EFFECT OF LEGUME INTERCROPPING ON WHEAT PRODUCTION

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ABSTRACT
Intercropping is the most significant farming practice in the developing countries to intensify and maintain the farm productivity. A research experiment on the legumes intercropping in wheat based farming system was conducted to study the effect of legumes on the production of wheat. The data revealed that legumes intercropping had a substantial effect on the yield and yield components of wheat. Data on yield related parameters of wheat indicated that legumes intercropping showed significant effect on fertile tillers $m^{-2}$, spikelets spike$^{-1}$, number of grains spike$^{-1}$, 1000-grain weight and grain yield. The grain yield of sole wheat was significantly more than the grain yield of wheat associated with lentil, mathra, or gram. However, the land equivalent ratio was the highest for wheat associated with mathra among all other combinations.

Keywords: Wheat, legumes, intercropping, grain yield, lentil, Pakistan

INTRODUCTION
Intercropping is one of the important features of farming being widely practiced by small farmers in tropical and sub tropical regions of the world (Finlay, 1974). Traditionally this system of cropping aimed to avoid dependence on a single crop, obtain a variety of products from the same piece of land, improve efficiency of the available resources (labor etc) and increase farm income from small holdings. However, scientific background of this concept showed that mixtures of cereals-legumes is usually opted for coping with problems of soil erosion, declining level of soil organic matter, nitrogen availability to the companion or subsequent crop in addition to the extra yield of intercropped legumes from the same piece of land and time. Mixed cropping with legumes, viz. green gram, black gram, cow peas, cluster bean, velvet bean, lentil and mathra helps to increase protein content in the associated crop of wheat (anonymous, 1962).

Chan (1971) observed that lucerne crop began transferring nitrogen to fescue plants after 6 weeks of growth and continued up to 18 weeks age. During this period, the total transfer was 4.9 to 5.8 percent of the total nitrogen fixed by the lucerne. Pal and Sheshu (2001) studied the direct and residual contribution of legumes to the yield and nitrogen uptake of maize and found that all the legume crops contributed to the yield and nitrogen uptake of maize, either intercropped with the legume or grown after legumes as a sole crop. Direct transfer of $N$ from the nodulating soybean lablab bean, green gram and black gram to the intercropped maize was 29.9-30.1, 23.8-29.2, 19.7-22.1, and 18.4-18.6 kg N ha$^{-1}$, respectively. The transfer of residual nitrogen from these legumes to the succeeding maize crop was 18.4-20.9, 19.5-29.9, 12-13.7 and 9.3-10.3 kg ha$^{-1}$, respectively. Singh and Baylon (2000) indicated that the intercropping systems registered significant increase in total productivity (wheat equivalent) over sole wheat.
Intercropping (growing two or more crops simultaneously on the same field) is one of the ways of ameliorating the productivity of land and other inputs (Kharkar et al. 1993). The main reason behind these practices is the high return in yield (Nazir et al. 1998) and offers defense against the risk involved in monocropping (Singh et al. 1998). The objectives of this study were to investigate the feasibility of legumes intercropping in wheat based farming system of D.I. Khan.

MATERIALS AND METHODS

An experiment was conducted at Research Farm Faculty of Agriculture Gomal University D.I. Khan during 2004-2005 to investigate the impact of legumes intercropping on wheat production. The treatments comprised of Wheat alone (T1), Wheat + Lentil (T2), Wheat + Mathra (T3) and Wheat + Gram (T4). Wheat variety “Inqilab 91”, Lentil, “Masoor 85”, Mathra, “Local Variety” and Gram, “CM-72” were sown alone and in intercropping. The intercrops (Lentil, Gram and Mathra) were planted on the same day of wheat sowing. The experiment was conducted in a Randomized Complete Block Design maintaining a plot size of 5 x 2.4 m. Fertilizer dose of 60 kg/ha Phosphorus and 90 kg/ha Nitrogen were applied in the form of Single Supper Phosphate (SSP) and Urea, respectively. Nitrogen was divided into three equal doses .The first dose of nitrogen (30 Kg/ha) was applied to the whole experimental plot uniformly with full dose of phosphorous at the time of sowing on 4th November 2004. The second and 3rd dose of nitrogen was applied on 5th and 20th January 2005, respectively. Hand weeding was done to keep the crop free of weeds. At maturity, the whole plot of wheat and intercrops were harvested and tied into small bundles for sun dryings for about a week. The sun dried bundles were threshed manually and data collected on productive tillers m⁻², spikelets spike⁻¹, grains spike⁻¹, 1000-grain weight, grain yield, and land equivalent ratio (LER), were analyzed statistically at 5 % level of probability. Means were separated using Least Significant Difference (LSD) Test (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

The data revealed that legumes intercropping had significantly affected all the parameters pertaining to yield and yield relating component of wheat (Table-1). Wheat sown alone gave the highest productive tillers m⁻² (377) followed by wheat + Lentil intercropping. However, there was non significant difference among the intercrop treatments with the lowest productive tillers shown by wheat + Gram intercropping. The reason for the highest number of fertile tillers m⁻² in case of wheat alone was the utilization of all the available moisture, space and nutrients by wheat crop. Zaman (1989) and Mendal et al. (1995) also reported similar results. The data depicted in Table-1 showed that legume intercropping significantly affected the number of spikelets/spike. There was maximum number of spikelets/spike (28) in wheat sown alone, while it was minimum in wheat + Lentil intercropping (23). The possible reason for lower number of spikelets/spike in all the intercrop combinations was the same as mentioned above. Mendal et al. (1985) also reported similar significant results.

Data further indicated that legumes intercropping had significantly decreased the number of grains spike⁻¹, 1000-grain weight and grain yield (t ha⁻¹) of wheat compared to sole wheat (Table-1). Sole wheat produced maximum number of grains spike⁻¹ (66) compared to wheat grown in association with Lentil, Mathra and Gram, which produced 47.25, 54.5 and 44.25 grains spike⁻¹, respectively. These findings are in accordance with the findings of Mushtaq (1988), who recorded comparable results about the afford mention parameters. The decrease in number of grains spike⁻¹ of wheat associated with legume might be the result of competition for inputs by legumes grown with wheat. This result is in line with the result reported by Zaman (1989) and Himayatullah (1991), who stated that monocrop wheat gave the highest grain yield.

Data on 1000-grain weight of wheat alone and in combination with all the rest of intercrops showed significant differences (Table-1). The highest 1000-grain weight (47gms) was obtained from wheat crop alone, while 1000-grain weight of the wheat in association with the legumes intercrops was mutually at par, ranging from 43.75 to 44.75 grams. These findings are in line with that of Nazir et al (1988).

Data on Land Equivalent Ratio (LER) was determined by dividing the intercrop yield of each crop by the respective sole crop yield, where by the resulting ratios were then added to get the required ratio and values were presented in Table-1. The greater LER value (1.66) was recorded for Wheat + Mathra intercropping, followed by Wheat+ Lentil and Wheat + Gram intercropping, respectively.
Khalid et al. (2000) also reported similar results for LER value of more than 1 and stated that legume intercropping is more profitable and may be extended to the farmers for higher economic return. The findings of this experiment revealed that Wheat + Mathra intercropping gave the best result followed by the rest of the two combinations i.e. Wheat + Lentil and Wheat + Gram. Moreover, the intercropping showed the best usage of land and the overall productivity of the intercropping system.

**Table-1:** Yield and yield components of wheat as affected by legumes intercropping

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Productive tillers m$^{-2}$</th>
<th>Spikelets spike$^{-1}$</th>
<th>No. of Grains Spike$^{-1}$</th>
<th>1000-grain weight (gm)</th>
<th>Grain yield (t ha$^{-1}$)</th>
<th>Land Equivalent Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat alone</td>
<td>377.50 a</td>
<td>28.00 a</td>
<td>66.00 a</td>
<td>47.00 a</td>
<td>2.58 a</td>
<td>-</td>
</tr>
<tr>
<td>Wheat + Lentil</td>
<td>353.50 b</td>
<td>23.00 b</td>
<td>47.25 b</td>
<td>44.25 b</td>
<td>1.73 b</td>
<td>1.34 a</td>
</tr>
<tr>
<td>Wheat + Mathra</td>
<td>347.00 b</td>
<td>23.50 b</td>
<td>54.50 b</td>
<td>44.75 b</td>
<td>1.73 b</td>
<td>1.66 a</td>
</tr>
<tr>
<td>Wheat + Gram</td>
<td>351.30 b</td>
<td>25.00 ab</td>
<td>44.25 b</td>
<td>43.75 b</td>
<td>1.69 b</td>
<td>1.19 a</td>
</tr>
<tr>
<td>LSD</td>
<td>11.48</td>
<td>3.19</td>
<td>10.26</td>
<td>1.07</td>
<td>0.32</td>
<td>0.55</td>
</tr>
</tbody>
</table>

* Means having different letters differ significantly at P<0.05
REFERENCES


