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EVALUATION OF COWPEA + FODDER MAIZE INTERCROPPING UNDER VARYING FERTILIZER LEVELS IN SUMMER RICE FALLOWS

A study was undertaken to asses the feasibility and efficiency of introduction of fodder maize with cowpea in the popular rice- rice-cowpea cropping system. The experiment was conducted in the summer rice fallows of the Instructional Farm attached to the College of Agriculture, Vellayani, Kerala (India) during 1988-'89 with the objective of selecting the best crop arrangement for a cowpea + fodder maize intercropping system under different fertility levels. The cowpea variety used was C-152 while the fodder maize was CO-H-2. The different crop arrangements tried were pure crop of cowpea at 25 x 15 cm spacing (S_1), pure crop of fodder maize at 30 x 15 cm spacing (S_2), cowpea and maize in alternate rows with cowpea at 30 x 15 cm spacing (S_3), paired rows of cowpea at 45/15 x 15 cm spacing with one row of maize in between (S_4) and triple rows of cowpea at 30/15 x 15 cm with one row of maize in between (S_5). The fertilizer levels tried were 100 per cent (F_1), 75 per cent (F_2) and 50 per cent (F_3) of the recommended doses of nutrients (20:30:10 kg N, P and K per hectare for cowpea and 120:60:40 kg N, P and K per hectare for fodder maize) based on the crop arrangement and area occupied by each crop. The experiment was laid out in split plot design with four replications. Yields, nutrient uptakes and biological efficiency indices like land equivalentratio (LER) and land equivalent coefficient (LEC) and the economic efficiency index, income equivalent ratio (1ER) were worked out to evaluate the systems.

Results revealed that intercropping ; id not decrease the grain yield of cowpea Table 1). The yields from different treatnents were on par with the sole crop yield. The fodder yield of maize in the alternate •ow arrangement (30.71 t ha^{-1}) was on par with the sole crop yield (32.99 t ha^{-1}). Hundred per cent dose of fertilizers produced significantly higher fodder yield than the other fertilizer levels tried. Intercropping resulted in higher uptake of nutrients as compared to sole cropping. Similar findings were obtained by Dalai (1974) and Chui (1988). The alternate row arrangement recorded the maximum uptake of N, P and K. This arrangement might have resulted in better exploitation of resources and hence recorded the maximum uptake values.

The individual uptake of nutrients by component crops showed a declining trend with decreasing level of fertilizers. The full dose of fertilizers resulted in the maximum total uptake of nutrients followed by 75 per cent dose which in turn was followed by 50 per cent dose. Willey (1979) concluded that the most generally useful single index for expressing the yield advantage is LER and it represents the increased biological efficiency achieved by growing two crops together in the particular environment used. In the present investigation, the highest value for LER (Table 2) was recorded by the alternate row arrangement (S_3). The LER value for this arrangement was 1.9 meaning 90 per cent more land would be required as sole crops to produce the same yields as in intercropping. It was 90 per cent more efficient than the respective sole crops. Even though triple row arrangement recorded the lowest value, it was 50 per cent more efficient than its corresponding pure crops. With the three fertilizer levels, 100 per cent dose was on par with 75 per cent dose.

Land equivalent coefficient has been found to be very effective in deciding the mixture yields as well as the inter-crop proportion that gives agronomic advantage (Adetiloye *et al.*, 1983). The LEC value (Table 2) for alternate row arrangement was 0.94. When LEC for a two crop mixture is greater than 0.25, but less than

unity the neighbourhood effects involve competitive complementarity. In the present study all the intercropping arrangements fall in this category which indicates that they are in a situation involving competitive complementarity. The higher two levels of fertilizers were on par.

Table 1. Grain yield of cowpea and fodder yield of maize and nutrient uptake under different intercropping arrangements and fertility levels

Treatments	Grain yield of cowpea (kg ha^{-1})	Fodder yied of maize (kg ha^{-1})	Uptake (kg ha^{-1})		
			N	P	K
S_1	1373	-	67.76	14.73	56.91
S_2	-	32.99	76.85	13.49	56.99
S3	1301	30.71	147.51	28.19	79.34
S_4	1255	22.14	132.42	21.91	63.60
%	1244	19.04	121.45	23.20	79.12
CD(0.05)	NS	9.27	23.52	5.96	11.26
Fertilizer levels (F)					
F_1	1325	29.59	156.29	26.49	96.69
F_2	1284	24.94	134.29	23.81	78.73
F_3	1271	24.14	120.39	25.85	76.55
CD(0.05)	NS	4.17	23.39	NS	8.60
S x F interactions					
S_1F_1	1414	-	73.94	15.53	54.33
S_1F_2	1331	-	71.18	13.20	54.66
S_1F_3	1374	-	58.16	15.45	61.75
S_2F_1	-	34.14	72.45	10.12	57.53
S_2F_2	-	31.18	81.09	12.72	54.41
S_2F_3	-	33.66	77.01	17.66	59.05
S_3F_1	1336	37.80	181.88	31.90	90.80
S_3F_2	1334	29.69	136.61	27.22	87.59
S_3F_3	1234	24.66	124.01	25.48	59.60
S_4F_1	1269	23.62	134.12	23.67	66.48
S_4F_2	1234	21.38	140.53	18.37	66.19
S_4F_3	1263	21.42	128.62	23.79	58.12
S_5F_1	1283	22.42	162.77	24.76	117.60
S_5F_2	1236	17.50	107.78	23.81	52.08
S_5F_3	1214	16.81	93.78	21.00	67.67
CD(0.05)	NS	8.35	56.78	7.52	19.24

Table 2. LER, LEC and IER of cowpea + fodder maize inter-cropping

Treatments	LER	LEC	IER
Crop arrangement (S)			
S_3	1.90	0.94	1.87
S_4	1.61	0.64	1.61
S_5	1.51	0.54	1.47
CD(0.05)	0.20	0.09	0.18
Fertilizer levels (F)			
F_1	1.75	0.85	1.72
F_2	1.72	0.71	1.72
F_3	1.55	0.57	1.51
CD(0.05)	0.14	0.15	0.16
S x F			
S_3F_1	2.08	1.30	2.06
S_3F_2	1.97	0.86	1.94
S_3F_3	1.65	0.66	1.60
S_4F_1	1.58	0.62	1.60
S_4F_2	1.67	0.71	1.68
S_4F_3	1.58	0.59	1.56
S_5F_1	1.58	0.61	1.50
S_5F_2	1.52	0.56	1.53
S_5f_3	1.42	0.46	1.38
CD(0.05)	0.25	0.26	0.28

The analysis of various biological and economic efficiency indices clearly reveals the vast potential of introducing a crop like fodder maize along with cowpea in the rice-rice-cowpea cropping system. Yield of cowpea was not decreased from that of sole cropping by the inclusion of fodder maize as an inter-crop. The efficiency indices showed that the best arrangement was alternate rows of cowpea and fodder maize. Seventy five per cent of the recommended dose of fertilizers was as good as 100 per cent dose. So the alternate row arrangement of cowpea and fodder maize with cowpea at 30 x 15 cm spacing supplied with 75 per cent dose of fertilizers recommended for the crops is ideal for getting increased returns from summer rice fallows.

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