these yield contributing parameters and fibre quality parameters. Similar results were reported by Pettigrew and Johnson 2005) [5]. Ginning percentage were not significantly due to any canopy management practices.

Among the different mulching practices, M2 (polythene mulching) was significantly higher than the other mulching practices. Application of M2 (polythene mulching) significantly highest the number of bolls plant^{-1} (37.33), average boll weight (4.88 g), seed cotton yield plant^{-1} (182.90 g), seed index (7.72), lint index (4.76), fibre fineness (3.68 microgram/inch), fibre length (31.36 mm) and fibre uniformity (86.73). It showed an increase of 13.12, 14.28, 29.75, 1.17, 3.03, 3.95, 1.12 and 0.20 over M1 (No mulching practice control). It must be due to the proper soil temperature maintained by polythene mulch, which also must have maintained proper water availability for the plants which must increase water and mineral absorption by the plants at critical growth stages. These results are in agreement with the findings of (Kumar *et al*. 2022) [4]. Ginning percentage were not significantly affect by any canopy management practices.

Interaction effect of canopy management and different mulching practices significantly affected the number of bolls plant^{-1}, average boll weight, seed cotton yield plant^{-1}, seed index, lint index, fibre fineness, fibre length and fibre uniformity. Among the twenty different treatment combinations C3M2 (Monopodia removal at 60 DAS and spraying of Mepiquat Chloride 5% w/w at 75 DAS +Polythene mulching) recorded significantly higher number of bolls plant^{-1} (40.67), average boll weight (5.64 g), seed cotton yield plant^{-1} (229.24 g), seed index (8.06), lint index (5.21), fibre fineness (3.87 microgram/inch), fibre length (32.17 mm) and fibre uniformity (87.04). These results showed an increase of 35.56, 35.25, 83.18, 10.25, 19.49, 17.62, 1.12 and 0.88 per cent higher over the treatment combination C1M1 (Control *i.e.,* without canopy management and without mulching). Ginning percentage were not significantly affect by any canopy management practices.

Table 1: Yield contributing characters affected due to different canopy management and mulching practices.

Treatments	Yield contributing characters		
	Number of bolls plant^{-1}	Average boll weight	Seed cotton yield plant^{-1}
Canopy management			
C1(Control)	33.60	4.33	145.60
C2	34.80	4.46	155.47
C3	37.33	5.28	197.54
C4	35.93	4.49	161.56
S.Em. ±	0.27	0.04	2.16
C.D. at 5%	0.77	0.12	6.18
Mulching practices			
M1(Control)	33.00	4.27	140.96
M2	37.33	4.88	182.90
M3	36.50	4.72	172.87
M4	34.75	4.63	161.19
M5	35.50	4.70	167.30
S.Em. ±	0.30	0.05	2.41
C.D. at 5%	0.86	0.13	6.91
Interaction effect			
S.Em. ±	0.60	0.09	4.82
C.D. at 5%	1.73	0.27	13.81

Table 2: Fibre quality parameters affected due to different canopy management and mulching practices.

Treatments		Fibre quality parameters				
	Ginning percentage	Seed index	Lint index	Fibre fineness	Fibre length	Fibre uniformity
Canopy management						
C1(Control)	33.42	7.39	4.47	3.43	30.79	86.41
C2	33.38	7.63	4.60	3.60	31.28	86.57
C3	34.26	7.90	5.02	3.78	31.66	86.84
C4	33.12	7.72	4.70	3.71	31.29	86.69
S.Em. ±	0.66	0.01	0.02	0.01	0.05	0.01
C.D. at 5%	NS	0.03	0.05	0.02	0.16	0.03
Mulching practices						
M1(Control)	33.11	7.63	4.62	3.54	31.01	86.55
M2	34.27	7.72	4.76	3.68	31.36	86.73
M3	33.88	7.67	4.72	3.66	31.32	86.65
M4	33.23	7.64	4.69	3.63	31.29	86.57
M5	33.26	7.65	4.71	3.65	31.30	86.64
S.Em. ±	0.74	0.01	0.02	0.01	0.06	0.01
C.D. at 5%	NS	0.04	0.06	0.03	0.17	0.04
Interaction effect						
S.Em. ±	1.47	0.03	0.04	0.02	0.12	0.03
C.D. at 5%	NS	0.07	0.11	0.05	0.35	0.07

4. Conclusion

Among the four canopy management practices C3 (Monopodia removal at 60 days after sowing and spraying of Mepiquat Chloride 5% w/w at 75 days after sowing) was observed significantly superior for number of bolls plant^{-1}, average boll weight, seed cotton yield plant^{-1}, seed index, lint index, fibre fineness, fibre length and fibre uniformity. It showed an increase of 11.10, 21.93, 35.67, 6.90,
12.30, 10.20, 2.82 and 0.49 per cent in number of bolls plant^{-1}, average boll weight, seed cotton yield plant^{-1}, seed index, lint index, fibre fineness, fibre length and fibre uniformity, respectively over no canopy management.

Among the five mulching types M2 (Polythene mulching) was observed significantly superior for number of bolls plant^{-1}, average boll weight, seed cotton yield plant^{-1}, seed index, lint index, fibre fineness, fibre length and fibre uniformity. It showed an increase of 13.12, 14.28, 29.75, 1.17, 3.03, 3.95, 1.12 and 0.20 per cent in number of bolls plant^{-1}, average boll weight, seed cotton yield plant^{-1}, seed index, lint index, fibre fineness, fibre length and fibre uniformity, respectively over no mulching practice.

Treatment combination of Monopodia removal at 60 days after sowing and spraying of Mepiquat Chloride 5% w/w at 75 days after sowing + Polythene mulching was observed significantly superior for number of bolls plant^{-1}, average boll weight, seed cotton yield plant^{-1}, seed index, lint index, fibre fineness, fibre length and fibre uniformity. It showed an increase of 35.56, 35.25, 83.18, 10.25, 19.49, 17.62, 1.12 and 0.88 per cent in number of bolls plant^{-1}, average boll weight, seed cotton yield plant^{-1}, seed index, lint index, fibre fineness, fibre length and fibre uniformity, respectively over Control *i.e.*, without canopy management and without mulching.

From the results of experimental study, it can be concluded that, the treatment combination of Monopodia removal at 60 DAS and spraying of Mepiquat Chloride 5% w/w at 75 DAS +Polythene mulching recorded increased yield contributing parameters fibre quality in plants, which may increase seed cotton yield.

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