Effect of Row Proportions On Yield Components and Yield Of Intercropping Wheat \((Triticum aestivum\text{ L.})\) + Chick Pea \((Cicer arietinum\text{ L.})\) Under Rainfed Conditions

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ABSTRACT

To study the influence of row proportions on yield components and yield of rabi crops under different intercropping systems, an experiment was laid out in a randomized complete block design with three replications. Wheat (GW-273) was sown as sole crop and intercropped with chickpea (Vaibhav) in different proportions viz; 1:1, 2:1 and 3:1. It was found that the effective numbers of tillers \((\text{m}^{-2})\), plant height (cm), LER (Land Equivalent Ratio), spike length (cm), numbers of grains per spike and grain weight (g), seed yield (kg), straw yield (kg) and harvest index (%) of wheat varied significantly among intercropping systems. The highest seed yield of 1255 kg ha\(^{-1}\) for wheat + chickpea \((1255 \text{ kg ha}^{-1})\) was found as compared to sole crop of wheat which was recorded as 1132.45 kg ha\(^{-1}\).

Key words : Intercropping, wheat, chickpea, yield components

INTRODUCTION

The practice of growing two or more crops simultaneously in the same field is called intercropping. It is a common feature in traditional farming of small landholders. It provides farmers with a variety of returns from land and labour, often increases the efficiency with which scarce resources are used and reduces the failure risk of a single crop that may be susceptible to environmental and economic fluctuations. The objective of enhanced cropping intensity can also be achieved through intercropping. The need for increased production of pulses can also be fulfilled through their intercropping in wheat. Besides intercropping of compatible crops, use resources very efficiently and provide yield advantage over sole crops. According to Malik et al. (1998), inter cropping of lentil, gram and rapeseed in wheat under rainfed conditions.

Intercropping has gained interest because of potential advantages with improved utilization of growth resources by the crops and improved reliability from season to season. When a legume is grown in association with another crop (intercropping), commonly a cereal, and the nitrogen nutrition of the associated crop may be improved by direct nitrogen transfer from the legume to cereal (Giller and Wilson, 1991). Legumes, with their adaptability to different cropping patterns and their ability to fix nitrogen, may offer opportunities to sustain increased productivity (Jeyabal and Kuppuswamy, 2001). Therefore, productivity normally is potentially enhanced by the inclusion of a legume in a cropping system (Maingi et al., 2001). Legume intercrops are also potential sources of plant nutrients that complement/supplement inorganic fertilizers (Banik and Bagchi, 1994; Ofori and Stern, 1987). In addition, legume intercrops are included in cropping systems because they reduce soil erosion (Giller and Cadisch, 1995) and suppress weeds (Exner and Cruse, 1993). The objective of this study was therefore to investigate the feasibility and yield advantage of intercropping different leguminous (chickpea) crops in wheat under rainfed conditions.
Land equivalent ratio was calculated as follows (Willey, 1979):

\[ \text{LER} = \frac{Y_{	ext{inter}}}{Y_{	ext{sole}}} \]

For dry weight determination, the samples were oven-dried at 70°C to a constant weight.

Yield attributes and yield showed significant variation due to adoption of different row proportion (Table 1). The data on plant effective numbers of tillers (m²), plant height (cm), Land Equivalent Ratio (LER), spike length (cm), number of grains per spike and grain wt (g), grain yield, straw yield and harvest index were recorded (Fig 2). For dry weight determination, the samples were oven-dried at 70°C temperature to a constant weight. Land equivalent ratio was calculated as follows (Willey, 1979):

**Table 1**: Treatment details of the experiment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Intercrop</th>
<th>Row proportions</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Wheat + chickpea</td>
<td>1:1</td>
</tr>
<tr>
<td>T2</td>
<td>Wheat + chickpea</td>
<td>2:1</td>
</tr>
<tr>
<td>T3</td>
<td>Wheat + chickpea</td>
<td>3:1</td>
</tr>
<tr>
<td>T4</td>
<td>Sole crop wheat</td>
<td></td>
</tr>
</tbody>
</table>

The seed rates of wheat as 100 kg ha⁻¹ and chickpea as 75 kg ha⁻¹ respectively were kept. The wheat seeds were treated with bavistin (2.5 g per kg of seeds), chickpea seeds with rhizobium culture respectively. All other cultural practices were kept uniform for all the treatments. Harvesting was done manually in March 2014 with the help of sickles, leaving border rows (single row from each side).

**DATA ANALYSIS**

Five wheat plants from each wheat sole crop and wheat-chickpea intercrop plot were dug up at 50 days after emergence (before flowering, which occurred approximately 55 DAS). The yield attributes and yield showed significant variation due to adoption of different row proportion (Table 2). The data on plant effective numbers of tillers (m²), plant height (cm), Land Equivalent Ratio (LER), spike length (cm), number of grains per spike and grain wt (g), grain yield, straw yield and harvest index were recorded (Fig 2). For dry weight determination, the samples were oven-dried at 70°C temperature to a constant weight. Land equivalent ratio was calculated as follows (Willey, 1979):
\[ \hat{Y}_{ab} = Y_{ba} \hat{u} \]
\[ LER = (LER_a + LER_b) = \frac{\hat{Y}_{aa}}{\hat{u}} + \frac{\hat{Y}_{bb}}{\hat{u}} \]

Where \( LER_a \) and \( LER_b \) are the partial LER of crop wheat and chickpea, respectively.

RESULTS AND DISCUSSION
In case of Sole wheat (T4), the crop performance parameters including yield (1132.45 kg ha\(^{-1}\)), straw yield (1637.67 kg ha\(^{-1}\)), 1000 grain weight (37.23 g), grain spike \(^{-1}\) (47.75), effective No. of tillers (432 m\(^2\)), plant height (77.39 cm), Land Equivalent Ratio (LER) 1.07, and spike length (10.40 cm) were found significantly higher as compared to intercropping of wheat + chickpea with 1:1 row proportion (T1) and wheat + chickpea with 2:1 row proportion (T2) but these parameters excepts harvest index were found little inferior to that of intercropping wheat + chickpea with 3:1 row proportion (T3) but deference was non significant. Harvest Index for T3 and T4 was found non-significant at different growth stage of crop growth. Among intercropping treatments, T3 - wheat + chickpea 3:1 row ratio recorded highest seed yield (1255.33 kg/ha), straw yield (1755.33 kg/ha), 1000 grain weight (39.33 g), Grain/spike (49.58), Effective No. of tillers (456.33 m\(^2\)), plant height (79.75 cm), spike length (10.54 cm). Similar results were found by Singh et al. (1992) and Singh et al. (1988).

CONCLUSION
The productivity of sole crop of wheat was higher in comparison to wheat-chickpea (1:1) and wheat-chickpea (2:1) row proportion intercropping pattern. Intercropping system was found to be beneficial for wheat-chickpea (3:1) row proportion intercrop. Wheat-chickpea (3:1) intercrop gives higher yield as compared to sole crop of wheat in terms of LER and productivity.

ACKNOWLEDGEMENT
The authors are grateful to ICAR New Delhi, Niche Area of Excellence Programme- Farm Mechanization in Rainfed Agriculture, for granting financial assistant during the course of the investigation.

Table-2: Effect of different row proportions on yield components of wheat-chickpea intercropping systems

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. Of Tillers m(^2)</th>
<th>Plant height (cm)</th>
<th>LER spike length (cm)</th>
<th>Grain yield (g)</th>
<th>1000 grain weight (g)</th>
<th>Seed yield (Kg/ha)</th>
<th>Straw yield (Kg/ha)</th>
<th>Harvest index</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 - Wheat + chickpea (1:1)</td>
<td>313.00</td>
<td>73.32</td>
<td>1.03</td>
<td>7.66</td>
<td>43.05</td>
<td>33.52</td>
<td>964.33</td>
<td>1464.33</td>
</tr>
<tr>
<td>T2 - Wheat + chickpea (2:1)</td>
<td>456.33</td>
<td>74.89</td>
<td>1.05</td>
<td>8.78</td>
<td>45.99</td>
<td>35.97</td>
<td>1053.63</td>
<td>1545.67</td>
</tr>
<tr>
<td>T3 - Wheat + chickpea (3:1)</td>
<td>432.00</td>
<td>79.75</td>
<td>1.53</td>
<td>10.54</td>
<td>49.58</td>
<td>39.33</td>
<td>1255.33</td>
<td>1755.33</td>
</tr>
<tr>
<td>T4 - sole crop wheat</td>
<td>60.05</td>
<td>77.39</td>
<td>1.07</td>
<td>10.40</td>
<td>47.75</td>
<td>37.23</td>
<td>1132.45</td>
<td>1637.67</td>
</tr>
<tr>
<td>C.D. at 0.05%</td>
<td>17.02</td>
<td>3.08</td>
<td>0.32</td>
<td>0.87</td>
<td>1.01</td>
<td>2.07</td>
<td>79.54</td>
<td>79.54</td>
</tr>
<tr>
<td>SE(m)</td>
<td>24.07</td>
<td>0.87</td>
<td>0.09</td>
<td>0.25</td>
<td>0.29</td>
<td>0.59</td>
<td>22.55</td>
<td>22.55</td>
</tr>
<tr>
<td>SE(d)</td>
<td>7.60</td>
<td>1.23</td>
<td>0.13</td>
<td>0.35</td>
<td>0.40</td>
<td>0.83</td>
<td>31.89</td>
<td>31.89</td>
</tr>
<tr>
<td>C.V.</td>
<td>1.97</td>
<td>13.44</td>
<td>4.34</td>
<td>1.04</td>
<td>2.73</td>
<td>3.47</td>
<td>2.44</td>
<td>2.55</td>
</tr>
</tbody>
</table>
REFERENCES