Effect of Plant Density on Four Short Statured Cotton Varieties

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Abstract: The experiment was conducted to evaluate the maximum yield potential of cotton as affected by plant population for four short statured varieties viz., NIAB-Karishma, NIAB-78, CIM-443 and CIM-448 planted at spacings 10, 20, and 30 cm with rows at 75 cm apart. Maximum seed cotton yield 267.7 kg ha⁻¹ was recorded when plant spacing was 30 cm for all the varieties closely followed by 2640 kg ha⁻¹ for the treatment where plant spacing was 20 cm. The minimum values were obtained at plant spacing of 10 cm.

Key words: Plant density, short statured cotton varieties

Introduction
Cotton (Gossypium hirsutum L.) is an important cash crop of Pakistan. It covers an area of 282.7 thousand hectares with a production of 1.9 thousand bales during the year 2000 (Anonymous, 2002). Cotton is not only a source of foreign exchange but it is also a source of income to farmer's and labourer's because local textile industry is based on the cotton production. Cotton seed is the major source of vegetable oil and oil seed cake for animal feed. Production of cotton use in textile industry.

Although Pakistan has been able to achieve breakthrough in production of cotton, yet there is vast gap between the potential and national average yield. Out of factors, limiting higher yield in cotton effective crop management practices particularly to maintain an appropriate plant population may help to get maximum seed cotton yield.

Cotton production point out that, plant population has been identified as one of the major factors responsible for low yield in the country (Anonymous, 1995). The PACC recommended plant population of 60,000-75,000 plants ha⁻¹ in Sindh and NWFP. Devi et al. (1996) stated that cotton cv. JH-7 was grown at densities of 65,856, 74,074 or 111,111 plants ha⁻¹ and ginned 0-160 N kg ha⁻¹. Seed cotton yield was highest with 160kg N and at a plant density of 111,111 plants ha⁻¹. Goudreddy et al. (1996) concluded that cotton yield was greatest at the higher plant population and reduced by sowing in July compared with June. Jeganathan and Venkitaswamy (1998) reported that seed cotton yield decreased with increase in plant spacing and it was highest with 80 kg N + 40 kg P + 40 kg K ha⁻¹ while, seed cotton yield was unaffected by cultivars. El-Din (1997) concluded all combinations of 3 plant densities (target populations of 140,000, 70,000 or 46,866 plants feddan⁻¹) and yield per feddan was highest at 70,000 plants feddan⁻¹ in both years (1 feddan = 0.42 ha). Esparza and Pedroza (1997) reported that cotton cv. Laguna 89 grown at spacings of 10, 30 or 50 cm between plants. Plant density have no significant effect on seed cotton yield. Manjappa et al. (1997) concluded that cotton cv. RAMPBS 156 gave the highest yield of 3.11 t ha⁻¹ when grown at 50 x 45 cm spacing. The lowest plant density of 4 spacing treatments tested. Sheker et al. (1998) grown cotton cv. DCH-32 at 9 different spacing. Seed cotton yield was highest (2881 kg ha⁻¹) from 60 x 30 cm, which was the highest plant density (55556 plants ha⁻¹) studied. Spacing at 80 x 30 cm gave the yield of 2675 kg ha⁻¹ and it is suggested that this spacing be more convenient for cultural operations.

Materials and Methods
The study was carried out at Agronomic Research Station, Bahawalpur during the kharif 1999 and 2000 to find out the optimum plant population in exploring the maximum yield potential of cotton varieties. The experiment was laid out in split plot design with four replications, having a plot size of 3 x 6m².

The experiment involved the following levels of the two factors

Factor 1
Varieties
V₁ NIAB-Karishma
V₂ NIAB-78
V₃ CIM-443
V₄ CIM-448

Factor 2
Plant spacings
S₁ 10 cm
S₂ 20 cm
S₃ 30 cm

Row spacing was maintained at 75 cm.

The observations for each entry were recorded on yield and yield components. Data were collected analyzed statistically using least significant difference test (Steel and Torrie, 1984). Results and Discussion
The analysis of variance showed significant differences among plant spacings in cotton varieties. A thorough scrutiny of the data revealed a superiority of plant spacings of 30 cm over others. The data (Table 1) depicts a detailed scenario of yield performance at different plant spacings of four cotton varieties. The highest mean seed cotton yield of 267.7 kg ha⁻¹ was obtained when plant and row spacings were 30 and 75 cm respectively, followed by (2640 kg ha⁻¹) for plant and row spacing 20 and 75 cm respectively. A significantly lowered weights were obtained when plant and row spacings were 10 and 75 cm respectively. The interaction between varieties and plant spacings was also significant, reflecting the optimum plant spacing for different cotton varieties under study. These results are in line with those reported by Khan et al. (1975) and Goudreddy et al. (1996) and not in line with those reported by Devi et al. (1996). El-Din (1997) and Sheker (1999). As for as varieties were concerned V. NIAB-Karishma gave the highest yield (2702 kg ha⁻¹) with significantly lowered values for V. CIM-443. V. CIM-448 and NIAB-78 i.e., 2634, 2567 and 2509 kg ha⁻¹ respectively. Irrespective of varieties, maximum no of bolls plant⁻¹ were attained by plant spacing 30 cm followed non significantly by plant spacing of 20 cm, while the significantly lowest values were recorded by plant spacing 10 cm (Table 2). These results are in line with those reported by Sinha (1974) and not in line with Kataki et al. (1970).

The data (Table 3) explains that boll size was maximum when plant spacings was 30 cm followed significantly by plant spacing 20 cm while, least value was obtained by plant spacing 10 cm with standard row spacing. The interaction between plant spacings and varieties were also significant reflecting the optimum plant spacing for different cotton varieties under study. Similar findings were reported by Emiroglu (1970). As for as varieties were concerned,
Table 1: Effect of plant spacing on seed cotton yield (Kg ha\(^{-1}\)) of different varieties of cotton

<table>
<thead>
<tr>
<th>Plant spacing (cm)</th>
<th>NIAB-Karihsha</th>
<th>NIAB-78</th>
<th>CIM-443</th>
<th>CIM-448</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>S(_1) (10)</td>
<td>2570b</td>
<td>2341b</td>
<td>2532b</td>
<td>2478c</td>
<td>1506b</td>
</tr>
<tr>
<td>S(_1) (20)</td>
<td>2763a</td>
<td>2674b</td>
<td>2632b</td>
<td>2599b</td>
<td>2640a</td>
</tr>
<tr>
<td>S(_1) (30)</td>
<td>2783a</td>
<td>2613b</td>
<td>2638b</td>
<td>2594b</td>
<td>2657a</td>
</tr>
<tr>
<td>Means</td>
<td>2702a</td>
<td>2508c</td>
<td>2534ab</td>
<td>2557bc</td>
<td></td>
</tr>
</tbody>
</table>

Cd\(_1\) for plant spacings = 73.37
Cd\(_1\) for varieties = 84.47
Cd\(_1\) for varieties X plant spacings = 83.45

Table 2: Effect of plant spacing on boll plant\(^{-1}\) of different varieties of cotton

<table>
<thead>
<tr>
<th>Plant spacing (cm)</th>
<th>NIAB-Karihsha</th>
<th>NIAB-78</th>
<th>CIM-443</th>
<th>CIM-448</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>S(_1) (10)</td>
<td>37c</td>
<td>33d</td>
<td>37c</td>
<td>33d</td>
<td>34.83b</td>
</tr>
<tr>
<td>S(_1) (20)</td>
<td>39bc</td>
<td>40ab</td>
<td>37c</td>
<td>38bc</td>
<td>38.75a</td>
</tr>
<tr>
<td>S(_1) (30)</td>
<td>41ab</td>
<td>43a</td>
<td>42a</td>
<td>39bc</td>
<td>41.17a</td>
</tr>
<tr>
<td>Means</td>
<td>39</td>
<td>38.56</td>
<td>38.78</td>
<td>38.78</td>
<td></td>
</tr>
</tbody>
</table>

Cd\(_1\) for plant spacings = 2.715
Cd\(_1\) for plant spacings X varieties = 2.675

Table 3: Effect of plant spacing (cm) on 100 bolls weight (g) of different varieties of cotton

<table>
<thead>
<tr>
<th>Plant spacing (cm)</th>
<th>NIAB-Karihsha</th>
<th>NIAB-78</th>
<th>CIM-443</th>
<th>CIM-448</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>S(_1)-10</td>
<td>336ef</td>
<td>310g</td>
<td>330f</td>
<td>340e</td>
<td>38.20c</td>
</tr>
<tr>
<td>S(_1)-20</td>
<td>362abc</td>
<td>340e</td>
<td>350d</td>
<td>361bc</td>
<td>353.30b</td>
</tr>
<tr>
<td>S(_1)-30</td>
<td>370a</td>
<td>355cd</td>
<td>368ab</td>
<td>369ab</td>
<td>366.70a</td>
</tr>
<tr>
<td>Means</td>
<td>355.80a</td>
<td>335.20b</td>
<td>349.30a</td>
<td>356.70a</td>
<td></td>
</tr>
</tbody>
</table>

Cd\(_1\) for plant spacings = 8.608
Cd\(_1\) for varieties = 10.22
Means sharing different letters differ significantly at P< 0.05
Row spacing was maintained at 75 cm

all the varieties were statistically same for this yield components.
On the basis of two years results it was concluded that maximum seed cotton yield was obtained when plant and row spacings were 30 and 75 cm respectively followed by plant and row spacing 20 and 75 cm respectively.

References