J. Cotton Res. Dev. **32** (2) 256-259 (July, 2018) **ISSN No. 0972-8619**

Agronomic manipulation of high strength cotton genotype, CCH4474 for yield maximization under irrigated agro ecosystem of Coimbatore

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ABSTRACT : The manipulation of plant geometry to optimize cotton yield is a time tested agro technique for achieving higher cotton yield. To improve the yield potential of high strength Cotton genotype CCH4474 by agronomic manipulation, field experiment was conducted during 2014-2015 cropping season at Central Institute for Cotton Research, Regional Station, Coimbatore. Three high density planting system (HDPS) were evaluated with recommended geometry under three levels of fertilizers. This genotype produced the highest seed cotton yield of 3325 kg/ha at 90x10 cm (111111 plants / ha) with 125 per cent RDF.

Key words: Fertilizer levels, High density planting, high strength cotton, seed cotton yield

The *hirsutum* genotype, CCH 4474 is very good in terms of fiber quality and produces high strength fiber (> 24g/tex) but in spite of this, it was rejected in multi location trial because of its low yield which has produced just 13 q/ha in breeders' trial at Coimbatore. Hence an attempt was made to improve the yield potential of this high strength genotype by agronomic manipulations. High density planting system is very popular in Brazil and is being evaluated successfully to suite Indian condition. The manipulation of cotton plant geometry for yield improvement is a time tested agronomic practice and the most commonly tested plant densities range from 5 to 15 plants/m^2 (Kerby *et al.,* 1990) resulting in a population of 50000 to 1,50,000 plants/ha. In China, a plant population of 4.5-7.5 plants/m^2 in non saline soil and 7.5- 9.0 plants/m^2 in saline soil has been standardized (Dong *et al.* 2006-2010). To meet the demand of additional plant population, the need for extra dose of nutrients has to be standardized under HDPS system. Singh *et al.,*. 2012 reported 25 per cent additional fertilizers for HDPS system with a population of 1, 48,000 plants/ha. To maximize the yield performance of this high strength cotton genotype under HDPS and to standardize the fertilizer requirement this study was attempted.

Field experiment was conducted during winter (August – February) cropping season of 2014-2015 at Coimbatore under irrigated condition to maximize the yield potential of high strength cotton genotype, CCH 4474. The design used was Factorial RBD with three replications. Four geometry *viz.,* recommended 75x45cm (29629 plants /ha) , three high density plantings of 90x10 cm (1,11,111 plants/ha), 45x10 cm (2,22,222 plants/ha), 37.5x10cm **(**2,66,666 plants/ha) were evaluated under three fertilizer levels of RDF (100 % 60:30:30 NPK/ha), RDF (125%) and RDF (150%).The scheduling of fertilizers were done at three equal splits for N and K at sowing, 45 DAS and 75 DAS while the entire phosphatic fertilizer was applied as basal.

The soil of the experimental field was low in nitrogen (182.5 kg/ha), medium in phosphorus (13.75 kg/ha) and high in potassium (812.5 kg/ha). The EC of the soil was 0.24 (dSm^{-1}) with PH of 8.47.For the HDPS treatments, mepiquat chloride (1,1- dimethyl-piperidinium chloride) @50 g ai/ha was applied twice at 45 and 65 DAS to reduce the vegetative growth.

Effect of plant geometry and fertilizer levels on yield attributes of CCH4474 : The enhanced boll numbers/plant at recommended spacing of 75x45 cm over closer spacings could not be compensated for yield due to reduction in population which was drastically reduced on unit area basis. Among the HDPS, 90x10 cm recorded significantly higher bolls/plant over other two HDPS planting system (Table1). The boll weight was highest (4.48 g/boll) at 90x10cm (Table 2) as compared to other geometry levels signifying the optimum geometry of 90cm row spacing to harvest maximum solar radiation for efficient

Table 1. Bolls /plant in CCH 4474 as influenced by geometry and fertilizer levels

Fertilizer levels	Plant geometry (cm)				
	75 x45	90x10	45x10	37.5x10	**Mean**
RDF (100%)	29.5	13.86	7.0	8.07	**14.61**
RDF (125%)	33.7	17.53	9.53	6.87	**16.91**
RDF (150%)	30.9	15.33	9.33	7.00	**15.64**
Mean	**31.40**		**15.57**	**8.62**	**7.31**
CD (p=0.05)	**2.82**				
Fertilizer levels					
CD (p=0.05)	NS				
Interaction	NS				

Table 2. Boll weight (g/boll) in CCH 4474 as influenced by geometry and fertilizer levels

Fertilizer levels	Plant geometry (cm)				
	75 x45	90x10	45x10	37.5x10	**Mean**
RDF (100%)	3.82	4.42	2.87	2.71	**3.46**
RDF (125%)	4.47	4.58	3.09	2.98	**3.78**
RDF (150%)	4.71	4.46	3.06	2.88	**3.78**
Mean	**4.33**	**4.48**	**3.01**	**2.85**	
CD (p=0.05)	**0.280**				
Fertilizer levels					
CD (p=0.05)	NS				
Interaction	NS				

partitioning of assimilates so as to have higher harvest index. The boll weight reduced with the reduction of row spacing as could be evidenced at 4.33g, 3.01g and 2.85 g at 75,45 and 37.5cm row spacing respectively. The boll numbers and boll weight enhanced up to RDF 125 per cent and no further response could be noticed beyond RDF 125 per cent.

Effect of plant geometry and fertilizer kevels on seed cotton yield of CCH4474 : The optimum plant geometry of 90x10cm with 1,11,111 plants/ha translated to the maximum yield enhancement of 36.82 per cent over the recommended geometry of 75x45cm for CCH4474 in the irrigated agro ecosystem of Coimbatore. All the three HDPS treatments recorded enhancement in yield over recommended geometry and the yield enhancement worked out to be at 36.82 per cent,33.04 per cent and 26.38 per cent at 90x10 cm (1,11,111plants/ha), 45x10cm (2,22,222 plants/ha) and 37.5x10cm (2,66,666plants/ha) respectively. Venugopalan *et al.,* 2014 reported an average yield increase of 29.5 per cent across ten genotypes due to HDPS over recommended spacing. Among the fertilizer levels, RDF (125 %) recorded the highest (3220 kgs/ha)seed cotton yield and was on par with RDF (150 per cent Table 3) but found significantly superior to RDF(100 per cent) . This was in confirmation with the findings of Sing *et al.,* 2012 who has reported an additional dose of 25 per cent to meet the crop demand under HDPS

Table 3. Seed cotton yield (kg/ha) of CCH 4474 as influenced by geometry and fertilizer levels

Fertilizer levels	Geometry (cm)				
	75x45	90x10	45x10	37.5x10	**Mean**
RDF (100%)	2158	3183	2895	2503	**2684**
RDF (125%)	2526	3325	3263	3266	**3220**
RDF (150%)	2297	3043	3130	3056	**2859**
Mean	**2327**	**3184**	**3096**	**2941**	
CD (p=0.05)	**470.7**				
Fertilizer levels					
CD (p=0.05)	**407.7**				
Interaction	NS				

Table 4. Fibre quality parameters of CCH4474 as influenced by geometry and fertilizer levels

Treatments	2.5 per cent span length (mm)	Fibre strength (g/tex)	Micronaire	Uniformity ratio	Elongation
Geometry (cm)					
75x45	30.9	24.1	3.5	45	5.4
90x10	31.7	24.1	3.5	45	5.3
45x10	32.6	24.1	3.2	45	5.3
37.5x10	31.9	24.1	3.2	45	5.3
Mean	**31.8**	**24.1**	**3.4**	**45**	**5.3**
CD (p=.05)	NS	NS	NS	NS	NS
Fertilizer levels					
RDF (100%)	31.9	24.1	3.3	45	5.4
RDF (125%)	31.7	24.1	3.4	45	5.3
RDF (150%)	31.7	24.1	3.4	45	5.4
	31.8	24.1	3.4	45	5.3
CD (p=0.05)	NS	NS	NS	NS	NS

with 148000 plants/ha. Among the combination of treatments, the highest seed cotton yield of 3325 kgs/ha was recorded at 90x10cm with RDF 125 per cent.

Effect of plant geometry and fertilizer kevels on fibre quality of CCH4474 : None of the fibre quality parameters were significantly influenced by the geometry or fertilizer levels (Table 4).

It is concluded from this study that the hirsutum cotton genotype, CCH4474 responded to HDPS and fertilizer levels. The yield enhancement to the tune of 3325 kg/ha is possible with agronomic manipulation of 90x10 cm with RDF 125 per cent.

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Received for publication : December 20, 2017
Accepted for publication : May 19, 2018