EFFECT OF NITROGEN MANAGEMENT ON AGRO-ECONOMIC EFFICIENCY OF DIFFERENT WHEAT-BASED INTERCROPPING SYSTEMS

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A study on different wheat-based intercropping systems in relation to nitrogen management was conducted at the University of Agriculture, Faisalabad during the year 1999-2000 on a sandy clay loam soil. The experiment comprised three intercropping systems viz. wheat + canola, wheat + Methera and soil wheat while nitrogen levels were 0, 100, 150 and 200 kg ha\(^{-1}\). Wheat was planted in 100 cm apart 4-row strips with 15 cm space between the rows of each strip. The intercrops were grown in the vacant space between the wheat strips. Various yield components of wheat such as number of spikes m\(^{-2}\), number of grains spike\(^{-1}\) and grain yield ha\(^{-1}\) were not affected by the various intercrops while different nitrogen levels had significant effect on these parameters. However, the grain yield did not increase significantly beyond the level of 150 kg N ha\(^{-1}\). The maximum net income of Rs. 50170.17 ha\(^{-1}\) with a benefit cost ratio (BCR) of 4.03 was obtained from wheat + canola intercropping at 100 kg N ha\(^{-1}\) against the minimum income of Rs. 25908.73 ha\(^{-1}\) with BCR of 2.97 from wheat alone with no fertilizer application.

Key words: agro-economic efficiency, nitrogen management, wheat-based intercropping systems

INTRODUCTION
Farmers in Pakistan are constrained by low crop productivity due to limited supply of water, nutrients and inappropriate cropping systems. The conventional system of monocropping has failed to meet the diversified needs of the small farmer with limited resources. Hence there is a need to test new production systems which are growing in inter-strip vacant space. Intercropping is one of the best land use systems which not only increases productivity per Unit area but also makes the best use of land, water and labour resources. The cereal-legume intercropping system has been reported to be an efficient and more beneficial system to obtain good yields of the component crops besides improving the soil fertility and land use efficiency (Nazir et al., 1988). Ahmad and Saeed (1998) determined the resource-use efficiency of four wheat-based intercropping systems and reported that water and NPK use efficiency was increased by intercropping. Similarly, Saleem et al. (2000) evaluated the bio-economics of some rice-based intercropping system. They reported that intercropping reduced the paddy yield but net income and BCR were minimum in case of rice alone. Among the fertilizer treatments, N application at 200 kg ha\(^{-1}\) produced significantly the highest plant height (113.45 cm) as against the lowest in check plots. Data regarding number of spikes m\(^{-2}\) and half of N were applied at sowing while remaining was added with first irrigation as per treatments. All other agronomic practices were uniform for all the treatments. Observations on different agronomic traits of the component crops were recorded using standard procedures. The data thus collected were analyzed using a computer programme MSTAT of variance technique and treatment means were compared by least significant difference (LSD) test at 0.05 P (Freed and Eisensmith, 1986).

RESULTS AND DISCUSSION
The plant height of wheat under different intercropping systems did not vary significantly (104.18 to 105.03 cm), Among the fertilizer treatments, N application at 200 kg ha\(^{-1}\) produced significantly the highest plant height (113.45 cm) as against the lowest in check plots. Data regarding number of spikes m\(^{-2}\) and half of N were applied at sowing while remaining was added with first irrigation as per treatments. All other agronomic practices were uniform for all the treatments. Observations on different agronomic traits of the component crops were recorded using standard procedures. The data thus collected were analyzed using a computer programme MSTAT of variance technique and treatment means were compared by least significant difference (LSD) test at 0.05 P (Freed and Eisensmith, 1986).

MATERIAL AND METHOD
This study was conducted at the University of Agriculture, Faisalabad during 1999-2000 on a sandy clay loam soil. Replicated three times the experiment was laid out in a randomized complete block design with factorial arrangement. The net plot size was 4.8 x 6.0 m\(^{2}\). The experiment comprised three intercropping systems viz. wheat + canola, wheat + Methera [Fenugreek (Trigonella foenumgraecum)] and wheat alone while nitrogen levels were 0, 100, 150 and 200 kg ha\(^{-1}\). The crop was planted in 100 cm apart 4-row strips with 15 cm space between the rows of each strip using a seed rate of 100 kg ha\(^{-1}\). The intercrops were grown in inter-strip vacant space. Sowing was done with a single row hand drill. A basal dose of phosphorus @ 100 kg P\(_2\)O\(_5\) ha\(^{-1}\) was used in the treatments under study. The whole of P\(_2\)O\(_5\) and half of N were applied at sowing while remaining N was added with first irrigation as per treatments. All other agronomic practices were uniform for all the treatments.

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Table 1. Effect of nitrogen management on agronomic traits of wheat under different wheat-based intercropping systems

<table>
<thead>
<tr>
<th>Plant height (cm)</th>
<th>Number of spikes m⁻²</th>
<th>Number of grains spike⁻¹</th>
<th>1000-grain weight (g)</th>
<th>( \text{N} \text{a} )</th>
<th>( \text{db} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Intercropping system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat alone</td>
<td>10.1 ( ^{NS} )</td>
<td>326.0 ( ^{NS} )</td>
<td>43.91 ( ^{NS} )</td>
<td>107.7 ( ^{NS} )</td>
<td></td>
</tr>
<tr>
<td>Wheat + canola</td>
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<td>399.1 b</td>
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<td>113.4 ( ^{NS} )</td>
<td></td>
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<td>Wheat + methera</td>
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Means not sharing a common letter differ significantly at 5% level of probability (LSD).

Table 2. Economic analysis of wheat-based intercropping systems

<table>
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<tr>
<th></th>
<th>( \text{Y} ) 1 ( \text{ha}^{-1} )</th>
<th>( \text{Y} ) 2 ( \text{ha}^{-1} )</th>
<th>( \text{CM} ) 1 ( \text{ha}^{-1} )</th>
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Market rates per 40 kg
Wheat: Rs. 300.00  Canola: Rs. 825.00  Price of fertilizer per 50 kg
Urea: Rs. 350.00  SSP: Rs. 205.00
Wheat straw: Rs. 50.00  M ethera: Rs. 1200.00
Effect of nitrogen management

The data on 1000-grain weight of wheat indicated non-significant differences among the intercropping systems which on an average ranged between 36.22 and 36.55 g. By contrast, though application of N @ 100 kg ha\(^{-1}\) recorded significantly higher grain weight than control but was at par with 150 and 200 kg N ha\(^{-1}\). The results reported by Dilbaugh et al. (1988) are in conformity with these findings. The final grain yield is a function of the integrated effects of various yield components. The data on grain yield ha\(^{-1}\) showed non-significant differences among the various intercropping systems under study. However, the grain yield on an average varied from 4107.42 to 4121.77 kg ha\(^{-1}\). Although there was a linear increase in grain yield with each successive increase in N dose but the difference between 150 and 200 kg ha\(^{-1}\) was non-significant which produced 4272 and 4262 kg ha\(^{-1}\), respectively. Increase in grain yield with the application of N has also been reported by Ayub et al. (1994).

In terms of monetary gain, all the intercropping systems, gave considerably higher net income ha\(^{-1}\) than from pure stand of wheat at all N levels with the maximum of Rs. 50,170.17 ha\(^{-1}\) in case of wheat + canola at a N level of 100 kg ha\(^{-1}\) (IINI) followed by 1:2N (wheat + methera at 200 kg N ha\(^{-1}\)) and 1:N, (wheat + methera at 100 kg N ha\(^{-1}\)) with a net income of Rs. 46,936.79 and 46,827.98 ha\(^{-1}\), respectively. The minimum net income of Rs. 25,908.73 ha\(^{-1}\) was obtained in case of wheat alone in control (I\(_0\)N\(_0\)). Intercropping of methra in wheat grown at 100 cm apart 4-row strips with 100 kg N ha\(^{-1}\) appeared to be the best intercropping system under the irrigated conditions of Faisalabad.

REFERENCES


