E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2019; 2(1): 07-09
Received: 07-11-2018
Accepted: 09-12-2018

AD Pandagale
Cotton Research Station,
Nanded Maharashtra, India

VK Khargkharate
Cotton Research Station,
Nanded Maharashtra, India

GL Kadam
College of Agriculture, Anand Agricultural University, Jabugam TQ. Bodeli. Chhota Udepur Gujarat, India

Corresponding Author:
AD Pandagale
Cotton Research Station,
Nanded Maharashtra, India

Studies on various intercropping system under different plant geometry in *Bt* cotton

AD Pandagale, VK Khargkharate and GL Kadam

Abstract
At Cotton Research Station, Nanded during *Kharif* season this field experiment was carried out to study the suitable planting patterns which can be useful to enhance intercrop population by flanking additional rows and to access the feasibility of different intercropping systems in Bt cotton. The result revealed that plant geometry of 120 x 45 cm was superior than 180 x 30 cm for seed cotton yield and cotton + green gram recorded significantly highest seed cotton equivalent yield (2627 kg/ha). Due to addition of intercrop can harvest a larger yield proportion than sole crop of cotton on one hand and obtain food ingredients without extra allocation of land.

Keywords: Various intercropping system, plant geometry, Bt cotton

Introduction
Cotton crop is grown in about 70 countries across the world and planted in an area of 31.8 million hectares. India commands highest share globally (36%) in terms of area under cultivation. During the year 2017- 18, Gujarat, Maharashtra and Telangana were the major cotton growing states covering around 71% (86.4 lakh hectare) in area under cotton cultivation and 65% (246 lakh bales) of cotton production in India (Anonymous, 2017-18) [2]. Cotton accounts for 13.77 per cent of the export of its annual produce in India. Still Indian cotton productivity (542 kg lint /ha) is low as compared to that of world, 760 kg lint /ha (Anonymous, 2016-17) [1] which directs a great scope to increase. In 2013-14, 11.8 million tons of edible oil and 3.04 million tones of pulses were imported. Such situation demands a simultaneous increase in the productivity of cotton, edible oil seeds and pulses.

For minimizing risk in rainfed farming, intercropping in cotton is advocated. Intercropping enhances total productivity, total monetary returns, diversify crop to produce food, greater land use efficiency, soil fertility enrichment, insurance against aberrant weather conditions and improve intrinsic capasity of natural resources. (Deshpande *et al.*, 1989) [3]

Conventional method of planting cotton in closely spaced rows does not permit convenient intercropping. A new pattern of cotton cultivation, in widely spaced rows with closer plant to plant distance has been adopted by many farmers in Maharashtra. Due to wider intra row spacing and slow initial crop growth, intercrop population can be increased by adding number of rows in between adjacent cotton rows.

The present study was conducted to evaluate suitability of planting patterns which can facilitate increased intercrop population by inclusion of additional rows and to access the feasibility of different intercropping systems in Bt cotton.

Materials and Methods
The study was conducted at Cotton Research Station, Nanded (MS) in factorial randomized block design comprising combinations of two planting geometries (120 x 45 cm and 180 x 30 cm with two and three rows of intercrops in between adjacent two rows of cotton, respectively) and four intercropping treatments (sole Bt cotton, Cotton + Green gram, Cotton + Black gram and Cotton + Soybean). The soil of experimental site was having low organic carbon and available nitrogen, medium phosphorus and high potassium content. The experiment was conducted as rainfed and replicated thrice. All other recommended agronomic practices were followed. Recommended dose of fertilizers (100:50:50 NPK kg / ha) was applied.

Bt cotton hybrid (NCH 134 Bt), Green gram (BPMR 2002-1), Black gram (TAU 1) and Soybean (MAUS 71). Two rows of intercrop were flanked in 120 x 45 cm plant geometry (1:2) where as three rows were flanked in 180 x 30 cm geometry (1:3). Intercrops were harvested at their physiological maturity. The number of cotton plants per ha were similar in both planting geometries. Interaction of the two factors were non significant, hence individual results of the factors are discussed.

Results and Discussion

Plant growth characters: Planting geometry with the intercropping in Bt cotton did not resulted in significant difference in plant height at harvest. Satish *et al* (2012) [7] reported non significant response of plant geometry and intercropping systems for plant height. Number of monopodia and sympodia per plant remained statistically similar due to effect of plant geometry. In different types of intercropping treatments, sole cotton treatment recorded significantly highest number of monopodia (1.37) and sympodia per plant (19.70) over other intercropping systems. Lowest monopodia per plant (1.07) were observed in Bt cotton + Black gram intercropping system. Number of sympodia per plant in soybean intercropping were significantly reduced than intercropping of Green gram and Sole Bt cotton. This was due to more competitive and exhaustive behavior of soybean which suppressed growth of companion crop to a large extent. Raghurami Reddy (2006) also observed reduction in number of branches by intercropping of green gram, black gram and soybean.

Yield contributing characters: The planting patterns of 120 x 45 cm plant geometry with two rows of intercrops recorded significantly higher number of bolls and yield per plant over plant geometry 180 x 30 cm with three rows of intercrops. All intercropping systems produced significantly lower number of bolls per plant with reduction in boll weight over sole cotton. This has depicted to significant reduction in yield per plant due to intercropping treatments over sole Bt cotton. This was ascribed to an intensive competition between the component crops in intercropping systems for factors required boll setting and their development *viz.* moisture, light and nutrients. These results are in confirmation with Satish *et al* (2012) [7].

Seed cotton yield and seed cotton equivalent yield: During all the years of experimentation and on pooled mean basis, plant geometry of 120 x 45 cm was significantly superior over geometry 180 x 30 cm for seed cotton yield. This might be due to higher evaporation loss in 180 cm row spaced crop due to increased light inception directly on soil. Pandagale *et al.* (2015) [5] also reported reduction in seed cotton yield in wider row spaced crop under rainfed condition. The seed cotton yield showed significant decrease when intercropped with legumes over sole cotton and intercropping of soybean was more harmful. Similar results were also reported by Reddy and Mohammad (2009) [6] and Khargkharate *et al.* (2014) [4].
However, seed cotton equivalent yield was significantly higher in all intercropping treatments over sole Bt cotton. Cotton + Green gram recorded significantly highest seed cotton equivalent yield (2627 kg / ha). This was due to higher seed cotton yield in the intercropping treatment and better prices fetched to green gram. Thus farmers can harvest a larger yield proportion than sole crop of cotton on one hand and obtain food ingredients without extra allocation of land, on the other.

Economics: Plant geometries were found statistically similar for GMR and NMR. Higher yields in geometry 120 x 45 cm resulted to higher B:C ratio (2.66). Cotton + Green gram recorded significantly higher GMR and NMR (Rs. 88,694/- and Rs. 53,557/-, respectively). Increased NMR in Cotton + Green gram intercropping system depicted to increased mean B:C ratio (2.93).

Table 1: Growth and yield contributing characters (pooled mean) and mean intercrop yield (kg / ha) as influenced by different plant geometry and intercropping system

Treatment	Plant height (cm)	Mono-podia /plant	Sympodia/ plant	No. bolls/ plant	Boll weight (g)	Yield / plant (g)	Mean intercrop yield (kg / ha)
Main plot : Plant geometry							
G_1 : 120 cm x 45 cm	117.94	1.21	18.06	29.55	3.55	108.39	-
G_2 : 180 cm x 30 cm	118.31	1.19	18.37	25.49	3.51	92.98	-
S.E.±	1.77	0.04	0.24	0.42	0.03	1.58	-
C.D. at 5%	N.S.	N.S.	N.S.	1.27	N.S.	4.79	-
Sub-plot : Intercrops							
I_1 : Cotton + Green gram	117.19	1.13	18.44	29.45	3.60	104.45	763
I_2 : Cotton + Black gram	117.18	1.07	17.76	25.96	3.53	93.59	624
I_3 : Cotton + Soybean	118.08	1.22	16.95	22.37	3.30	81.06	1516
I_4 : Sole Cotton	118.74	1.37	19.70	32.31	3.68	123.63	-
S.E.±	2.50	0.05	0.34	0.59	0.04	2.24	-
C.D. at 5%	N.S.	0.16	0.96	1.79	0.12	6.79	-
Interaction G X I							
S.E.±	3.54	0.08	0.49	0.83	0.06	3.16	-
C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	-
G. mean	118.12	1..20	18.21	27.52	3.53	100.68	-
C.V. %	9.01	19.14	8.15	9.91	5.54	7.94	-

Table 2: Seed cotton equivalent yield (kg / ha) and pooled economics as influenced by different plant geometry and intercropping system

Treatment	Seed cotton yield (kg / ha)	Seed cotton equivalent yield (kg / ha)	GMR (Rs. /ha)	NMR (Rs. /ha)	B:C ratio
Main plot: Plant geometry					
G_1 : 120 cm x 45 cm	1937	2419	80287	45536	2.66
G_2 : 180 cm x 30 cm	1752	2295	76706	41968	2.55
S.E.+	50.64	54.46	1487	1496	-
C.D. at 5%	153.38	N.S.	N.S.	N.S.	-
Sub-plot : Intercrops					
I_1 : Cotton + Green gram	1875	2627	88694	53557	2.93
I_2 : Cotton + Black gram	1805	2329	78192	43015	2.57
I_3 : Cotton + Soybean	1613	2386	79879	45365	2.62
I_4 : Sole Cotton	2085	2085	67220	33070	2.28
S.E.+	71.61	77.02	2104	2116	-
C.D. at 5%	216.91	233.28	6371	6408	-
Interaction G X I					
S.E.+	101.28	108.92	2974	2992	-
C.D. at 5%	N.S.	N.S.	N.S.	N.S.	-
G. mean	1844	2357	78496	43752	2.60
C.V. %	9.50	8.03	7.70	13.53	-

References

1. Anonymous. 2016-17. https://cotcorp.org.in/statistics.aspx#.
2. Anonymous. ICAR-All India Coordinated Research Project on Cotton – Annual Report, 2017-18.
3. Deshpande RM, Kharche SG, Rawankar HN. Studies on intercropping with legumes in relation to planting pattern of hybrid cotton. PKV Res. T., 1989; **13**:100-104.
4. Khargkharate VK, Kadam GL, Pandagale AD, Awasarmal VB, Rathod SS. Studies on kharif legume intercropping with Bt cotton under rainfed conditions. J Cotton Res. Dev. 2014; 28(2):243-246
5. Pandagale AD, Khargkharate VK, Kadam GL, Rathod SS. Response of Bt Cotton (*Gossypium hirsutum* L.) to varied plant plant geometry and fertilizer levels under rainfed condition. J Cotton Res. Dev. 2015; 29(2):260-263
6. Raghu Rami Reddy P, Shaikh Mohammad. Evaluation of cotton (*Gossypium hirsutum*) based inetcropping system through different approaches under rainfed conditions. Indian J Agric. Sci. 2009; 79(3):210-214.
7. Satish P, Raja V, Shaikh Mohammad, Sailaja V. Effect of intercropping on growth and seed cotton yield of Bt cotton with different planting patterns. J Res. Angrau. 2012; 40(1):21-25.