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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 sy.stems 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 sole wheat while nitrogen levels were 0, 100, 150 and 200 kg ha", 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", number of grains spike" and grain yield ha'! were not affected by the various intercropswhile different nitrogen levels had significant effect on these parameters. However, the frain yield did not increase significantly beyond the level of 150 kg N ha", The maximum net income of Rs. 50170.17 ha' with a benefit cost ratio (BCR) of 4.03 was obtained from wheat + canola intercropping at 100 kg N ha" against the minimum income ofRs. 25908.73 ha'! with BCR of2.97 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 to new production systems which will suit the growing needs of the farmers with small holdings and limited financial resources. Intercropping is one of the best production systems which not only increases the 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. According to Singh and Pal (1994) intercropping of wheat and mustard growing in 6: 1 and 9: I row ratios not only reduced the yield of both the crops compared to their pure stands but also reduced the soil fertility. It is therefore, necessary either to replenish the soil fertility with balanced fertilizer application or through Nvfixation by gram-legume intercropping system. Thu~ the present study was planned to det~rmine the effect of nI~rog~~ mana~ement on agro-eco~omlceffi.clency and sustainability of dlffe~ent whea~-.based mt~rcroppmg systems under the agro-ecological conditions at Faisalabad.

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", The experiment comprised three intercropping systems viz. wheat + canola, wheat + Methera [Fen~gre~k *(Trigonella foenumgraecum)]* and wheat al~ne while mtro~en levels were 0, 100, 150 and 200 kg ha . Th~ wheat variety tested w~s Inq~lab-9 I. The crop .was planted m 100 cm apart 4-ro~ str~ps WIth 15 cm space m be,t;ween ~he rows of each stnp usmg a seed rate of 100 kg ha '. The mtercrops were grown m inter-strip vacant space. Sowmg was done WIth a smgle row hand drill. A basal dose of phosphorus @ 100 kg PzOs ha'! was used in the treatments under study. The whole of P_2O_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. 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).

RESUL TS AND DISCUSSION

The plant height of wheat under different inter-cropping systems did not vary significantly (104.18 to 105.03 cm), Among the fertilizer treatments, N application at 200 kg ha" produced significantly the highest plant height (113.45 cm) as against the lowest in check plots. Data regarding n~m~er of. spikes m,2 reveale~ that th~re were non-slgnlfi~ant d~Verences among the. mtercroppmg systems and the spikes m on ~ a.verage varied from 382.2?\ to 389.00. ~y ~ontrast, application of N. at 15,~ kg ha produce1 significantly more number of spikes m than 100 kg N ha' but was at par with 200 kg N ha.' These results are in line with those of Ram and Joshi (1987). The number of grains spike" also did not vary significantly under different intercropping systems, while on the contrary, there was a linear increase in the number of grains spike' 1 with each successive increase in N rate from 0 to 200 kg ha", but the difference between 150 and 200 kg N ha'! was non-significant which produced equal number of grains spike", respectively.

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

	Plant height (cm)	Number of spikes m^{-2}	Number of grains $spike^{-1}$	1000-grain weight (g)	[illegible]
A. Intercropping system					
Wheat alone	[illegible]	[illegible]	43.91^{NS}	[illegible]	[illegible]
Wheat + canola	104.18	[illegible]	43.83	[illegible]	[illegible]
Wheat + methera	105.03	[illegible]	44.41	[illegible]	[illegible]
B. Nitrogen levels (kg ha^{-1})					
0	92.33 d	326.2 c	[illegible]	[illegible]	[illegible]
[illegible]	104.14 c	399.1 b	[illegible]	[illegible]	[illegible]
[illegible]	108.00 b	407.9 a	[illegible]	[illegible]	[illegible]
[illegible]	113.45 a	412.4 a	[illegible]	[illegible]	[illegible]

Means not sharing a common letter differ significantly at 5% level of probability (LSD).

Table 2. Economic analysis of wheat based intercropping systems

[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	-	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	-	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	-	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	-	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Market rates per 40 kg
Wheat: Rs. 300.00 Canola: Rs. 825.00
Wheat straw: Rs. 50.00 Methera:Rs. 1200.00

Price of fertilizer per 50 kg
Urea: Rs. 350.00
SSP: Rs. 205.00

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" recorded significantly higher grain weight than control but was at par with 150 and 200 kg N ha". 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" 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". 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" was non-significant which produced 4272 and 4262 kg ha", 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" than from pure stand of wheat at all N levels with the maximum of Rs. 50,170.17 ha" in case of wheat + canola at a N level of 100 kg ha" (IINI) followed by 1_2N_3 (wheat + methera at 200 kg N ha") and 1_2N, (wheat + methera at 100 kg N ha") with a net income of Rs. 46,936.79 and 46,827.98 ha", respectively. The minimum net income of Rs.25,908.73 ha" was obtained in case of wheat alone in control (I_0N_0). Intercropping of methra in wheat grown at 100 cm apart 4-row strips with 100 kg N ha" appeared to be the best intercropping system under the irrigated conditions of Faisalabad.

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