



Effect of bio stimulant application on growth, yield and economics of cotton

R. VEERAPUTHIRAN* AND S. THIRUVARASAN

Tamil Nadu Agricultural University, Cotton Research Station, Srivilliputtur 626 135

*E-mail: veeraagri@yahoo.co.in

ABSTRACT: Field experiments were carried out at Cotton Research Station, Srivilliputtur and Department of Cotton, Tamil Nadu Agricultural University, Coimbatore during September 2019 to February 2020 under irrigated condition to find out the effect of bio stimulant application on growth, yield and economics of cotton. The experiment was conducted in split plot design with three replications. The treatments consisted of two varieties/hybrids (*Bt* Hybrid – Jadhua at Srivilliputtur and RC 659 BG II at Coimbatore and variety SVPR 6 at Srivilliputtur and CO 14 at Coimbatore) in main plots and four biostimulant application (Application of ethrel at 45 ppm 40 DAS, Mepiquat chloride at 100 ppm on 90 DAS, Ethrel at 45 ppm on 40 DAS followed by Mepiquat chloride at 100 ppm on 90 DAS and a control of without any spray) accommodated the sub plots. The results revealed that *Bt* hybrids produced significantly higher growth and yield attributes and higher seed cotton yield with more economic benefits than the cotton varieties at both the locations of the study. With respect to bio stimulants, application of ethrel @ 45 ppm on 40 DAS followed by Mepiquat chloride @ 100 ppm on 90 DAS recorded the significantly higher growth and yield attributes and highest seed cotton yield of 2515 kg/ha at Srivilliputtur and 2580 kg/ha at Coimbatore which were statistically *on par* with Mepiquat chloride @ 100 ppm on 90 DAS (2366 and 2414 kg/ha) and both were significantly higher than control. Higher gross income, net income and BC ratio were also associated with ethrel application @ 45 ppm on 40 DAS followed by Mepiquat chloride @ 100 ppm on 90 DAS at both the centres. Thus it is concluded from the study that foliar spraying of ethrel @ 45 ppm on 40 DAS followed by Mepiquat chloride @ 100 ppm on 90 DAS was found to be optimum for higher seed cotton yield and economic benefits of both varieties and *Bt* hybrids of cotton.

Key words: Cotton, economics, Ethrel, Mepiquat chloride, seed cotton yield

Cotton, popularly called as “King of Fibre” and “White Gold” is the most important fibre and commercial crop of India and also Tamil Nadu state as well. Though India has the largest area (12.66 M ha, 26 %) of cotton in the world (Gacche and Gokale, 2018), due to its lower productivity the share to the total world cotton production is only 12 per cent. In order to meet the demand to satisfy the native mill requirement of cotton, the productivity of cotton should be increased. In Tamil Nadu, cotton is cultivated in an area of 1.48 lakh ha during 2017-2018 with production of 2.80 lakh bales and productivity of 599 kg/ha which is below the world average yield of 788 kg/ha (Anonymous, 2018). As cotton is having vigorous growth in nature by producing more vegetative growth and hence production of cotton requires careful consideration

of several management strategies including use of growth retardant or bio-stimulant. Mepiquat chloride is one such growth retardant used to suppress the excessive vegetative growth by decreasing plant height, number of nodes, branch lengths and leaf area. It is mainly used to maintain the balance between vegetative and reproductive growth that in turns regulate the cotton yield (Yang *et al.*, 2014). Ethrel is also a bio stimulant mainly used in horticultural crops. As the effect of these bio stimulants application depends on environmental conditions, investigation of optimum time of application is essential. With these background, the present study was, therefore, undertaken to optimize the bio stimulant application for cotton. The data were analysed statistically as per standard procedures.

Field experiments were carried out at Cotton Research Station, Srivilliputtur and Department of cotton, Tamil Nadu Agricultural University, Coimbatore during September 2019 to February 2020 under irrigated condition to find out the effect of bio stimulant application on growth, yield and economics of cotton. The experiment was conducted in split plot design with three replications. The treatments consisted of two varieties/hybrids (*Bt* Hybrid – Jadhua and variety SVPR 6 at Srivilliputtur and RC 659 BG II and variety CO 14 @ Coimbatore respectively) in main plots and four bio-stimulant application (Application of ethrel @ 45 ppm on 40 DAS, Mepiquat chloride at 100 ppm on 90 DAS, Ethrel at 45 ppm on 40 DAS followed by Mepiquat chloride at 100 ppm on 90 DAS and a control of without any spray) accommodated the sub plots. The *Bt* hybrid and variety were grown in a spacing of 120 x 60 cm and 75 x 30 cm respectively, and fertilizer dose of 120: 60: 60 for *Bt* hybrid and 100: 50: 50 kg NPK/ha for variety were followed. The bio stimulants ethrel and Mepiquat chloride were sprayed as per treatment schedule. Pre emergence herbicide pendimethalin at 1.0 kg a. i./ha followed by one hand hoeing on 35-40 DAS were carried out for the management of weeds and need based plant protection measures were taken for the control of pests and diseases. The biometric observation on growth and yield attributes and seed cotton yield were recorded and economics were also worked out.

Growth attributes

The results showed that the monopodia production of cotton was not influenced by both genotypes and bio stimulant application (Table 1). However significant variation was observed on plant height due to the varieties and bio stimulant at both the centres. *Bt* hybrids produced significantly taller plants than the cotton varieties at both the locations of the study. Significantly higher growth of *Bt* cotton than cotton varieties as observed by Ali *et al.*, (2012) is in accordance with

the present study. Though the effect of individual application of either or Mepiquat chloride application was not significant on plant height, however application of both ethrel and Mepiquat chloride recorded significantly lesser plant height than control. The interaction effect was found to be nonsignificant. Alexander *et al.*, (2001) found that height to node ratio, main stream nodes and node above white flower were reduced by the application of Mepiquat chloride and this could be the reasons for reduced plant height. Similar effect of reduction in plant height and decreased shoot length due to Mepiquat chloride application was also realized by Steve *et al.*, (2003) and Xiaoming *et al.*, (2013).

Yield attributes

All the yield attributes were significantly varied by genotypes and bio stimulant application at both the centres of experimentation (Table 1). Among the genotypes, *Bt* hybrids produced significantly higher number of sympodia, bolls/m² (82.63 and 83.00) at Srivilliputtur and Coimbatore centres respectively) with higher boll weight of 4.87 g at Srivilliputtur and 4.78 g at Coimbatore than the cotton varieties. Association of higher yield attributes in *Bt* hybrids than the varieties was due to hybrid vigour. The effect of both the bio stimulants were not significant on boll weight. However, Mepiquat chloride (78.62 and 75.21/m² at Srivilliputtur and Coimbatore centres respectively) and application of both ethrel and Mepiquat chloride recorded significantly more bolls/square meter (81.54 and 82.33/m²) than control. The interaction effect was found to be not significant. Higher bolls/unit area and increased boll weight as reported by Xiaoming *et al.*, (2013) was in conformity with the present investigation.

Seed cotton yield

The results indicated that genotypes and bio stimulant application exerted significant influence on seed cotton yield of cotton at both the centres (Table 2). With respect to genotypes,

Table 1. Effect of bio stimulant application on growth and yield attributes of cotton

Treatment	Plant height at 120 DAS (cm)		Monopodia /plant		Sympodia /plant		Bolls /m ²		Boll weight (g)	
	SVPR*	CBE**	SVPR	CBE	SVPR	CBE	SVPR	CBE	SVPR	CBE
Variety/hybrid										
<i>Bt</i> hybrid – Jadhu/RC 659 BG II	147	148	1.83	1.79	22.49	23.12	82.63	83.00	4.87	4.78
Variety - SVPR 6/CO 14	138	135	1.58	1.45	18.22	19.13	73.55	73.15	4.26	4.15
SEd.	3.5	4.6	0.21	0.29	1.21	1.22	2.85	2.92	0.18	0.20
CD(p=0.05)	8.6	11.0	NS	NS	2.99	3.04	7.01	7.05	0.42	0.48
Bio - stimulant										
Ethrel	142.6	144.2	1.61	1.59	18.76	18.88	74.65	73.19	4.23	4.29
Mepiquat chloride	139.1	138.3	1.62	1.57	19.11	19.13	78.62	75.21	4.38	4.32
Ethrel and Mepiquat chloride	136.3	136.4	1.62	1.58	19.48	19.22	81.54	82.33	4.49	4.52
Control	147.2	147.5	1.61	1.56	18.57	18.43	71.37	72.42	4.28	4.24
SEd.	4.4	4.7	0.27	0.42	1.64	1.65	3.38	3.59	0.22	0.23
CD(p=0.05)	9.3	9.9	NS	NS	NS	NS	7.21	7.32	NS	NS
Interaction	NS	NS	NS	NS	NS	NS	6.09	6.10	NS	NS

* - SVPR - Cotton Research Station, TNAU, Srivilliputtur

** - CBE - Department of cotton, TNAU, Coimbatore

Bt hybrid Jadhu and RC 659 BG II registered significantly higher seed cotton yield of 2449 kg/ha at Srivilliputtur and 2538 kg/ha at Coimbatore respectively, than the cotton varieties (2226 and 2354 kg/ha respectively, for SVPR 6 and CO 14). The significant superiority of hybrid than cotton variety was due to the expression of hybrid vigour and also the resultant higher yield attributes.

Regarding bio stimulant application, though the influence of ethrel was not significant, Mepiquat chloride and application of both ethrel and Mepiquat chloride exhibited favourable and significant effect on seed cotton yield. Application of ethrel @ 45 ppm on 40 DAS and Mepiquat chloride @ 100 ppm on 90 DAS recorded the significantly highest seed cotton yield of 2515 kg/ha at Srivilliputtur and 2580 kg/ha at Coimbatore which were statistically *on par* with Mepiquat chloride @ at 100 ppm on 90 DAS (2366 and 2414kg/ha) and both were significantly higher than control. The interaction effect was found to be not significant. Higher yield under Mepiquat chloride application might be due to maintain the balance between vegetative and reproductive growth which in turns regulate the cotton yield and also inhibition of vertical growth and subsequently promoting lateral growth

including branching. Similar result of significant increase in seed cotton yield by the application of Mepiquat chloride during early blooming and full blooming stages were noticed by Wenchao *et al.*, (2017) and Mao *et al.*, (2015). Significant improvement in seed cotton yield due to Mepiquat chloride application during square formation and flowering stages as reported by Veeraputhiran and Gunasekaran, (2020) and Xiaoming *et al.*, (2013) were in accordance with the results of this present study.

Economics

The economic analysis (Table 2) clearly revealed that higher economic benefits were associated with *Bt* hybrid than cotton variety. Higher gross income, net income (Rs.34562/ha at Srivilliputtur and Rs.39014/ ha Coimbatore) and benefit cost ratio (1.59 and 1.68 were associated with *Bt* hybrid than the cotton variety.

Application of both the bio-stimulants had favourable economic returns than individual application. Foliar spraying of ethrel @ 45 ppm on 40 DAS followed by Mepiquat chloride @ at 100 ppm on 90 DAS recorded the highest gross income, net income (Rs.33470/ha Srivilliputtur and Rs.36190/ha Coimbatore) and BC ratio (1.54 and 1.59). Higher economic benefits due

Table 2. Effect of bio stimulant application on yield and economics of cotton

Treatment	Seed cotton yield (kg/ha)		Cost of cultivation (Rs/ ha)		(Gross Income (Rs/ ha)		Net Income (Rs/ ha)		Benefit Cost Ratio	
	SVPR*	CBE**	SVPR	CBE	SVPR	CBE	SVPR	CBE	SVPR	CBE
Variety/ hybrid										
<i>Bt</i> hybrid –Jadhu/RC 659 BG II	2449	2538	58500	57430	96444	131976	34562	39014	1.59	1.68
Variety - SVPR 6/CO 14	2226	2354	57500	56540	84588	89452	27088	32912	1.47	1.58
SEd.	66.7	77.2	-	-	-	-	-	-	-	-
CD(P=0.05)	160.6	186.4	-	-	-	-	-	-	-	-
Bio - stimulant										
Ethrel	2271	2341	60000	59850	86298	88958	26298	29108	1.44	1.49
Mepiquat chloride	2366	2414	60100	60000	89908	91732	29808	31732	1.50	1.53
Ethrel and Mepiquat chloride	2515	2580	62100	61850	95570	98040	33470	36190	1.54	1.59
Control	2199	2210	58000	58250	83562	83980	25562	25730	1.44	1.44
SEd.	78.6	89.4	-	-	-	-	-	-	-	-
CD (p=0.05)	165.1	189.8	-	-	-	-	-	-	-	-
Interaction	NS	NS	-	-	-	-	-	-	-	-

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to Mepiquat application were the reflection of corresponding increase in the seed cotton yield. Similar results of higher economic benefits by the application of Mepiquat chloride under high density planted cotton was documented by Veeraputhiran and Gunasekaran, (2020).

Thus it is concluded from the study that foliar spraying of ethrel @ 45 ppm on 40 DAS followed by Mepiquat chloride @ 100 ppm on 90 DAS was found to be optimum for higher seed cotton yield and economic benefits of both varieties and *Bt* hybrids of cotton.

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