EFFECT OF SCATTERED TREES OF DALBERGIA SISSOO AND ACACIA NILOTICA ON THE YIELD OF COTTON CROP IN SOUTHERN PUNJAB

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The effect of aspect and distance from the base of scattered trees of Dalbergia sissoo and Acacia nilotica were studied in Bahawalpur district of southern Punjab. Four transects of 20m length were laid in north, east, south and western directions. Measurement of cotton yield was made by 2m² quadrat at 1, 4, 7, 10 and 20m distances. Cotton yield increased significantly with increase in distance from both D. sissoo and A. nilotica. Southern aspect had higher cotton yield under D. sissoo but there was no effect of aspect under A. nilotica. Timely pruning of both the species might reduce the loss in cotton yield.

Key words: Acacia nilotica; Dalbergia sissoo; cotton yield

INTRODUCTION

Cotton is one of the major exports of Pakistan (Government of Pakistan 2000). The natural cotton growing area spreads over southern Punjab and the province of Sindh (Byerlee et al 1992). In the province of Sindh cotton is inter cropped with A. nilotica following the centuries old system of Hurries (Byerlee et al 1992, FAO 2000). In the southern Punjab mainly scattered trees of D. sissoo and A. nilotica are grown on cotton farms (Byerlee et al 1992, Khan et al 1999). Occasionally linear plantations of both these trees are also grown (Hussain et al 1998). The main landholdings in southern Punjab are small and farmers avoid the risk of planting trees due to the main perception that trees might reduce the cotton yield (Khan et al 1999). In past, studies have been conducted to measure the affect of single scattered trees of A. nilotica on yield of wheat (Dhillon et al 1998, Dhillon et al 1984, Sheikh et al 1978) and wood lots of D. sissoo on cotton yield (Singh et al 1975, Khan 1957) but there little information available about the affect of single scattered trees of both these trees on yield of cotton crop. Both D. sissoo and A. nilotica trees have potential for fixing nitrogen in soils through root nodules (Parker 1924, Parsad et al 1996, Viswanath et al 1998). This necessitates growing of these trees on nutrient deficient soils of southern Punjab (Byerlee et al 1992). Both these species can also help in reclaiming saline and sodic soils (Singh 1989) which is one of the factors causing land deterioration in the area (Akram et al 1971). Farmers might also benefit from these two species by attaining fuelwood and fodder for their livestock. Therefore this study was conducted to measure the affect of scattered trees of both D. sissoo and A. nilotica on yield of cotton crops in southern Punjab. The results of this study will not only benefit the cotton growing areas of southern Punjab but also parts of Sindh and Balochistan.

METHODS

The study was conducted in Bahawalpur administrative district of southern Punjab, Pakistan in October 2000. A total of 13 cotton farms were selected. Seven farms had scattered trees of Dalbergia sissoo (Shisham) and six farms had scattered trees of Acacia nilotica (Kikar). The mean height of D. sissoo was 12.08 ± 0.21 metres (m) and of A. nilotica was 10.61 ± 0.93m. The mean east-western ground cover of D. sissoo was 10.75 ± 0.17 m and that of the A. nilotica was 14.67 ± 0.43 m. The mean north-southern ground cover of D. sissoo was 11.62 ± 0.18 m and that of the A. nilotica was14.88 ± 0.38 m. The effect of crown cover on cotton yield was analysed, separately, by using GenStat version 4.2 (Lawes et al 1998). Total numbers of cotton bolls growing on them were counted in each quadrat. Fresh weight of ten cotton bolls was measured in each quadrat. The cotton yield per 2m² was calculated by dividing the fresh weight of cotton bolls with ten and multiplying with the total number of cotton bolls in each quadrat. The cotton yield per 2m² was converted into one m² by dividing fresh weight with four. The effect of aspect and distance from the base of the D. sissoo and A. nilotica on cotton yield was analysed, separately, by using GenStat version 4.2 (Lawes et al 1998).
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Agricultural Trust 2000). The interaction between aspect and distance was also analyzed.

RESULTS AND DISCUSSION

There was significant effect of aspect \((P=0.016)\) and distance \((P <0.001)\) on cotton yield (Table 1). The yield was significantly higher on southern aspect as compared to eastern and western aspects. Dhillon et al (1984) has also reported that linear rows of D. sissoo away from the effect of crown ground cover of D. sissoo (See methods for crown ground cover). Sheikh et al (1978) also concluded that yield of wheat increased with increase in distance from A. nilotica and D. sissoo. The significantly low cotton yield at a distance of 1 m as compared to all other distances might be due to the lateral roots of the D. sissoo. Singh et al (1975) also concluded that cotton yield was low close to the bole of the D. sissoo but when lateral roots were cut the rate of moisture extraction from soil caused reduction in wheat yield on the southern as compared to all other aspects. Furthermore, the geographical location of the study area indicates that southern aspect receive more sunlight as compared to other aspects (Akram et al 1971) which might be responsible for better plant growth of cotton on the southern aspect.

The higher yield at 20m as compared to 4m and 7m was possibly due to the reason that cotton crop was reduced and resulted in increasing the yield of cotton by 21%. It was presumably due to the same reason that there was significant effect of distance \((P <0.001)\) from A. nilotica on cotton yield and it progressively increased from 1 to 7 m (Table 2).

A. nilotica has relatively less dense crown (and lower plant height; see methods) as compared to D. sissoo (Parker 1924; Champion et al 1965). The effect of crown density of A. nilotica reduced with increase in

Table 1. Mean cotton yield \(\text{(kg/m}^2\text{)}\) at various distances (metres) and in different directions (aspects) from single scattered trees of Dalbergia sissoo.

<table>
<thead>
<tr>
<th>Distance (metres) (D)</th>
<th>1</th>
<th>4</th>
<th>7</th>
<th>10</th>
<th>20</th>
<th>Mean Aspect</th>
<th>P-Value Distance</th>
</tr>
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<tbody>
<tr>
<td>Aspect (A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>0.13</td>
<td>0.25</td>
<td>0.29</td>
<td>0.27</td>
<td>0.32</td>
<td>0.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>0.10</td>
<td>0.20</td>
<td>0.23</td>
<td>0.28</td>
<td>0.28</td>
<td>0.22&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>0.13</td>
<td>0.26</td>
<td>0.31</td>
<td>0.33</td>
<td>0.34</td>
<td>0.28&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>0.12</td>
<td>0.21</td>
<td>0.21</td>
<td>0.27</td>
<td>0.30</td>
<td>0.22&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Mean Distance</td>
<td>0.12&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.23&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.26&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>0.29&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>0.31&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.016</td>
<td>A*D 0.982</td>
</tr>
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</table>

Values with the same superscripts are not significantly different at \(P = 0.05\).
LSD test was used to compare between mean values (see methods).
LSD value for mean yield on different aspects = 0.04; at different distances = 0.04 and for the interaction between aspects and distances = 0.09.

Table 2. Mean cotton yield \(\text{(kg/m}^2\text{)}\) at various distances (metres) and in different directions (aspects) from single scattered trees of Acacia nilotica.

<table>
<thead>
<tr>
<th>Distance (metres) (D)</th>
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<th>Mean Aspect</th>
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<td>Aspect (A)</td>
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<tr>
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<td>0.12</td>
<td>0.19</td>
<td>0.24</td>
<td>0.29</td>
<td>0.32</td>
<td>0.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
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<tr>
<td>East</td>
<td>0.09</td>
<td>0.19</td>
<td>0.23</td>
<td>0.25</td>
<td>0.27</td>
<td>0.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>0.08</td>
<td>0.16</td>
<td>0.25</td>
<td>0.28</td>
<td>0.30</td>
<td>0.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
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<tr>
<td>West</td>
<td>0.09</td>
<td>0.17</td>
<td>0.20</td>
<td>0.24</td>
<td>0.27</td>
<td>0.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Mean Distance</td>
<td>0.09&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.18&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.23&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.27&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.29&lt;sup&gt;d&lt;/sup&gt;</td>
<td>&lt;0.001</td>
<td></td>
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</table>

Values with the same superscripts are not significantly different at \(P = 0.05\).
LSD test was used to compare between mean values (see methods).
LSD value for mean yield on different aspects = 0.03; at different distances = 0.03 and for the interaction between aspects and distances = 0.06.
distance from the bole of the tree which allowed more light to reach the ground, resulting in better plant growth under A. nilotica. The progressive increase in cotton yield with increase in distance from the A. nilotica and also less effect of crown beyond 10m distance might also be due to the low crown density of A. nilotica. Since the penetration of light through the crown of A. nilotica is homogeneous on all aspects and allows more light to penetrate resulting in better plant growth hence cotton yield was not effected with change in aspect (Hocking 1993). Since there is no coherence between increase and decrease in cotton yield due to the effect of aspect and distance from D. sissoo and A. nilotica, hence the interaction between aspect and distance was not significant (Table 1 & 2).

CONCLUSIONS

The effect of aspect and distance on cotton yield is relatively less in case of scattered trees of A. nilotica as compared to D. sissoo. It would be preferable to inter-crop cotton with individual trees of A. nilotica since it has lower height and crown density as compared to D. sissoo. The effect of tree shade may be reduced by proper pruning of crown before peak growing season of the cotton crop. The competition of lateral roots with the cotton crop may be reduced if the individual trees are planted along water channels instead of open fields. This will encourage the roots to grow vertically downwards instead of lateral expansion. There is a need to further study the appropriate harvesting age of D. sissoo at which its crown and height will not affect cotton yield.

REFERENCES


