Indian Journal of Agronomy **46** (2) : 211–215 (June 2001)

Production potential of forage maize *(Zea mays)* with legumes under intercropping system

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Received : May 2000

ABSTRACT

A field experiment was conducted during the rainy season (*kharif*) of 1998 and 1999 to evaluate the production potential and economic feasibility of maize (*Zea mays* L.) + legumes intercropping systems. The highest green-forage and dry-matter yields as well as net returns were obtained when maize + cowpea [*Vigna unguiculata* (L.) Walp.] was sown in planting pattern of 5:2 and this planting pattern was statistically at par with 4:2 raw ratio during both the years. However, maize + clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.] in 3:3 row proportion recorded the maximum land-equivalent ratio over all other treatments.

Key words : Forage, Maize, Legume, Intercropping, Return, Land-equivalent ratio

Quality forage production plays an important role in dairy industry. The area under fodder crops in India is very less (5% of the cultivable area), as the fodder crops hardly find any place in the common cropping pattern. Hence efforts are to be made to increase the productivity and quality of fodder crops. Cultivation of cereal forages along with legumes either in mixed or in an intercropping system appears to be a prospective method to get an increased quantity and nutritious fodder with an appriciable improvement in the enrichment of the soil (Sudhakar *et al.*, 1996). An information on crop management practices for maize and legume fodder is inadequate in the agroclimate of Chhattisgarh plains. Hence present study was undertaken to evaluate the forage productivity of maize along with cowpea and clusterbean in intercropping system.

MATERIALS AND METHODS

The experiment was conducted at the Farm of the College of Veterinary Science, Anjora (Durg), Madhya Pradesh, during mansoon (*kharif*) season of 1998 and 1999. The clay-loam soil of the experimental plot had organic carbon 0.58%, available nitrogen 250 kg, available phosphorus 13 kg (P_2O_5) and available potassium 350 kg

(K_2O)/ha, with pH 7.6. Total 15 treatments (Table 1) were replicated 3 times in randomized block design. The crops were sown at 30 cm spacing in row proportion as per treatments in the first week of August 1998 and 1999. Package of practices recommended for crops were adopted for cultivation of fodders. Both maize and legume crops were harvested at milk stage of maize for green-forage yield. The economics was worked out considering the current market prices.

RESULTS AND DISCUSSION

Forage yield

Green-forage and dry-matter yields were significantly affected by various treatments (Tables 1, 2). The total green-forage and dry-matter yields were highest under maize + cowpea in 5:2 row ratio which were statistically at par with those obtained with 4:2 row proportion of maize + cowpea intercropping system. The increase in green-fodder yield with maize + cowpea intercrop combination in 5:2 proportion was 9.69 and 17.31% over yield of sole maize forage during 1998 and 1999 respectively. Similarly, the respective increase in dry-forage yield was 6.82 and 13.53% during first and second year. The findings are in accordance to those of Barik and Tiwari (1996) and Tripathy *et al.* (1997) with cowpea. The planting pattern of maize + cowpea or clusterbean in different row proportions produced significantly higher green as well as dry matter than sole crop of maize, cowpea or clusterbean. The increase in the overall yield of green and dry matters in the intercropping system might be owing to the nutrient sparing effect of leguminous fodder. It is well evident that the atmosphere nitrogen fixed by bacteria in the root nodules of leguminous fodder import nitrogen enrichment to non-leguminous fodder grown in combination, increasing the yield of forage. The results support the observations of Gill and Verma (1993).

Economic feasibility

The mean cost of cultivation of clusterbean was slightly higher than all other treatments either grown as sole crop or intercropped in different ratios (Table 3). The gross return was highest under maize + cowpea intercropping system of 4:2 row ratio in both the years. Moreover, the net return was maximum in maize + cowpea combination with 5:2 row proportion. However, the difference between 5:2 and 4:2 row ratios of maize + cowpea was statistically non-significant. The gross and net returns obtained from sole crop (maize or cowpea or clusterbean) was significantly lower than all the intercropping systems (maize + cowpea or clusterbean) under present study (Table 3). The results support those of Keshwa and Singh (1991) under cereal + legume intercropping system.

Land-equivalent ratio (LER)

The highest LER values were realized when maize + clusterbean was sown in 3:3 row proportion, followed by maize + clusterbean grown in 3 : 2 row ratio. The present intercropping system resulted in better utilization of land and total herbage production than sole cropping. The present findings are in accordance with those of

Table 1. Green-forage yield as influenced by intercropping treatments

Treatment	Green-forage yield (q/ha)							
	1998				1999			
	Maize	Legume	Total	Increase over sole maize (%)	Maize	Legume	Total	Increase over sole maize (%)
Sole maize (M)	504.15		504.15		498.96		498.96	
Sole cowpea (CP)		155.11	155.11			156.40	156.40	
Sole clusterbean (CB)		135.78	135.78			133.65	133.65	
M+CP (3:2)	470.34	67.55	537.89	6.69	498.20	69.72	567.92	13.82
M+CP (4:2)	489.11	58.24	547.35	8.57	518.70	60.14	578.84	16.01
M+CP (5:2)	502.22	50.77	552.99	9.69	532.21	53.15	585.36	17.31
M+CP (3:3)	455.62	72.15	527.77	4.68	481.73	75.08	556.81	11.59
M+CP (4:3)	473.43	64.70	538.13	6.74	500.83	66.56	567.39	13.71
M+CP (5:3)	486.55	56.42	542.97	7.70	515.15	57.37	572.52	14.74
M+CB (3:2)	463.33	62.35	525.68	4.27	481.52	64.36	545.88	9.40
M+CB (4:2)	480.75	54.12	534.87	6.09	499.20	55.61	554.81	11.19
M+CB (5:2)	491.88	48.22	540.10	7.13	517.05	50.02	567.07	13.65
M +CB (3:3)	446.14	68.62	514.76	2.10	463.82	70.25	534.07	7.03
M + CB (4:3)	460.25	61.04	521.29	3.40	478.54	61.92	540.46	8.32
M+CB (5:3)	472.33	55.32	527.65	4.66	491.00	56.00	547.00	9.63
CD (P = 0.05)			7.85				8.22	

Table 2. Dry-matter yield as influenced by intercropping treatments

Treatment	Dry-matter yield (q/ha)							
	1998				1999			
	Maize	Legume	Total	Increase over sole maize (%)	Maize	Legume	Total	Increase over sole maize (%)
Sole maize (M)	98.94		98.94		97.62		97.62	
Sole cowpea (CP)		26.82	26.82			26.07	26.07	
Sole clusterbean (CB)		24.85	24.85			24.84	24.84	
M + CP (3:2)	92.12	10.72	102.84	3.94	97.57	10.95	108.52	11.16
M + CP (4:2)	95.35	8.77	104.12	5.23	100.96	9.03	109.99	12.67
M + CP (5:2)	97.56	8.13	105.69	6.82	102.35	8.48	110.83	13.53
M + CP (3:3)	87.72	11.52	99.24	0.30	92.60	11.97	104.57	7.12
M + CP (4:3)	90.80	10.23	101.03	2.11	94.89	10.43	105.62	8.19
M + CP (5:3)	92.89	8.95	101.84	2.93	98.02	9.04	107.06	9.67
M + CB (3:2)	87.99	11.16	99.15	0.21	91.34	11.27	102.61	5.11
M + CB (4:2)	89.56	9.70	99.26	0.32	92.95	9.85	102.80	5.30
M + CB (5:2)	91.42	8.75	100.17	1.24	96.50	9.07	105.57	8.14
M + CB (3:3)	82.50	12.22	94.72	(–)4.26	85.62	12.46	98.08	0.47
M + CB (4:3)	84.61	10.90	95.51	(–)3.47	86.87	12.07	98.94	1.35
M + CB (5:3)	86.64	9.95	96.59	(–)2.37	90.06	10.07	100.13	2.57
CD (P=0.05)			0.92				1.01	

Table 3. Cost of cultivation, gross and net return and land-equivalent ratio (LER) as affected by intercopping treatments

Treatment	Mean cost of cultivation (Rs/ha)	Gross return (Rs/ha)		Net return (Rs/ha)		LER	
		1998	1999	1998	1999	1998	1999
Sole maize (M)	6,550	15,120	14,968	8,570	8,418	1.00	1.00
Sole cowpea (CP)	6,060	9,300	9,384	3,240	3,324	1.00	1.00
Sole clusterbean (CB)	6,560	8,100	8,019	1,540	1,459	1.00	1.00
M + CP (3:2)	6,354	18,140	19,029	11,686	12,676	1.37	1.44
M + CP (4:2)	6,386	18,150	19,169	11,764	12,783	1.34	1.42
M + CP (5:2)	6,409	18,060	19,155	11,781	12,786	1.32	1.41
M + CP (3:3)	6,305	17,970	18,956	11,665	12,651	1.37	1.44
M + CP (4:3)	6,339	18,030	19,018	11,691	12,679	1.35	1.43
M + CP (5:3)	6,365	17,940	18,896	11,575	12,531	1.33	1.40
M + CB (3:2)	6,554	17,610	18,307	11,056	11,053	1.38	1.45
M + CB (4:2)	6,552	17,640	18,323	11,088	11,771	1.35	1.42
M + CB (5:2)	6,552	17,610	18,512	11,058	11,960	1.33	1.41
M + CB (3:3)	6,555	17,460	18,129	10,905	11,574	1.39	1.46
M + CB (4:3)	6,553	17,460	18,081	10,907	11,528	1.36	1.42
M + CB (5:3)	6,553	17,460	18,090	10,910	11,537	1.34	1.40
CD (P=0.05)				72.40	96.22		

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