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STUDIES ON WHEAT-METHRA BIOLOGICAL INTERCROP RELATIONSHIP

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The biological intercrop relationship of wheat-methra intercropping systems comprising four rows of wheat + one row of methra, four rows of wheat + two rows of methra, four rows of wheat + three rows of methra and four rows of wheat + four rows of methra, was studied against sole wheat and sole methra on sandy clay loam soil. Wheat was planted in four rows strips, 100 cm apart with a 20 cm space between the rows. One, two, three and four rows of methra were grown in between wheat strips. The various yield components of wheat like number of fertile tillers per unit area, number of grains per spike and grain weight per spike, were affected significantly by the various intercropping systems. Intercropping of one, two, three and four rows of methra in four rows of wheat strips, decreased the wheat yield by 4.43, 7.77, 8.49 and 7.88 q ha^{-1}, respectively. However, at the cost of this much reduction in wheat yield an additional harvest of 2.21, 2.81, 3.00 and 2.4 q ha^{-1} of methra seed was obtained by intercropping one, two, three and four rows of methra, respectively, which compensated much more than the losses in wheat production.

INTRODUCTION

Multiple cropping may be an effective way of increasing the income from small holdings through better light, nutrients and water harvest. The yield of the cereals is sometimes increased when intercropped with legumes compared to a sole crop (Kalra and Gangwar, 1980).

Singh *et al.* (1983) revealed that neither sowing pattern nor intercropping *Vigna mungo* had any effect on grain yield of wheat. It was concluded by Khan (1984) that intercropping linseed and mungbean in wheat reduced the grain yield by 16.98% and 4.91%, respectively. Wheat-legume intercropping system proved better than that of wheat-non legume. Rehman (1984) reported that grain yields of wheat and lentil were reduced significantly in lentil-wheat mixture in 100:40 and 100:50 intercropping systems compared with monocropping. However, mixed cropping resulted in better land utilization and higher income than either crop alone. Mandal *et al.* (1985) substantiated that number of fertile tillers in wheat was the highest when grown alone. Number of grains per ear in wheat were reduced by intercropping mustard. However, the optimum ratio of the component crops with appropriate planting geometry was considered essential for obtaining maximum economic returns of any companion/intercropping systems (Grewal *et al.* 1983).

The present study was, therefore, designed to find the feasibility and profitability of different wheat-methra intercropping systems under irrigated conditions.

MATERIALS AND METHODS

An experiment was conducted at Agronomic Research Area, University of Agriculture, Faisalabad in 1987-88. The experiment was quadruplicated in randomized complete block design using a net plot size of 6.50 m x 3.20 m. The four inter-cropping systems were: four rows of wheat + one row of methra (4:1), four rows of wheat + two rows of methra (4:2), four rows of wheat + three rows of methra (4:3) and four rows of wheat + four rows of methra (4:4), sole wheat and sole methra.

tance between the rows. As per treatment, local methra (*Trigonella foenugraceum*) was planted in rows in 100 cm space between the strips of wheat. The seed rate used was 100 and 40 kg ha^{-1} for wheat and methra, respectively. Nitrogen and phosphorus were applied at the rate of 80 and 40 kg ha−1, respectively. All the other agronomic practices were kept uniform for all the plots.

The data collected were subjected to Fisher's Analysis of Variance Technique, using Duncan's Multiple Range Test at 5% level of probability to test the significance among the treatment means (Steel and Torrie, 1980).

Table 1 a. Effect of wheat-methra biological intercrop relationship on yield and yield components of wheat

Intercropping system	No. of fertile tillers per unit area (3.20 x 1 m)	No. of grains per spike (g)	Grain weight per spike	1000-grain weight (g)	Grain yield (q. ha^{-1})
Wheat alone	590.00 a	38.31 a	2.77 a	50.16^{NS}	42.49 a
Methra alone	-	-	-	-	-
Four rows of wheat + one row of methra	576.25 a	34.49 b	2.68 a	49.58	38.06 b
Four rows of wheat + two rows of methra	540.50 b	34.19 bc	2.63 ab	49.55	34.72 c
Four rows of wheat + three rows of methra	523.50 bc	33.63 bc	2.15 bc	46.22	4.61 c
Four rows of wheat + four rows of methra	515.50 c	30.97 d	1.87 c	45.33	33.99 c

Any two means not sharing a letter in common differ significantly at 5% probability level
NS = Non-significant

Wheat cv. LU-26S was planted in four rows strips, 100 cm apart with 20 cm dis-

RESULTS AND DISCUSSION

The dat (Table 1 a) revealed that various intercropping systems affected significantly fertile tillers per unit area. The number of fertile tillers was decreased as the wheat-methra ratio was narrowed. Wheat alone remained similar with four rows of wheat + one row of methra but produced significantly more fertile tillers than the other intercropping systems. Four rows of wheat + three rows of methra did not differ from four-two and four-four rows intercropping systems. The decrease in fertile tillers per unit area with the narrowed ratio of wheat and methra might be due to more competition for nutrients, light and air between the main and the intercrop. Similar results were reported by Mandal *et al.* (1985).

Wheat alone produced significantly the highest and four-four rows wheat-methra intercropping gave the lowest grain number per spike (Table 1 a). All the other intercropping systems did not differ significantly from one another. This decrease with increasing intercropping intensity of methra in wheat might be due to more competition for growth inputs between component crops. These conclusions are in line with those of Ahmad (1984).

Sole wheat produced maximum grain weight per spike but did not differ significantly from four-one and four-two rows of wheat-methra intercropping systems. Four rows of wheat + four rows of methra gave the minimum grain weight but did not differ significantly from four rows of wheat + three rows of methra which in turn re-

Table 1 b: Effect of wheat-Methra Biological intercrop relationship on yield and yield components of Methra

Intercropping system	No. of plants per unit area (3.20 x 1 m)	No. of pods per plant	No. of seeds per pod	No. of seeds per plant	Seed weight per plant (g)	1000-seed weight (g)	Seed yield (q. ha^{-1})
Wheat alone	-	-	-	-	-	-	-
Methra alone	367.50 a	14.26 a	14.78 a	169.38 a	1.89 a	14.19 a	6.19 a
Four rows of wheat + one row of methra	91.75 e	13.82 b	14.30 a	137.29 b	1.58 b	13.83 b	2.21 c
Four rows of wheat + two rows of methra	175.00 d	11.30 c	14.35 a	121.39 c	1.24 c	13.60 c	2.81 bc
Four rows of wheat + three rows of methra	237.25 c	9.48 d	14.43 ab	66.39 d	0.96 d	12.46 d	3.00 b
Four rows of wheat + four rows of methra	313.75 b	7.83 e	12.25 b	40.14 e	0.63 e	12.37 d	2.40 bc

Any two,means not sharing a letter in common,differ significantly at 5% probability level
NS = Non-significant

mained at par with four rows of wheat + two rows of methra. The decrease in grain weight per spike due to increased rows of methra intercropped appears obviously due to decreased grain number per spike. The 1000-grain weight was decreased as wheat-methra ratio was narrowed. Sole wheat and four-four wheat-methra intercropping system produced the heaviest and the lightest grains, respectively. Kalbhor and Gaikhwad (1986) had drawn similar conclusions.

The lowest grain yield of 33.99 q ha^{-1} was obtained from four rows of wheat + four rows of methra which was statistically similar to those of four-two and four-three rows of wheat-methra intercropping systems. The maximum grain yield of 42.49 q ha^{-1} was produced by wheat alone. The decrease in fertile tillers and grain number per spike with an increase in rows of methra might have produced corresponding decrease in yield. These results are in agreement with those of Khan (1984).

Sole methra resulted in maximum plant stand (Table 1 b). In intercropped methra, there had been a consistent and significant increase in plant population with an increase in rows of methra which might be due to more number of seeds sown per unit area. But less plant population in four-four system compared with sole methra might probably be due to higher mortality of methra because of intercrop competition. These results are similar to those of Ahmad (1984). Within the intercropping systems, there had been a consistent and significant decrease in the number of pods, number of seeds per plant and seed weight per plant with the increased density of methra intercropped. This decrease appeared to be due to more inter and intera crop competition for nutrition, air and light.

Seed number per pod was influenced significantly by the various intercropping systems. Sole methra remained non-significantly different from four-one, four-two and four-three rows wheat-methra intercropping systems, though produced the maximum seed (14.78) per pod. Four-four cropping system produced the minimum seeds per pod (12.25) and was similar to four-three intercropping system. These results are in conformity with those of Ahmad (1984) and Khan (1984).

Intercropping system of four-four gave minimum 1000-seed weight (12.37 g) and did not differ significantly from four-three intercropping system (Table 1 b). Sole methra gave the highest seed weight. One row of methra in four rows of wheat produced significantly heavier seeds than two rows in four rows of wheat. Results obtained by Kalbhor and Gaikhwad (1986) are in agreement with these findings.

Methra alone produced maximum seed yield of 6.19 q ha^{-1}. Two, three and four rows of methra intercropped within four rows of wheat did not differ significantly from one another, but yielded more than one row of methra in four rows of wheat. There had been a decrease in pod number per plant, seed number per pod and 1000-seed weight with an increase in intercropping intensity of methra which resulted decrease in seed yield per plant. But these depressing effects of various methra intercropping intensities on the yield components were modified by increased plant population to a considerable extent. Seed yield of methra was reduced by 3.98, 3.38, 3.19 and 3.79 q ha^{-1} over pure stand by one, two, three and four rows of intercropping intensities, respectively. However, at the cost of this much reduction in yield an additional harvest of 8.63, 6.98, 6.86 and 7.00 q ha^{-1} of

Table 2: Economic analysis of wheat-methra intercropping systems

Intercropping Benefit System	Yield (q/ha)			Income (Rs/ha)		Gross Income (Rs./ha)	Total Expenditures (Rs.)	Net income (Rs.)	Benefit cost ratio
	Wheat		Methra	Wheat	Methra				
	Grain	Bhoosa							
Wheat alone	42.49	42.49	-	9560.75	-	9560.75	3112	6438.75	3.06
Methra alone	-	-	6.19	-	6809	6809.00	2809.38	3999.62	2.42
Four rows of wheat + one row of methra	38.06	38.06	2.21	8563.5	2431	10994.5	3502.00	7492.0	3.13
Four rows of wheat + two rows of methra	34.72	34.72	2.81	7812.0	3091	10903.0	3794.69	7108.31	2.87
Four rows of wheat + three rows of methra	33.99	33.99	3.00	7647.75	3300	10947.75	4065.0	6882.75	2.69
Four rows of wheat + four rows of methra	34.61	34.61	2.4	7787.25	2640	10427.25	4292.41	6134.87	2.43

wheat was obtained from the respective treatments which compensated more than the loss in methra production. Theses results are in agreement with results of Kalra and Gangwar (1980).

Four-one, four-tow and four-three rows of wheat-methra intercropping systems gave higher net income than sole wheat and sole methra (Table 2). However, four-four rows wheat-methra intercropping systems gave less net income than sole methra. The highest net income of Rs. 7492.50 ha^{-1} was obtained from four-one row wheat-methra intercropping system followed by Rs. 7108.31, 6882.75 and 6134.89 ha^{-1} from four-two, four-three and four-four intercropping systems respectively. Rupees 6438.75 and 3999.62 was the income for sole wheat and sole methra, respectively. In terms of benefit cost retail (BCR), the highest BCR of 3.31 was obtained for four-one wheat-methra intercropping system, followed by wheat alone with a BCR of 3.06 as against the minimum of 2.42 in methra alone.

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