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YIELD AND YIELD COMPONENTS OF WHEAT AS INFLUENCED BY INTERCROPPING OF CHICKPEA, LENTIL AND RAPESEED IN DIFFERENT PROPORTIONS

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The feasibility of intercropping chickpea, lentil and rapeseed in wheat under rainfed condition was investigated at Arid Zone Research Farm, D.I.Khan during 2002-03. The experiment was laid out in a randomized complete block design with three replications. Wheat (Inqilab-91) was sown as sole crop and intercropped with chickpea (NIFA-88), lentil (Masoor-93), and rapeseed (Dunkled) in different proportions viz; 1:1, 2:1 and 3:1. The experiment was sown on 2nd November 2002. The results showed that plant height, spike length, number of grains per spike and grain yield of wheat varied significantly among intercropping systems, while the effect on 1000-grain weight was non-significant in all cases. Plant height, spike length, number of grains per spike and grain yield of wheat was higher with chickpea intercropping. The mean values of different proportions showed that the highest grain yield of wheat (1687 kg ha^{-1}) was obtained with chickpea intercropping, against the minimum with rapeseed intercropping. Among different ratios of intercropping, the chickpea intercropping in 1:1 ratio gave the highest grain yield (1721 kg ha^{-1}) of wheat while the lowest yield of 1213 kg ha^{-1} was obtained from wheat-rapeseed intercropping in 1:1 ratio.

Key words: Intercropping, planting geometry, legumes, wheat, *Brassica napus*, lentil

INTRODUCTION

The practice of growing of 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 is susceptible to environmental and economic fluctuation. The objective of enhanced cropping intensity can also be achieved through intercropping. The need for increased production of oilseed and pulses can also be fulfilled through their intercropping in wheat. Besides intercropping of compatible crops use resources very efficiently and provides yield advantage over sole crops. According to Sherma *et al.* (1993) mixture of cereals and legumes gave higher yield than their respective sole crops. Similarly Mandal *et al.* (1991) reported that wheat plus chickpea intercropping gave higher yield of wheat and water-use efficiency than wheat plus rapeseed intercropping. Kerrio and Aslam (1986) suggested that two crops of differing height, canopy and growth habits can be grown simultaneously with least competition.

Malik *et al.* (1998) reported that yield and yield components of wheat were significantly affected by association of chickpea, lentil and rapeseed while Mikhov *et. al.* (1991) stated that wheat yield in pure stand was significantly higher than mix cropping under rainfed conditions. Nazir *et al.* (1988) also reported that intercropping of lentil (*Lens culinaris*), Sarson (*Brassica napus*) and chickpea (*Cicer arietinum*) decreased the wheat yield over wheat alone under un-irrigated conditions, however, the losses were compensated by their additional harvest in terms of net income.

The objective of this study was therefore to investigate the feasibility and yield advantage of intercropping different leguminous (chickpea and lentil) and oilseed (rapeseed) crops in wheat under rainfed conditions.

MATERIALS AND METHODS

The present study was carried out at Arid Zone Research Institute, D. I. Khan during 2002-03. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications using net plot size of 5 m x 2.4 m. The experiment comprised the following treatments; T1 = Sole wheat (*Triticum astivam),* T_2 = One line of wheat plus one line of chickpea (*Cicer arietinum),* T_3 = two lines of wheat plus one line of chickpea, T_4 = three lines of wheat plus one line of chickpea, T_5 = one line of wheat plus one line of lentil (*Lins culinaris*), T_6 = two lines of wheat plus one line of lentil, T_7 = three lines of wheat plus one line of lentil, T_8 = one line of wheat plus one line of rapeseed (*Brassica napus*), T_9 = two lines of wheat plus one line of rapeseed and T_{10} = three lines of wheat plus one line of rapeseed.

The row-to-row distance was kept 30 cm in all the treatments. The sowing was done in "*watter*" condition developed after flood irrigation of the field. After wards, no irrigation was applied up to the harvest of crop. The

seedbed was well prepared with the help of a rotavator. A basal dose of 60-40 kg NP ha^{-1} was applied in the form of Urea and Di-ammonium phosphate (DAP) respectively, at the time of seedbed preparation. Approved varieties of wheat, chickpea, lentil, and rapeseed i.e. Inqilab-91, NIFA-88, Masoor-93 and Dunkled were used as test crop. Planting was done with single row hand drill on 2nd November 2002. The seed rates of 100, 60, 25 and 6 kg ha^{-1} for wheat, chickpea, lentil and rapeseed respectively, were used. The aphids attack on rapeseed crop was controlled through insecticide (*Confidor)* spray. All other cultural practices were kept uniform for all the treatments. The crops were harvested during the month of April 2003. The rainfall recorded during the growing period (November-April) was 128 mm. The data recorded on different parameters were subjected to Fishers analysis of variance technique and Duncan's Multiple Range test at P=0.05 was used to compare the treatments means. (Steel and Torrie 1980).

RESULTS AND DISCUSSION

Plant height is an important growth parameter, which is affected by genetic as well as environmental variation. The data on plant height of wheat showed significant variation (Table 1). The greater plant height (80.9 cm and 79.3 cm) was recorded in the treatments where chickpea was intercropped in 1:1 and 2:1 ratios, respectively. The mean values of different ratios with different intercrops showed that the maximum plant height of wheat (79.1 cm) was recorded in the treatment intercropped with chickpea followed by that intercropped with lentil (74.3 cm). The wheat intercropped with rapeseed showed the minimum plant height of 71.1 cm. These results are in accordance with the findings of Mandal (1991), who reported that intercropping of leguminous crops significantly increased wheat plant height, while rapeseed intercropping decreased the plant height due to its exhaustive competitions and dominant plant stature. Ahmed and Quresh (2001) also reported decrease in plant height of wheat intercropped with rapeseed.

Spike length is an important yield component of wheat. Data on spike length varied significantly (Table 1). The maximum spike length of 11.0 cm was recorded in the treatment where wheat was intercropped with chickpea in 1:1 ratio. The mean values of different ratios for different intercrops showed that wheat produced greater spike length (10.4 and 10.3 cm) when intercropped with chickpea and lentil, respectively. The spike length in case of rapeseed intercropping was 9.5 cm, which was less than wheat alone (9.8 cm). These results are in line with the findings of Malik *et al* (2002) and Nazir *et al* (1998).

Number of grains per spike is an important parameter, which greatly contributes to yield. The number of grains per spike showed significant variation among the intercrop treatments. The greatest number of grains per spike (48.3) was recorded in the treatments

Table 1. Yield components and grain yield of wheat as affected by different intercropping systems

Intercropping treatments		Plant height (cm)	Spike length (cm)	Grains $spike^{-1}$	1000-grain wt (g)	G. Yield ($kgha^{-1}$)	Yield advantage (%)
W	Sole	**73.5 b**	**9.8 ab**	**42.0 c**	**38.3 ns**	**1510 b**	**-**
W+CP	1:1	80.9 a	11.0 a	48.3 a	37.6 ns	1721 a	13.97
W+CP	2:1	79.3 a	10.5 ab	47.9 a	38.6 ns	1673 ab	10.79
W+CP	3:1	77.1b	9.7 b	47.8 a	37.6 ns	1668 ab	10.46
Mean	-	**79.1 a**	**10.4 a**	**48.0 a**	**37.9 ns**	**1687 a**	**11.74**
W+L	1:1	74.9 b	10.1 ab	45.7 b	38.0 ns	1552 b	2.78
W+L	2:1	73.9 b	10.6 ab	46.7 b	38.0 ns	1517 b	0.46
W+L	3:1	74.3 b	10.1 ab	45.9 b	38.0 ns	1469 c	-2.15
Mean	-	**74.3 b**	**10.3 a**	**46.1 b**	**38.0 ns**	**1513 b**	**0.36**
W+RS	1:1	70.4 c	9.1 bc	40.9 d	38.0 ns	1213 de	-19.63
W+RS	2:1	71.3 bc	9.7 b	43.5 c	38.3 ns	1349 cd	-10.67
W+RS	3:1	71.7 bc	9.7 b	44.1 bc	38.6 ns	1279 d	-15.30
Mean	**-**	**71.1 bc**	**9.5 ab**	**42.8 c**	**38.3 ns**	**1280 d**	**-15.20**

- Means not sharing a letter differ significantly at P =0.05
- NS = non significant
- W = wheat, CP = chickpea, L = lentil and RS = rapeseed

where wheat was sown with chickpea in 1:1 ratio, which did not differ significantly from 2:1 and 3:1 ratios. The less number of grains per spike (9.1 cm) was recorded for rapeseed sown with wheat in 1:1 ratio. The mean values of different intercrops showed significant variation. The greatest number of grains per spike (48.0) was recorded for chickpea intercropping followed by lentil intercropping (46.1). The minimum number of grains per spike (42) were recorded in wheat alone, which were at par with the rapeseed intercropping which produced (42.8) grains per spike. These results corroborate the findings of Malik *et al* (2002), who reported increased number of grains per spike in wheat when intercropped with legumes. Ahmed and Qureshi (2001) recorded less number of grains per spike of wheat when intercropped with rapeseed.

Different intercrops and their ratios showed significant variation in grain yield of wheat. The grain yield ranged between 1213 - 1721 kg ha^{-1} (Table-1). The highest grain yield was obtained from wheat grown in association with chickpea in 1:1 ratio, against the minimum in 1:1 ratio of wheat and rapeseed. The next higher yield of 1673 and 1668 kg ha^{-1} was obtained from chickpea intercropping in the ratio of 2:1 and 3:1, respectively, with non-significant difference between them. The mean values of different ratios of intercrops showed that significantly the highest grain yield of wheat (1687 kg ha^{-1}) was obtained from chickpea intercropping. The yield advantage of wheat ranged between 13.97 to –19.76 percent among the different intercropping treatments. The maximum yield advantage was obtained in chickpea intercropping of 1:1 ratio, while the minimum in case of rapeseed of 1:1 ratio. The mean values of different ratios showed that chickpea intercropping gave the maximum yield advantage of 11.74 % over wheat alone. Rapeseed produced the minimum yield advantage (-15.21%).

The positive effect of legumes intercropping on wheat yield under rainfed condition might be due to moisture conservation. The faster growth and wider canopy of the legumes soon covers the soil surface causing less evaporation. This gives additional edge to inter-cropping over sole wheat. Furthermore, due to their leguminous nature they compete less with wheat for available nitrogen. The more positive effect of chickpea as compared to lentil might be due to their different plant size canopy and root system. These results are in consonance with the findings of Singh and Ram (1972) and Singh *et al.* (1992). The less yield in case of rapeseed intercropping in wheat might be due dominant plant stature of rapeseed causing over shading, exhaustive nutrient and light competition with wheat. Nazir *et al.* (1988), Ahmed and Qureshi (2001), Malik *et al.* (1998); Das *et al.* (1992) and Khan (1986) also reported similar results.

It is thus concluded from the study that intercropping of chickpea and wheat in 1:1 ratio gave the maximum increase in the grain yield of wheat under rainfed conditions.

REFERENCES

Ahmad, G. and Z. Qureshi. 2001. Better use of land through intercropping of canola with wheat. Sarhad J. Agric. 17(3): 363-366.

Das, K., N.N. Shyam and S.R. Baroova. 1992. Intercropping of wheat (*Triticum aestivum* L.) with rapeseed (*Brassica napus*) and mustard (*Brassica juncea*) under rainfed conditions. Ind. J. Agron. 37(3): 543-545.

Keerio, H.K. and M. Aslam. 1986. Intercropping in maize crop. Maize production manual, PARC, Islamabad.

Khan, H.R. 1986. Studies on feasibility of inter/relay cropping in wheat planted in multi-row strips uniform plant population. M.Sc thesis, Univ. of Agric. Faisalabad.

Malik, M.A., F. Hassan and I. Aziz. 2002. Feasibility of intercropping lentil and lathyrus in wheat under rainfed condition. Pak. J. Arid Agric. 5(1): 13-16.

Malik, M.A., M.A. Hayat, S. Ahamad and I. Haq. 1998. Intercropping of lentil, gram and rapeseed in wheat under rainfed conditions. Sarhad J. Agric. 14 (5): 417-421.

Mandal, B.K., S. Dasgupta and P.K. Roy. 1991. Effect of intercropping on yield components of wheat, chickpea and mustard under different moisture regimes. Field Crop Absts., 39(10): 7025.

Mikhov, M., N. Nankov and I. Dimitrov. 1991. Investigations of growing lentil sown in a mixture with wheat. Rasteriv, dni-Nauki. 28(7-10): 23-29.

Nazir, M.S., H.R. Khan, G. Ali and R. Ahmad. 1988. Inter/relay cropping in wheat planted in multi-row strips at uniform plant population. Pak. J. Agric. Res. 9(3): 305-309.

Sharma, R.K., K.D. Koranne, J.K. Joseph, Prem-Singh, Ved-Prakash, R.K. Mitlal, P. Singh, and V. Prakash. 1993. VL Massor 4: a new lentil variety for the hills of Uttar Pradesh. Ind. Farming. 42(10): 19-20.

Singh, B.D. and A. Ram. 1972. Note on response of wheat and gram when grown in different proportions. Ind. J.Agron. 17(1): 58-59.

Singh, S.B., B.N. Singh and M.L. Maurya. 1992. Comparative performance of mixed intercropping systems with different winter crops under diara land conditions. Ind. J. Agron. 37(1): 40-43.

Steel, R.G.D. and J.H. Torrie. 1980. Principal and procedures of statistic. McGraw Hill Book Co. Inc. New York.