Current Journal of Applied Science and Technology

39(15): 118-126, 2020; Article no.CJAST.57189
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

Weed Dynamics in *Bt* cotton under Moisture Conservation and Integrated Nutrient Management Practices

Ch. Pragathi Kumari[1*], K. B. Suneetha Devi[2], K. Bhanu Rekha[3], S. Sridevi[4] and S. Narender Reddy[5]

[1]AICRP on Integrated Farming Systems, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad-30, Telangana, India.
[2]Agricultural College, Jagtial, Jagtial District, Professor Jayashankar Telangana State Agricultural University, Telangana, India.
[3]College of Agriculture, Rajendrangar, Professor Jayashankar Telangana State Agricultural University, Telangana, India.
[4]Agricultural Polytechnic, Tornala, Siddipet District, Professor Jayashankar Telangana State Agricultural University, Telangana, India.
[5]Department of Crop Physiology, College of Agriculture, Rajendrangar, Professor Jayashankar Telangana State Agricultural University, Telangana, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author CPK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KBSD and KBR managed the analyses of the study. Authors SS and SNR managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2020/v39i1530725
Editor(s):
(1) Dr. Ahmed Fawzy Yousef, Desert Research Center, Egypt.
(2) Dr. Rita Andini, Syiah Kuala University, Indonesia.
(3) Dr. Hamid El Bilali, University of Natural Resources and Life Sciences, Austria.
Reviewers:
(1) Lucia Maria Jaeger De Carvalho, Universidade Federal do Rio de Janeiro, Brazil.
(2) Isaac Ola Oladipo, Federal Polytechnic, Ado Ekiti, Nigeria.
Complete Peer review History: http://www.sdiarticle4.com/review-history/57189

Original Research Article

Received 06 April 2020
Accepted 11 June 2020
Published 23 June 2020

ABSTRACT

A field investigation was conducted to evaluate the effect of moisture conservation practices [flat bed sowing, ridge and furrow, broad bed and furrow (BBF) and poly mulch on BBF] and integrated nutrient management treatments [Farmer's practice, 100% recommended dose of fertilizers (RDF)

**Corresponding author: E-mail: pragathi.agronomy@gmail.com;*

of 150:60:60 NPK kg ha^{-1}, 125% RDF, 100% RDF along with 25% N through Farm Yard Manure (FYM) or press mud] and their combined effect on weed dynamics of *Bt* cotton at College Farm, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Telangana, India. The experiment was laid out in strip-plot design and replicated thrice. Pooled data of the two years (2015 and 2016) indicated that poly mulch on broad bed (M_4) registered significantly lower weed density and dry weight at 30 days after sowing (DAS) and it was followed by broad bed and furrow (M_3) which was at par with flat bed (M_1) and ridge and furrow (M_2) methods. Among nutrient management practices, lower weed density was recorded with the application of 100% RDF (S_2) followed by 125% RDF (S_3) and 100% RDF (S_5) along with pressmud equivalent to 25% RDN (S_5). However, the interaction effect on weed density and drymatter was found to be non-significant at 30 DAS. Contrary to this, at 60 and 90 DAS, the interaction was found to be significant. At 60 DAS, poly mulch on broad bed (M_4S_2) along with 100% RDF and poly mulch on broad bed (M_4S_3) along with 125% RDF recorded lower weed density over other treatment combinations. At 90 DAS also similar results were observed with respect to weed density. However, lower weed dry weight was observed with poly mulch on broad bed (M_4S_3) along with 125% RDF.

Keywords: Bt cotton; poly mulch; ridge and furrow; broad bed and furrow; farm yard manure; pressmud; weed density; weed drymatter; yield.

1. INTRODUCTION

Cotton (*Gossypium hirsutum* L.), the "*white gold or the king of fibres*" is one of the most important commercial crops being cultivated under rainfed conditions in India. The productivity of cotton in India is significantly lower (568 kg ha^{-1}) in comparison to the four major cotton-growing countries *i.e* China (1300 kg ha^{-1}), USA (900 kg ha^{-1}), Pakistan (700 kg ha^{-1}) and Brazil (2027 kg ha^{-1}). India ranks first in area with 11.88 m ha^{-1}, accounting to 30 per cent of world coverage and 22 per cent (351 lakh bales of lint) of the world cotton production (second rank) with a productivity of 568 kg ha^{-1}. Telangana ranked third in area (1.65 m ha) with a production of 5 million bales and productivity of 515 kg ha^{-1} [1].

Among the various biological factors limiting yields of cotton, weed infestation is one of the serious factor. It was considered as a problem since 10,000 B.C [2]. Weeds compete for nutrients, water, light and thus reduce the yield of cotton substantially [3] to an extent of 34-61.4 per cent [4]. Although several techniques are followed for weed management, yet cotton yields are significantly reduced due to weed infestation [5]. Mulching is the practice of covering the soil surface to provide favourable conditions towards better plant growth and development. The main objective of mulching is water-saving and weed control [6]. Integrated use of chemical fertilizers and organic manures is not only essential for achieving higher yields but also has crucial role in improving soil health. Though, Farm Yard Manure (FYM) is the commonly recommended organic manure, its availability is becoming meager on account of low or negligible maintenance of cattle population in the farms. In this context, alternate organic sources like pressed are one of the sound option on account of its rich nutrient content [7].

2. MATERIALS AND METHODS

A field experiment was conducted during *kharif*, 2015 and 2016 at College Farm,situated at an altitude of 542 m above mean sea level at 17°19' N latitude, 78°23' E longitude,College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India under rainfed conditions. The soil of the experimental site was sandy loam with soil pH of 7.33, low available N (182 kg ha^{-1}), medium in P_2O_5 (46.8 kg ha^{-1}) and high in K_2O (432 kg ha^{-1}). The experiment was laid out in strip plot design with three replications. The gross and net plot size were 7.2 m x 5.4 m and 5.4 m x 4.2 m respectively. There were twenty treatments comprised of four *in-situ* moisture conservation practices *viz.,*flat method (M_1), ridge and furrow (M_2), BBF (M_3) and poly mulch on BBF (M_4) as main plots and five integrated nutrient management (INM) practices as sub plots *viz* farmer's practice (S_1), 100% recommended dose of fertilisers (RDF, S_2), 125% RDF (S_3), 100% RDF along with 25% N through FYM (S_4) and 100% RDF along with 25% RDN through pressmud (S_5).

Neeraja BT-II Bt cotton seeds were dibbled at one seed hill^{-1} on 7th July during, 2015 and 2nd July during, 2016. The recommended dose of

fertilizer (RDF) in Telangana state was 150:60:60 NP and K kg ha^{-1}. Entire P fertilizer was applied as basal and N and K applied at 20, 40, 60 and 80 days after sowing (DAS) in equal splits. In integrated nutrient management treatments (S_4 and S_5), 25 per cent nitrogen was applied through organic manures as basal and remaining as that of the recommended dose of fertilizers (100 per cent RDF). Farmers practice of nutrient management was decided after surveying 30 cotton growing farmers for nutrient management in Southern Telangana Zone. It accounted to 50 kg of DAP at 20-25 DAS, 50 kg of 14-35-14 at 40-45 DAS, 50 kg of urea and 25 kg of muriate of potash at 60-65 DAS, 75 kg urea and potash 25 kg at 80-100 DAS. Based on the above, farmers practice of nutrient management was fixed with 3.75 t FYM ha^{-1}, 184-101-92 kg N, P_2O_5 and K_2O ha^{-1} respectively. The details of the nutrient content of organic manures and amount of organics added were:

In M_1 treatment, simple flat bed method of sowing was imposed without any soil moisture conservation treatments (check). In M_2 treatment, ridges and furrows were laid at 90 cm apart respectively. While in M_3 and M_4 broad bed and furrow treatment, beds of 120 cm width and furrows of 60 cm were laid out. In M_4 treatment**,** polythene mulch with black (upper) and grey (bottom) having 25 µ thickness was laid before sowing of the crop on the raised (broad) beds (120 cm). Before laying the film, small circular holes were made as per the intra row spacing (60 cm) of the crop and the sheet was spread on the raised bed. After that, the sides of the polythene film were inserted tightly into the soil. In all the treatments, sowing was done adopting an intra row spacing of 60 cm, thus a uniform plant population (18,519 plants ha^{-1}) was maintained. A total rainfall of 375.3 mm was received in 27 rainy days during 2015-16 and 741.1 mm in 37 rainy days during 2016-17, as against the decennial average of 616 mm received in 37 rainy days for the corresponding period indicating that 2016-17 was comparatively a wet year.

Pre-emergence herbicide pendimethalin (Stomp 30% EC) at 1.0 kg a.i ha^{-1} was done to prevent the weed growth. Post emergence spray of quizalofop-p- ethyl (Targasuper 5% EC) at50 g a.iha^{-1} and pyrithiobac sodium (Hitweed 10% EC) at 62.5 g a.i $ha^{-1}$was carried out. Later, hand weeding was done at 40 DAS. The herbicide application and hand weeding were followed as a common practice in all the treatments. The crop was sprayed with monocrotophos at 1 ml l^{-1} against aphids and bollworms and drenching of carbendazim at 1 gl^{-1} of water was done against wilt. The seed cotton was harvested thrice, when the bolls were fully burst at 100 days after sowing (DAS), 125 and 150 DAS respectively during both the years of experimentation. The crop was finally terminated on 10th December, 2015 and 6th December, 2016 during first and second year of experimentation.

2.1 Weed Data

2.1.1 Weed density (No.m^{-2})

Weed density was recorded species wise in each treatment plot at 30, 60 and 90 DAS by using a quadrant (50 cm x 50 cm =0.25 m^{-2}). The weed count was expressed as number per meter square. The data was statistically analyzed after subjecting the values to square root transformation by using the formula.

$$X = \sqrt{x+1}$$

Where X = Transformed value, x = Original value

2.1.2 Weed dry matter (g m^{-2})

The weeds present in each treatment plot at 30, 60 and 90 DAS stages were cut close to the ground surface within the quadrant area of 50 cm x 50 cm (0.25 m^{-2}) and shade dried first for 4-5 days and then in hot air oven at 65 ± 5°C temperature till constant weight was obtained and expressed as g m^{-2}.

2.1.3 Weed flora

During crop growth period (2015 and 2016) the predominant weed species were as follows.

Five plants in each net plot were selected at random and tagged for taking observations on bolls $plant^{-1}$and boll weight. Destructive sampling for drymatter production at harvest was done in gross plots from the second row on both sides of border rows of the plot. The seed cotton in the net plot was harvested separately. The total seed cotton yield was obtained by adding the weight from each picking and expressed as kg ha^{-1}. Statistical analysis of the data of various growth, yield and yield attributes were carried out through analysis of variance technique as described by Panse and Sukhatme [8].

Table 1. Details of the nutrient content (%) and quantity of organic sources added are

S. no.	Nutrient source	Nitrogen content (%)		Amount of material added (kg ha^{-1})	
		2015	2016	2015	2016
1.	Pressmud	1.92	2.24	1953	1674
2.	FYM	0.49	0.72	7653	5208

Table 2. Weed flora observed in the experimental plot during 2015 and 2016

S. no.	Weed species	Common Name	Family
I. Grasses			
1	*Cynodondactylon*	Bermuda grass	Poaceae
2	*Echinocloacolona*	Jungle rice	Poaceae
3	*Eleusineindica*	Goose grass	Poaceae
II. Sedges			
1	*Cyperusrotundus*	Purple nut sedge	Cyperaceae
III. Broad leaved weeds			
1	*Partheniumhysterophorus*	Congress weed	Asteraceae
2	*Celosia argentea*	Foxtail amaranth	Amaranthaceae
3	*Commelinabenghalensis*	Bengal dayflower	Commelinaceaae
4	*Euphorbia geniculata*	Milkweed	Euphorbiaceae
5	*Trianthemaportulacastrum*	Carpet weed	Aizoaceae

3. RESULTS AND DISCUSSION

3.1 Effect of Moisture Conservation Treatments on Yield, Weed Density and Weed Drymatter

An overview of the data (Table 3) indicated a significant effect of moisture conservation treatments on seed cotton yield. Poly mulch on broad bed method (M_4) registered significantly higher seed cotton yield (2183 kg ha^{-1})as compared to other moisture conservation treatments (Table 3) the increase in yield with the treatment was to the tune of 31.34 per cent, 19.74 per cent and 8.66 per cent over flat bed, BBF and ridge and furrow. The improved yield under M_4 could be attributed to the favourable soil physical conditions apart from prolonged soil moisture and nutrient availability due to reduced evaporation losses as compared to the rest of the treatments. Some workers reported improved seed cotton yield under polyethylene mulch to an extent of 11 to 27 per cent over no mulch [9,10,11].

In general the weed density was relatively higher at 90 DAS as compared to 30 and 60 DAS. From the data it is clearly evident that at 30 DAS the interaction effect of moisture conservation practices and integrated nutrient management practices was non significant. Contrary to this, at 60 as well as at 90 DAS it exerted significant effect (Tables 4 and 5).

Perusal of the data revealed that poly mulch on broad bed recorded significantly lower weed density at all the stages of crop growth. The poly mulch treatment recorded significantly lower weed density till harvest over rest of the treatments. On the other hand flat bed method recorded higher weed density at all the stages as compared to other land configurations.

Pooled data revealed that at 30 DAS, among moisture conservation practices, poly mulch on broad bed recorded significantly lower weed density (3.1) and it was followed by BBF (6.4). This might be because black polythene mulch by its nature had absorbed higher quantum of sunlight owing to its dark color thus, increasing soil temperature, that suppressed weed inoculum that finally reflected in lower weed density in comparison to the non mulched treatments [12]. The treatments BBF was on par with ridge and furrow (6.7) and flat bed methods.

At 40 DAS, manual weeding was done in all treatments as a common practice. Hence, at 60 DAS, weed density in all the treatments was low as compared to 90 DAS. At this stage, lower weed density was recorded under poly mulch on broad bed and it was followed by ridge &furrow, which was on par with BBF. BBF was in turn on par with flat bed method. At 90 DAS stage, weed density followed similar trend as that of 30 DAS.

Table 3. Effect of moisture conservation practices and INM on kapas yield of Bt cotton (Pooled mean, 2015 and 2016)

Treatments	Kapas yield (kg ha^{-1})					
	S_1	S_2	S_3	S_4	S_5	Mean
M_1 - Flat bed (control)	1566	1447	1695	1758	1843	1662
M_2 - Ridge & furrow	1871	1779	2076	2125	2195	2009
M_3 - BBF	1687	1590	1898	1938	2004	1823
M_4 - Poly mulch on BBF	2018	1888	2293	2346	2370	2183
Mean	1785	1676	1990	2042	2103	1919
		Main	**Sub**	**MXS**	**SXM**	
S.Em±		26	21	18	29	
C.D at 5%		89	68	53	100	
CV		7.2				

Sub treatments (S), S_1: Farmerspractice, S_2: 100% RDF, S_3: 125% RDF, S_4: 100% RDF + FYM equivalent to 25% RDN, S_5: 100% RDF + Press mud equivalent to 25% RDN

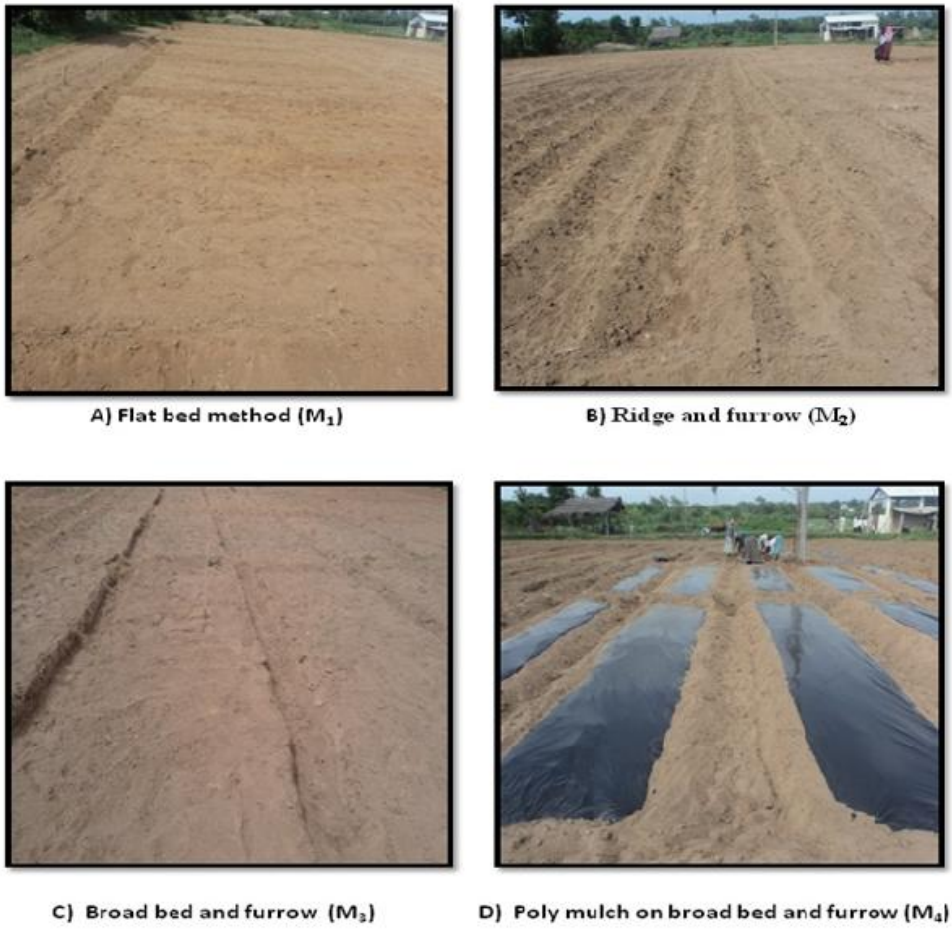

Plate 1. Laying of soil moisture conservation techniques

Similar to the weed density, higher weed dry weight was recorded at 90 DAS as compared to 30 and 60 DAS. Similarly, the interaction effect was non-significant at 30 DAS. In the same line as that of weed density the interaction effect was and significant at 60 & 90 DAS. Moisture conservation practices, as well as integrated nutrient management practices, exerted significant effect independently over weed dry weight (Tables 4 and 6).

Table 4. Effect of moisture conservation practices and INM on weed density (No m^{-2}) and weed dry weight (g m^{-2}) at 30 DAS

Treatments	Weed density (No m^{-2})	Weed dry weight (g m^{-2})
Main treatments		
M_1– Flat bed (control)	2.8 (6.7)	1.3(0.8)
M_2– Ridge & furrow	2.8 (6.7)	1.4(0.9)
M_3– Broad bed and furrow	2.7 (6.4)	1.3(0.8)
M_4– Poly mulch on broad Bed	2.0 (3.1)	1.2(0.4)
S.Em±	0.03	0.03
CD at 5%	0.1	0.06
Sub treatments		
S_1	2.7 (6.2)	1.3(0.8)
S_2	2.4 (5.0)	1.3(0.6)
S_3	2.5 (5.2)	1.3(0.6)
S_4	2.8 (6.9)	1.4(1.0)
S_5	2.5 (5.2)	1.3(0.6)
S.Em±	0.1	0.03
CD at 5%	0.2	NS
CV	6.2	6.8
Interaction		
M XS		
S.Em±	0.1	0.03
CD at 5%	NS	NS
S X M		
S.Em±	0.1	0.02
CD at 5%	NS	NS

Sub treatments (S), S_1: Farmers practice, S_2: 100% RDF, S_3: 125% RDF, S_4: 100% RDF + FYM equivalent to 25% RDN, S_5: 100% RDF + Pressmud equivalent to 25% RDN
Data subjected to square root transformation. Original values are given in parenthesis

At 30 DAS, among moisture conservation practices, poly mulch on broad bed recorded significantly lower weed drymatter (0.4 gm^{-2}). It was followed by BBF method (0.8gm^{-2}), which was on par with flat bed (0.8 gm^{-2}) and ridge & furrow (0.9 gm^{-2}). Weed dry weight recorded under ridge and furrow and flat bed was on par with each other.

In poly mulch treatment, the lower weed dry weight could be attributed to the reduced weed seed germination on account of high temperatures that suppressed the weed growth as compared to the non-mulched treatments [13].

Similarly at 60 DAS, poly mulch on broad bed maintained its superiority in terms of lower weed dry weight (0.4 g m^{-2}) and it was followed by BBF (0.6 g m^{-2}) which in turn was on par with ridge and furrow (0.6 g m^{-2}) and flat bed methods (0.6 g m^{-2}).

Contrary to 30 and 60 DAS, at 90 DAS, all the land configurations recorded lower weed dry weight as compared to flat bed method. Poly mulch on broad bed recorded significantly lower weed dry weight and it was followed by BBF, which was in turn comparable with ridge and furrow and ridge and furrow in turn on par with flat bed method.

3.2 Effect of Integrated Nutrient Management on Yield, Weed Density and Weed Drymatter

Seed cotton yield was significantly higher (2103 kg ha^{-1}) in 100 per cent RDF + 25 per cent RDN through press mud (S_5) treatment and it was on par with 100 per cent RDF + FYM (2042 kg ha^{-1}). Application of 100 per cent RDF + 25 per cent RDN through FYM was in turn on par with 125 per cent RDF (1990 kg ha^{-1}) followed by Farmers practice (1785 kg ha^{-1}) and (S_2) 100 per cent RDF (1676 kg ha^{-1}).

Improved yield under conjunctive use of nutrients could be ascribed to the favorable soil physic-chemical properties that favored slow and steady supply of the nutrients by the nutrient needs of the cotton crop coinciding with the critical stages apart from reduced losses of nutrients, common under inorganic fertilization [14].

Table 5. Effect of moisture conservation practices and INM on weed density (No m^{-2}) of *Bt* cotton (Pooled mean, 2015 and 2016)

Treatments	60 DAS						90 DAS					
	S_1	S_2	S_3	S_4	S_5	Mean	S_1	S_2	S_3	S_4	S_5	Mean
M_1 - Flat bed (control)	2.8 (7.0)	2.6 (5.9)	2.6 (5.9)	3.2 (9.1)	2.7 (6.1)	2.8 (6.8)	6.3 (38.2)	5.4 (28.2)	5.8 (32.6)	6.6 (42.1)	5.2 (26.5)	5.8 (33.5)
M_2 - Ridge & furrow	2.8 (6.6)	2.6 (5.5)	2.6 (5.9)	2.6 (5.8)	2.5 (5.4)	2.6 (5.8)	5.7 (32.4)	5.7 (31.1)	5.5 (28.9)	6.1 (36.0)	5.4 (28.2)	5.7 (31.3)
M_3 - BBF	2.1 (7.0)	2.5 (5.4)	2.6 (5.7)	2.9 (7.3)	2.6 (5.9)	2.7 (6.3)	5.7 (31.1)	5.4 (28.2)	5.1 (25.4)	5.9 (34.0)	5.5 (28.8)	5.5 (29.5)
M_4 - Poly mulch on BBF	2.1 (3.3)	2.0 (2.8)	2.0 (2.8)	2.2 (4.0)	2.0 (3.1)	2.1 (3.2)	4.3 (17.7)	4.2 (16.2)	3.9 (14.0)	4.6 (20.0)	4.2 (16.6)	4.2 (16.9)
Mean	2.6 (6.0)	2.4 (4.9)	2.4 (5.1)	2.7 (6.5)	2.5 (5.1)	2.5 (5.5)	5.5 (29.9)	5.2 (25.9)	5.1 (25.2)	5.8 (33.0)	5.1 (25.0)	5.3 (27.8)
		Main	**Sub**	**MXS**	**SXM**			**Main**	**Sub**	**MXS**	**SXM**	
S.Em±		0.04	0.05	0.10	0.10			0.08	0.09	0.10	0.10	
C.D at 5%		0.1	0.1	0.2	0.2			0.3	0.3	0.4	0.5	
CV		7.4						7.6				

Sub treatments (S), S_1: Farmerspractice, S_2: 100% RDF, S_3: 125% RDF, S_4: 100% RDF + FYM equivalent to 25% RDN, S_5: 100% RDF + Press mud equivalent to 25% RDN

- *Data subjected to square root transformation. Original values are given in parenthesis*

Table 6. Effect of moisture conservation practices and INM on weed dry weight (g m^{-2}) of *Bt* cotton (Pooled mean, 2015 & 2016)

Treatments	60 DAS						90 DAS					
	S_1	S_2	S_3	S_4	S_5	Mean	S_1	S_2	S_3	S_4	S_5	Mean
M_1 - Flat bed (control)	1.29 (0.7)	1.25 (0.6)	1.25 (0.6)	1.34 (0.8)	1.26 (0.6)	1.28 (0.6)	6.2 (37.3)	5.7 (31.4)	6.0 (34.6)	6.5 (41.2)	5.7 (31.6)	6.0 (35.2)
M_2 - Ridge & furrow	1.29 (0.7)	1.28 (0.6)	1.21 (0.5)	1.32 (0.7)	1.20 (0.4)	1.26 (0.6)	5.8 (32.3)	5.5 (29.4)	5.5 (29.5)	6.2 (37.0)	5.3 (27.5)	5.7 (31.1)
M_3 - BBF	1.31 (0.7)	1.22 (0.5)	1.23 (0.5)	1.29 (0.7)	1.25 (0.6)	1.26 (0.6)	5.8 (32.8)	5.4 (28.3)	5.1 (25.0)	6.0 (35.0)	5.5 (29.2)	5.6 (30.1)
M_4 - Poly mulch on BBF	1.21 (0.5)	1.11 (0.2)	1.16 (0.3)	1.22 (0.5)	1.19 (0.4)	1.18 (0.4)	4.3 (17.6)	4.1 (16.1)	3.8 (13.8)	4.6 (20.2)	4.0 (15.3)	4.2 (16.6)
Mean	1.27 (0.6)	1.22 (0.5)	1.21 (0.5)	1.29 (0.7)	1.23 (0.5)	1.24 (0.6)	5.5 (30.0)	5.2 (26.3)	5.1 (25.7)	5.8 (33.3)	5.1 (25.9)	5.4 (28.2)
		Main	**Sub**	**MXS**	**SXM**			**Main**	**Sub**	**MXS**	**SXM**	
S.Em±		0.02	0.02	0.02	0.02			0.08	0.06	0.10	0.10	
C.D at 5%		0.06	0.05	0.08	0.08			0.3	0.2	0.3	0.3	
CV		6.6						7.9				

Sub treatments (S), S_1: Farmerspractice, S_2: 100% RDF, S_3: 125% RDF, S_4: 100% RDF + FYM equivalent to 25% RDN, S_5: 100% RDF + Press mud equivalent to 25% RDN

- *Data subjected to square root transformation. Original values are given in parenthesis*

At all the crop growth stages, significant differences were observed in terms of weed density due to integrated nutrient management practices. At 30 DAS, application of 100 per cent RDF recorded lower weed density (5.0) followed by 125 per cent RDF (5.2) and (S_5) 100 per cent RDF along with 25 per cent RDN through pressmud (5.1) treatment.

Contrary to this, higher weed density in S_4 (6.9) and S_1 treatments (6.2) was due to the due to viable weed seed from FYM that might have contributed to the soil weed seed bank, which in resulted in higher weed seed density in FYM applied plots compared to either pressmud treated plots or plots applied with inorganic fertilizers alone [15].

At 60 and 90 DASDAS, lower weed density was observed in S_2 and S_3 treatments, which in turn was comparable with S_5 and followed by S_1 and S_4 treatments.

At 30 DAS, there were no significant differences observed in terms of weed dry weight among different integrated nutrient management practices. At 60 and 90 DAS, (S_3) application of 125 per cent RDF recorded lower weed dry weight (0.5 gm^{-2}) followed by 100 per cent RDF (0.5 gm^{-2}) and (S_5) 100 per cent RDF + 25 per cent RDN through pressmud (0.5 gm^{-2}). These treatments were in turn on par with (S_1) farmers' practice (0.6 gm^{-2}) and (S_4)100 per cent RDF + 25 per cent RDN through FYM (0.7 gm^{-2}). Contrary to this, higher weed drymatter was observed in case of S_4 and S_1 plots applied with FYM as compared to either pressmud applied plots or plots applied with inorganic fertilizers alone.

3.3 Interaction between Soil Moisture Conservation Practices and Integrated Nutrient Management

Treatment combination involving poly mulch on broad bed and application of RDF along with 25 per cent RDN through pressmud (M_4S_5) recorded significantly higher mean seed cotton yield (2370 $kgha^{-1}$)over rest of the treatment combinations. This treatment was comparable with (M_4S_4) poly mulch on broad bed and application of RDF along with 25 per cent RDN through FYM (2346 $kgha^{-1}$). While, M_4S_5 and M_4S_4 treatments were in turn on par with poly mulch on broad bed and application of 125 per cent RDF (M_4S_3) indicating that poly mulch was more effective when RDF was applied either with pressmud or FYM equivalent to 25 per cent RDN or with 125 per cent RDF alone.

At 30 DAS, the interaction between soil moisture conservation practices and integrated nutrient management practices on weed density and drymatter was found to be non-significant. However, at 60 and 90 DAS, the interaction was found to be significant at 5 per cent level of significance. At 60 DAS, (M_4S_2) poly mulch on broad bed along with 100 % RDF and (M_4S_3) poly mulch on broad bed along with 125 per cent RDF recorded lower weed density. These treatments were followed by (M_4S_5) poly mulch on broad bed along with pressmud. At 90 DAS also similar results were observed with respect to weed density whereas, lower weed dry weight was observed with M_4S_3, which was comparable with M_4S_5 and M_4S_2.

4. CONCLUSION

From the above results, it can be concluded that in Telangana region, *Bt* cotton in red soils could be profitably cultivated with lower weed infestation and favourable moisture conservation by following application of inorganic fertilizers alone or pressed equivalent to 25 per cent RDN along with 100 per cent RDN or 125 per cent RDF with *in-situ* moisture conservation practice of poly mulch on broad bed compared to ridge and furrow and flat bed sowing.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. CICR. Central Institute of Cotton Research, Annual Reports. 2014;27.
2. Avery AA, Prakash CS, McHughen A, Trewavas AR, Degregori TR. What kind of farming works best? Science. 2005;307: 1410-1414.
3. Iftikhar LK, Babar S, Zahoor N, Khan G. Best irrigation management practices in cotton. Pakistan Journal of Botany. 2010;42:3023-3028.
4. Ahmad IM, Ansar M, Iqbal M, Minhas N. Effect of planting geometry and mulching on moisture conservation, weed control and wheat growth under rainfed conditions. Pakistan Journal of Botany. 2003;4:1189-1195.
5. Ashigh J, Mohseni-Moghadam M, Idowu OJ, Hamilton C. Weed management in

cotton. Mexico: New Mexico State University Publisher; 2012.
6. Lamont WJ. Plastics: Modifying the microclimate for the production of vegetable crops. Horticulture Technology. 2005;15:477-481.
7. Ghulam S, Khan MJ, Usman K, Ullah S. Effect of different rates of pressmud on plant growth and yield of lentil in calcareous soil. Sarhad Journal of Agriculture. 2012;28(2):249-252.
8. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR, New Delhi; 1967.
9. Fortnum RA, Kasperaner MJ, Decoteau DR. Effect of mulch surface colour on root knot nematode of tomato grown in simulated planting beds. Journal of Nematology. 2000;32(1):101-109.
10. Hulihalli UK, Patil VC. Moisture use efficiency of cotton in relation to *in situ* moisture conservation practices and organic manures under rainfed conditions. Indian Journal of Dryland Agricultural Research & Development. 2004;19(2):154-163.
11. Hugar AY, Halemani HL. Influence of polyethylene mulching on soil moisture, nutrient uptake and seed cotton yield. Indian Journal of Agricultural Research. 2010;44:189-194.
12. Ramakrishna A, Hoang MT, Suhas PW, Tranh DL. Effect of mulch on soil temperature, moisture, weed infestation and yield of groundnut in Northern Vietnam. Field Crops Research. 2006;95: 115-25.
13. Singh J, Bhaskar KS, Bharambe PR. Available soil moisture and yield of rainfed hybrid cotton (*Gossypium hirsutum*) as influenced by rain water conservation practice. Indian Journal of Agronomy. 2011;569(2):154-158.
14. Rao PJ, Prasad PRK, Lalitha Kumari A, Prasuna Rani P, Pulla Rao CH. Long-term effect of manures and fertilizers on nutrient status under cotton mono-cropping in vertisol. International Journal of Current Microbiology and Applied Sciences. 2017;6(7):2084-2094.
15. Walia MK, Walia SS, Dhaliwal SS. Long term impact of chemical fertilizers and organic manures on weed dynamics of rice in rice-wheat system. International Journal of Science, Environment and Technology. 2014;3(3):1260–1267.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/57189