

Performance of grain maize (*Zea mays*) and forage cereal intercropping on black soils under rainfed condition

B. M. CHITTAPUR, S. M. HIREMATH AND A. S. PRABHAKAR

Department of Agronomy, College of Agriculture, University of Agricultural Sciences,
Dharwad, Karnataka 580 005

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ABSTRACT

A field experiment was conducted during the rainy seasons of 1990 and 1991 to study the performance of maize (*Zea mays* L.) + forage cereal intercropping on black clay-loam soil under rainfed condition. Maize-grain yield decreased due to intercropping. The reduction in yield was of higher magnitude with 1 : 2 proportion with forage maize intercrop. Yield components followed the similar trend. Intercrop forage yields were higher with 1 : 2 proportion. Net returns were higher under intercropping of maize + pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz].

Cereal-legume intercropping is a common practice under rainfed agriculture. Sufficient information is available on cereal + legume grain system (Hosmani *et al.*, 1990). Information is also available on forage + forage intercropping system (Gumaste, 1990). However, the information on grain + forage cereal system is scarce. Green-forage production is an important component in animal management. Exclusive forage cultivation has limitation due to ever-increasing demand for grain. One of the alternatives is to introduce grain cereal forage system. With this objective, an experiment was conducted on maize (*Zea mays* L.) + forage cereal system for the northern transitional tract of Karnataka under rainfed condition.

MATERIALS AND METHODS

The experiment was conducted on black clay-loam soil of Dharwad during rainy seasons of 1990 and 1991. Three forage

cereals, viz. 'African Tall' maize, 'DFB 1' pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz] and 'DFJ 1' sorghum [*Sorghum bicolor* (L.) Moench], were intercropped in 'Deccan 103' grain maize spaced at 90 cm × 20 cm in 1 : 1 and 1 : 2 row proportions. Seven treatments were tested in randomized block design. Uniform fertilizer N, P₂O₅ and K₂O @ 150, 75 and 37.5 kg/ha respectively was applied to all treatments. Nitrogen was in split in 2 equal parts, half was applied basal and the remaining half top-dressed to grain maize 30 days after sowing. Uniformly distributed rainfall of 730.5 and 1,092.1 mm was received during 1990 and 1991 respectively in the crop season. Forages were harvested 75 days after sowing and grain maize was harvested 120 days after sowing.

RESULTS AND DISCUSSION

Plant height of maize was influenced due to intercropping (Table 1). Sole maize was

Table 1. Plant height, dry matter, grain weight/plant and 100-grain weight under maize in maize + forage cereal intercropping

Treatment	Plant height (cm)		Total dry matter (g/plant)		Grain weight (g/plant)		100-grain weight (g)	
	1990	1991	1990	1991	1990	1991	1990	1991
<i>Intercropping</i>								
M + maize (F) 1 : 1	158.00	178.00	138.51	266.57	71.24	116.00	21.38	30.16
M + maize (F) 1 : 2	141.85	196.00	104.13	232.57	64.57	134.00	23.75	29.50
M + pearl millet (F) 1 : 1	168.95	182.00	212.67	343.13	114.12	164.73	23.12	31.00
M + pearl millet (F) 1 : 2	178.65	179.00	177.13	314.87	99.86	160.13	25.87	30.50
M + sorghum (F) 1 : 1	176.65	175.00	198.76	301.70	120.01	158.66	23.75	30.33
M + sorghum (F) 1 : 2	161.30	193.00	151.96	277.96	80.15	143.80	26.37	29.66
Intercropping*	164.23	183.80	163.99	289.47	91.66	146.22	24.04	30.20
Sole maize (M)	193.77	195.00	266.85	378.60	145.80	177.86	28.25	34.00
CD (P = 0.05)	24.19	5.10	13.15	17.26	5.92	10.29	0.76	NS
Row proportion 1 : 1	167.87	178.30	183.32	303.81	101.79	152.40	22.75	30.50
Row proportion 1 : 2	160.60	189.10	144.68	275.13	81.53	139.90	25.33	29.90
CD (P = 0.05)	NS	3.80	10.89	13.04	4.90	7.78	0.63	NS
<i>Forage crop</i>								
Maize (F)	149.93	187.00	121.32	249.57	67.91	125.00	22.56	29.83
Pearl millet (F)	173.80	180.50	195.30	329.00	106.99	162.43	24.80	30.75
Sorghum (F)	168.98	183.70	175.37	289.85	100.08	151.13	25.06	30.00
CD (P = 0.05)	NS	NS	13.33	15.98	5.99	9.53	0.77	NS
<i>Interaction</i>								
CD (P = 0.05)	NS	6.60	NS	NS	8.48	NS	NS	NS

M, Grain maize

*, Mean of intercropping systems

Table 2. Maize grain and stover yields, intercrop green-forage yield and net returns under maize + forage cereal intercropping

Treatment	Maize-grain yield (q/ha)		Maize-stover yield (q/ha)		Intercrop-forage yield (q/ha)		Net returns (Rs/ha)		
	1990	1991	1990	1991	1990	1991	1990	1991	Mean
<i>Intercropping</i>									
M + maize (F) 1 : 1	37.23	53.06	46.05	52.46	52.03	34.41	12,373	19,474	15,924
M + maize (F) 1 : 2	22.11	51.61	27.22	45.52	89.99	46.14	15,137	20,660	17,899
M + pearl millet (F) 1 : 1	57.34	65.25	64.33	80.24	41.66	31.79	15,668	26,941	21,305
M + pearl millet (F) 1 : 2	38.55	60.67	47.07	68.67	69.15	41.51	15,434	24,699	20,067
M + sorghum (F) 1 : 1	49.27	57.55	57.06	60.79	37.35	21.44	12,989	19,231	16,110
M + sorghum 1 : 2	38.33	55.24	49.75	56.17	56.85	36.11	13,576	20,668	17,122
Intercropping*	40.47	57.23	48.58	60.67			14,196	21,946	18,071
Sole maize (M)	67.39	74.38	85.65	90.74			11,543	22,321	16,932
CD (P = 0.05)	1.86	4.57	5.36	5.86					
Row proportion 1 : 1	47.95	58.62	55.81	64.44	43.67	29.21	14,010	21,882	17,946
Row proportion 1 : 2	32.99	55.84	41.35	56.76	71.99	41.25	14,716	22,009	18,363
CD (P = 0.05)	1.40	NS	4.11	4.43	6.15	1.73			
<i>Forage crop</i>									
Maize (F)	29.70	52.34	36.64	48.98	71.01	40.28	13,755	20,067	16,911
Pearl millet (F)	47.94	62.95	55.70	74.44	55.40	36.65	15,551	25,820	20,686
Sorghum (F)	43.75	56.40	53.41	58.52	47.10	28.78	13,283	19,950	16,615
CD (P = 0.05)	1.72	4.36	4.96	5.43	7.53	2.13			
<i>Interaction</i>									
CD (P = 0.05)	2.43	NS	NS	NS	NS	3.01			

M, Grain maize

*, Mean of intercropping systems

Price: Maize grain, Rs 225/q (1990-91); Rs 350/q (1991-92); Fodder: dry or green, Rs 200/tonne

taller than the intercropped one. This was attributed to competition for energy under intercropping system. Difference in the plant heights during 1992 was significant.

Dry matter/plant in maize was also affected due to intercropping. Intercropped maize gave significantly lower dry-matter content than the sole maize. Dry matter/plant under 1 : 2 row proportion was significantly lower than that under 1 : 1 proportion due to increased intercrop competition, resulting from increased population pressure under 1 : 2 row proportion. Various intercrops had also significant influence on dry-matter content. Forage maize was more competitive resulting in the lowest dry matter when intercropped.

Similar observations were noted for grain weight/plant and 100-grain weight.

Grain yield of maize under intercropping system was significantly reduced due to intercropping during both the years (Table 2). The grain yields under intercropping were 40.47 and 57.23 q/ha compared with 67.39 and 74.38 q/ha under sole cropping during 1990 and 1991 respectively. Under 1 : 2 row proportion the yield was lower than that under 1 : 1 proportion, obviously due to reduced dry matter/plant and lower 100-grain weight. Among the intercrops, the reductions in yields were of lower magnitude with pearl millet compared with sorghum or forage maize.

Performance of intercrops

Green-forage yield of intercrops varied significantly. Among the row proportions, 1 : 2 proportion recorded higher forage yield than 1 : 1 proportion during both the years. Forage maize recorded higher tonnage (77.01 and 40.28 tonnes/ha during 1990 and 1991 respectively), and was superior to the other intercrops during both the years. Interaction effects were significant during 1991 only. Maize + forage maize (1 : 2) gave higher green-forage yield, followed by maize + pearl millet (1 : 2). Similar trend was noticed during 1990 also.

Net returns

Net returns were higher under intercropping systems (Rs 18,071/ha). Among the row proportions, 1 : 2 proportion recorded higher returns (Rs 18,363/ha) owing to higher forage yield. Net returns among intercrops were higher (22%) with pearl millet (Rs 20,686/ha) due to higher grain and forage yields from the system. Among different combinations, maize + forage pearl millet under 1 : 2 row proportion recorded higher net returns (Rs 21,305/ha).

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