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Evaluation of *Hirsutum* Cotton Varieties under Various Fertility Levels and Plant Geometries

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ABSTRACT

An experiment was conducted at Agricultural Research Station, Borwat Farm, Banswara to evaluate the *hirsutum* cotton hybrids under various pant geometries and fertility levels Sowing of H-8 cotton hybrid gave significantly higher seed cotton yield (2274 kg ha^{-1}) over RAHH-259 (1827 kg ha^{-1}). The maximum seed cotton yield (2076 kg ha^{-1}) was observed under plant geometry of 90 x 45 cm than wider plant geometry of 90 x 60 cm (1808 kg ha^{-1}) and 90 x 90 cm (1735 kg ha^{-1}). Though, yield attributing parameters such as bolls $plan^{-1}$ and boll weight were statically improved in wider as compared to closer spacing but it could not compensate yield due to significantly higher plant population in the later case. Among fertility levels, similar seed cotton yield was recorded with the application of 100 % RDF (2079 kg ha^{-1}) and 125 % RDF (2108 kg ha^{-1}) but both were significantly better than that application of 75 % RDF and plant geometry 90 x 45 cm seemed to be ideal for *hirsutum* cotton hybrid for realizing higher productivity under the specific agro climatic zone IV b of Rajasthan.

Introduction

Cotton is known as white gold and queen of fibers. It is an important cash crop of global significance which plays a dominant role in world agriculture and industrial economy. India is important grower of cotton on a global scale. The cotton productivity in 2016-17 has 568 kg/ha with an area of 105 lakh ha and production 351 lakh bales each 170 kg (*http://cotcorp.gov.in/statistics.aspx#area* CCI, 2017).

Cotton productivity depends on various factors among them selection of potential genotypes along with plant densities play a vital role in increasing the productivity of cotton. The manipulation of row spacing, plant density and the spatial arrangements of cotton plants, for obtaining higher yield have been attempted by agronomists for several decades in many countries. 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 150000 plants/ha.

The maximum exploitation of these genotypes can be achieved only after determining their optimum planting densities in comparison to recommended cotton varieties. In general, it was observed that lower plant densities produces high values of growth and yield attributes per plant, but yield per unit area was higher with higher plant densities (Sharma *et al.*, 2001). However, it may happen that moderate increase in plant densities may not increase the yield but decrease due to competition between plants for nutrients, water, space and light (Nehra and Kumawat, 2003).

The reasons for decreasing productivity are due to decreasing soil fertility especially micronutrients, imbalanced use of fertilizer and occurrences of physiological disorders like square dropping, square drying, leaf reddening *etc*. Among these, imbalanced use of major and micro nutrients is the major problem (Hebbar *et al.*, 2007). To overcome these constraints, additional nutrition through foliar feeding is required over and above the normal fertilizer recommendation. This is one of the most efficient ways of supplying essential nutrients to a growing crop. Newly released, high yielding transgenic cotton cultivars are said to have a higher nutrient demand during the boll development period (between flowering and maturity) due to their higher boll retention rate and larger boll load than conventional cultivars (Sawan *et al.*, 2008). Therefore, supplying optimal quantities of mineral nutrients and using balanced macro and micronutrient doses to growing crop plants is one way to improve crop yields.

Materials and Methods

Field experiment was conducted during *kharif* -2012 at Agricultural Research Station, Borwat Farm, Banswara. The eighteen treatment combinations comprised of two cotton hybrids (H-8 and RAHH-259) in main plot, three plant geometries (90 x 45, 90 x 60 and 90 x 90 cm) in sub plot and three fertility levels (75, 100 and 125 % RDF) in sub-sub plot under split plot design with four replications. Experimental field was well prepared by two ploughing followed by harrowing and cultivator and one planking for uniform levelling were performed for sowing of cotton.

The soil was medium in available nitrogen (244 kg/ha), phosphorus (48 kg/ha) and high in available potassium (327 kg/ha) during the crop season. The crop was sown in second week of June by dibbling 2-3 seeds per hills and full dose of phosphorus and potash were applied before sowing, while nitrogen dose was given in two splits *i.e.* first half at the time of thinning and remaining half at flowering stage. All production and protection measures were applied as per package of the zone IV b.

Growth

Data shows that the sowing of *hirsutum* cotton, among the cotton hybrids the H-8 was proved superior over RAHH-259. Cotton hybrid H-8 gave higher plant height (108.40 cm), monopodial branches plant^{-1} (1.24), and sympodial branches plant^{-1} (17.02) as compared to RAHH-259. The wider plant spacing 90 x 60 cm and 90 x 90 cm were found at par with each other, gave significantly higher plant height (109.20 and 112.07 cm), monopodial branches plant^{-1}(1.13 and 1.17) and sympodial branches plant^{-1} (15.23 and 16.02) over sowing at 90 x 45 cm plant spacing.

Significantly increase the growth of cotton with the increasing of fertility levels, application of 100 % RDF and 125 % RDF were found at par with each other. The maximum plant height (107.40 cm), monopodial branches plant^{-1}(1.16) and sympodial branches plant^{-1} (13.90) were observed under application of 100 % RDF over application of 75 % RDF plant height

(99.05 cm), monopodial branches plant^{-1} (1.05) and sympodial branches plant^{-1} (12.03). Height increase could be due to competition for solar radiation, water and nutrient uptake among the plants. Besides leaf production was associated with plant height changes (Gao and Jein, 1989). Plant height and seed cotton yield was positively correlated with the plant spacing (Ganvir *et al.*, 2013).

Yield attributes

Cotton hybrid H-8 gave higher bolls plant^{-1} (23.27), boll weight (4.32) over RAHH-259 bolls plant^{-1} (18.14), boll weight (3.71). The wider plant spacing 90 x 60 and 90 x 90 cm gave significantly higher bolls plant^{-1} (21.52 and 22.05), boll weight (4.10 and 4.17) over sowing at 90 x 45 cm plant spacing bolls plant^{-1} (17.49), boll weight (3.80).Application of 100 % RDF and 125 % RDF were found at par with each other. The maximum bolls plant^{-1} (20.28), boll weight (3.97) were observed under application of 100 % RDF over application of 75 % RDF bolls plant^{-1} (16.56), boll weight (3.55). Application of NPK leads to increase bolls/plant, boll weight due to accelerated mobility of photosynthates from source to sink Similar observations were also made by Siddiqui *et al.*, 2009 and Sasthri *et al.*, 2000.

Table.1 Effect of plant geometry and fertility levels on growth, yield attributes and seed cotton yield of *hirsutum* cotton

Treatment	Plant height (cm)	Monopodial branches / plant	Sympodial branches / plant	Bolls / plant	Boll weight (g)	Seed cotton yield (kg/ha)
Variety						
H-8	108.40	1.24	17.02	23.27	4.32	2274
RAHH-259	98.15	1.08	15.70	18.14	3.71	1827
SEm±	1.69	0.04	0.45	1.25	0.17	74
CD (p=0.05)	5.27	0.13	1.32	3.68	0.50	218
Plant geometry						
90 x 45 cm	103.04	1.05	13.12	17.49	3.80	2076
90 x 60 cm	109.20	1.13	15.23	21.52	4.10	1808
90 x 90 cm	112.07	1.17	16.02	22.05	4.17	1735
SEm±	1.74	0.02	0.39	1.03	0.09	70
CD (p=0.05)	5.04	0.06	1.20	3.11	0.26	209
Fertility levels						
75 % RDF	99.05	1.05	12.03	16.56	3.55	1785
100 % RDF	107.40	1.16	13.90	20.28	3.97	2079
125 % RDF	109.36	1.18	14.48	22.42	4.01	2108
SEm±	1.80	0.03	0.42	1.12	0.11	82
CD (p=0.05)	5.52	0.08	1.26	3.30	0.34	243

Seed cotton yield

Sowing of cotton hybrids H-8 gave significantly higher seed cotton yield (2274 kg ha^{-1}) over sowing of RAHH-259 (1827 kg ha^{-1}). Significantly higher seed cotton yield (2076 kg ha^{-1}) was recorded under sowing at 90 x 45 cm plant spacing over sowing at wider plant spacing at 90 x 60 and 90 x 90 cm seed cotton yield (1808 and 1735 kg ha^{-1}). Application of 100 % RDF and 125 % RDF were found at par with each other. The maximum seed cotton yield (2079 kg ha^{-1}) was found under application of 100 % RDF over application of 75 % RDF seed cotton yield (1785 kg ha^{-1}), the difference between a narrow row and a wide row was not significant on yield but a wider row may facilitate intercultural (Table 1).

Earlier, Heitholt *et al*., (1996) observed that at equal densities, narrow row may allow each plant to intercept more light and increase seasonal light interception but this advantage is seldom translated into improvements in yield. These above are in accordance with those obtained by Gao and Jein (1989), Ganvir *et al.,* (2013), Nehra and Kumawat, (2003) and Sharma *et al.*, (2001).

It can be concluded that Hybrid-8 proved superior with 90 x 45 cm plant spacing and 100% RDF over RAHH-259 in respect of yield and yield attributes.

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