RESPONSE OF SEED COTTON YIELD TO VARIOUS PLANT POPULATIONS AND PLANTING METHODS

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ABSTRACT

Response of seed cotton yield to various plant populations and planting methods was studied at Adaptive Research Farm, Vehari, Pakistan during 2007 and 2008. Cotton variety CIM-496 was planted under three populations (88888, 59260 and 44444 plants/ha) maintained with plant spacings of 15, 22.5 and 30 cm, respectively and three planting methods viz. flat planting, ridge planting and bed planting in 75 cm apart rows. Average of two years data indicated that seed cotton yield was significantly higher in 59260 plants per hectare (2474 kg/ha) followed by 44444 (2324 kg/ha) and 88888 plants (2238 kg/ha). Among planting methods, bed planting gave significantly higher seed cotton yield (2290 kg/ha) than others.

KEYWORDS: Gossypium hirsutum, plant population, spacing; yield; Pakistan.

INTRODUCTION

Establishment of an acceptable population of cotton seedlings is important to obtain high yields (11). Its contribution ranged from 22.0 to 32.7 percent towards cotton yield (21) while planting method of different crops helps a lot for obtaining required plant population. Some researchers have observed reduced yields with extremely high or low plant populations (6,26) whereas several researchers have, however, concluded that plant population and seed cotton yield are unrelated (5,13,14,19,25,27). Soomro et al. (29) found that 23 and 30 cm plant spacings gave higher seed cotton yield than 15 and 38 cm and advised the growers to make thinning of cotton crop leaving 23-30 cm distance between plants. Plant population of 100,000 per hectare was optimum for cotton grown in 0.76 meter rows (31) while seed cotton yield decreased with increase in plant spacing (18). Khan et al. (20) concluded that

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plant spacing of 23 cm gave better yield than 30 and 38 cm spacing in cotton. Many scientists recommended 30 cm plant spacing for cotton crop (1,9,17,24,28) to obtain plant population of 44444 plants per hectare for maximum seed cotton yield. Ali et al. (3) suggested that cotton variety CIM-497 should be planted with 50000 plants per acre.

In Pakistan, flat planting of cotton is practiced in most of the cotton growing areas which may result in poor seed germination and patchy plant population. Some times after planting and before emergence of cotton seedlings, a light shower of rain results in crust formation which restricts the emergence of seedlings and causes poor plant population. Uniform plant population is the most important factor to harvest more profitable yield of all crops. Sowing of cotton on raised beds or ridges ensures adequate plant population due to better seed germination and emergence of seedlings even during unusual rains. Khan and Ullah (22) after studying various planting methods of cotton concluded that ridge sowing outyielded by producing 2582 kg per hectare seed cotton whereas Bridge et al. (8) observed no significant influence of planting methods on seed cotton yield. Planting on bed and furrow is the most appropriate and efficient method to fetch good seed germination and emergence of seedlings (15). Anwar et al. (4) reported that 33 percent higher seed cotton yield was obtained from bed-furrow planting as compared with flat planting. Similarly, Hussain et al. (16) concluded that ridge sowing produced significantly higher seed cotton yield (1729 kg/ha) than flat sowing (1683 kg/ha). Flat planted cotton was lower yielding than cotton planted on raised beds (7). Ali and Ehsanullah (2) concluded that flat planting with each row earthing up gave higher seed cotton yield than bed and ridge plantings. Bed sowing method was significantly superior to flat sowing method with 35 percent higher seed cotton yield in cotton-wheat rotation (10). Similarly furrow-bed seeded cotton increased lint yield by 25 percent compared with flat seeded cotton (12).

No systematic work has been done in the past in Pakistan to evaluate the response of seed cotton yield to various plant populations and planting methods. The present study was undertaken to find out optimum population of cotton seedlings at the most suitable planting method for improving seed cotton yield per unit area.

MATERIALS AND METHODS

This study was conducted at Adaptive Research Farm, Vehari, Pakistan during 2007 and 2008 on clay loam soil. Cotton variety CIM-496 was planted on May 11, 2007 and May 04, 2008 under three plant populations (88888,
59260 and 44444 plants/ha) and three planting methods viz. flat planting, ridge planting and bed planting in 75 cm apart rows. The trial was laid out in split plot arrangement having plot size of 6 x 15 m². In plots allocated for flat planting, sowing was done on well prepared seed bed with single row cotton hand drill at “wattar” condition and at the same time ridges and beds were made with tractor mounted ridger and bed-furrow shaper in dry soil in ridge and bed planting treatments, respectively. Seeding was done manually with delinted cotton seed with 5-6 seeds per hill at 15, 22.5 and 30 cm plant spacings to achieve required plant populations according to the treatments and followed by irrigation. Pendimethalin 330E was applied (2.5 l/ha) at the time of seed bed preparation and then incorporated before drilling in flat planting treatment. In ridge and bed planting treatments same pesticide was sprayed 24 hours after seeding for weed control. The ridge and bed planting treatments were irrigated after 72 hours of sowing to ensure germination of unsoaked seed during first irrigation followed by subsequent irrigation at fortnightly interval. Gaps were also filled where seeds could not germinate to ensure required plant population. Normal irrigations were applied according to need of crop in different planting methods. In flat planting treatment plots were hand thinned three weeks after emergence to their respective plant populations whereas, at same time in ridge and bed plantings thinning was done leaving one plant per hill. Earthing up was completed in all treatments during last interculturing. Phosphatic fertilizer @ 57 kg P₂O₅ per hectare as single super phosphate was applied at or before sowing and 170 kg N per hectare as urea was applied in three splits and last application was done by mid of August every year. Plant protection measures were adopted against sucking insects and bollworms after pest scouting. The seed cotton yield data were recorded from central four rows of eight-row plot. Weather data on temperature and rainfall were recorded during crop growth period (Fig.).
The data on seed cotton yield were calculated and analyzed statistically using Fisher’s analysis of variance technique and significant differences among treatments means were tested using least significant difference (LSD) test at five percent probability (30).

RESULTS AND DISCUSSION

The data (Table) indicated that significantly higher seed cotton yield was obtained with plant population of 59260 plants per hectare followed by 44444 plants per hectare during both years. Among planting methods bed planting gave more seed cotton yield followed by ridge planting. On the basis of two years average also plant population of 59620 (2474 kg/ha) and bed planting (2462 kg/ha) excelled in seed cotton yield. Minimum seed cotton yield was produced by flat planting (2256 kg).

Table. Response of seed cotton yield to various plant populations and planting methods during 2007 and 2008.

<table>
<thead>
<tr>
<th>Plant population/ha</th>
<th>Flat planting</th>
<th>Ridge planting</th>
<th>Bed planting</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2007</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88888</td>
<td>2115</td>
<td>2137</td>
<td>2189</td>
<td>2147c</td>
</tr>
<tr>
<td>59260</td>
<td>2314</td>
<td>2336</td>
<td>2382</td>
<td>2344a</td>
</tr>
<tr>
<td>44444</td>
<td>2261</td>
<td>2245</td>
<td>2298</td>
<td>2268b</td>
</tr>
<tr>
<td>Mean</td>
<td>2230b</td>
<td>2239b</td>
<td>2290a</td>
<td>-</td>
</tr>
<tr>
<td>LSD&gt;0.05: Plant population =16.37, Planting method =49.73</td>
<td></td>
<td></td>
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<tr>
<td><strong>2008</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>88888</td>
<td>2165f</td>
<td>2264e</td>
<td>2559c</td>
<td>2329c</td>
</tr>
<tr>
<td>59260</td>
<td>2428d</td>
<td>2626b</td>
<td>2757a</td>
<td>2604a</td>
</tr>
<tr>
<td>44444</td>
<td>2252e</td>
<td>2298e</td>
<td>2587bc</td>
<td>2379b</td>
</tr>
<tr>
<td>Mean</td>
<td>2281</td>
<td>2396b</td>
<td>2634a</td>
<td>-</td>
</tr>
<tr>
<td>LSD&gt;0.05: Plant population =18.93, Planting method =24.65</td>
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<tr>
<td>Plant population x Planting method =66.03</td>
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<tr>
<td><strong>Mean of two years</strong></td>
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</tr>
<tr>
<td>88888</td>
<td>2140g</td>
<td>2200f</td>
<td>2374d</td>
<td>2238c</td>
</tr>
<tr>
<td>59260</td>
<td>2371d</td>
<td>2481b</td>
<td>2569a</td>
<td>2474a</td>
</tr>
<tr>
<td>44444</td>
<td>2256e</td>
<td>2272e</td>
<td>2443c</td>
<td>2324b</td>
</tr>
<tr>
<td>Mean</td>
<td>2256c</td>
<td>2318b</td>
<td>2462a</td>
<td>-</td>
</tr>
<tr>
<td>LSD&gt;0.05: Plant population =16.37, Planting method =49.73</td>
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<tr>
<td>Plant population x Planting method =32.79</td>
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</tbody>
</table>

No significant effect of plant population x planting method interaction was found during 2007. However, significant differences were recorded during 2008 where maximum seed cotton yield was noted in 59260 plants per hectare with bed planting against minimum from 88888 plants with flat
Response of seed cotton yield to various plant populations

planting. Two years average (Table) showed that plant population of 59260 remained at top with bed planting (2569 kg) and minimum from 88888 plants with flat plating (2140 kg). These results confirmed the earlier findings (20, 29) where better seed cotton yield was noted in 30 cm plant spacing. However, these results are in contrast to some other findings (1,9,17,24,28), where 30 cm plant spacing was recommended to obtain plant population of 44444 plants per hectare and maximum seed cotton yield. In some other earlier findings (4,7,10,12,15) it was concluded that bed sowing method was superior to flat sowing, while Hussain et al. (16) observed that ridge sowing produced significantly higher seed cotton yield than flat sowing. This is in contrast to the findings of Ali and Ehsanullah (2) who reported that flat planting gave higher seed cotton yield than bed planting and ridge planting.

CONCLUSION

The study concludes that maximum seed cotton yield can be obtained with plant population of 59260 plants per hectare. Moreover, bed planting method proved to be superior to ridge and flat plantings. Therefore, cotton growers are advised to adopt bed planting method with 22.5 cm plant spacing to maintain 59260 plants for maximum yield.

REFERENCES