

Productivity and economics of sunflower based on intercropping systems during *Rabi* under rainfed conditions

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ABSTRACT

A field experiment was conducted during the *Rabi* seasons of 2006 and 2007 at Raichur, Karnataka to study the competition between component crops, crop geometry, productivity and profitability of sunflower based intercropping systems under rainfed conditions. Intercrop methi and coriander found better than linseed. Among various intercropping systems, sunflower + coriander (1:1) recorded maximum sunflower equivalent yield followed by sunflower + coriander (1:3) and sunflower + methi (1:3). With respect to monetary returns, sunflower + coriander (1:3) followed by sunflower + coriander (1:1) realized maximum net returns of Rs. 27743/ha and Rs. 27245/ha, respectively.

Chandranath, H.T., Chuhan, Mohan and Katti, Pramod (2011). Productivity and economics of sunflower based on intercropping systems during *Rabi* under rainfed conditions. *Internat. J. agric. Sci.*, 7(1): 20-22.

Key words : Sunflower, Intercrop, Row ratio, Productivity, Economics

INTRODUCTION

Sunflower is an important oilseed crop of northern part of Karnataka extensively grown under rainfed conditions during *Rabi* season. Cultivation of this crop is becoming more risky due to the occurrence of necrosis right from initial growth stage to seed tilling stage. Suitable inter cropping system can be more efficient practice of farming to maximize the productivity and profits besides minimization of agricultural risks (Kaushik *et al.*, 1980). The suitable component crop and spatial arrangement in intercropping system influence the performance of crops. Hence, the present investigation was undertaken to identify the suitable component crop and row proportion in sunflower based intercropping system during *Rabi* under rainfed condition.

MATERIALS AND METHODS

A field experiment was conducted during *Rabi* seasons of 2006 and 2007 under rainfed conditions at Raichur, Karnataka. The soil was medium black with a pH of 8.1, available nitrogen of 245 kg/ha, 25.6 kg/ha available phosphorus and available potassium of 396 kg/ha. The experiment consisted of 11 treatments including four sole crops *viz.*, sunflower (60 cm x 30 cm), sunflower (120 cm x 15 cm), linseed (30 cm x 10 cm), methi (30 cm x 10 cm) and coriander (30 cm x 10 cm) and six combinations of sunflower intercropped with linseed, methi and coriander in 1:1 and 1:3 row proportions. Single row

of methi, linseed and coriander at 1:1 and three rows of methi, linseed and coriander at 1:3 row proportion was taken in the experiment. All the crops grown in intercropping system were fertilized at their recommended dose of base crops. The experiment was laid out in Randomized Block Design with three replications. The amount of rainfall received was 572.8 mm and 928.9 mm, respectively during 2006 and 2007. The economic parameters, monetary advantage based on land equivalent ratio (LER) was computed as described by Jain and Rao (1980). The yields were further evaluated for different indices of competition functions as suggested by Willey (1979).

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussion have been presented under the following sub heads:

Sunflower yield:

The sole crop of sunflower sown at 60 x 30 cm and 120 x 15 cm realized significantly higher seed yield of 1198 kg/ha and 1148 kg/ha, respectively over intercropped sunflower yields (Table 1). The reduction in yield was due to the effect of intercropping system. The reduction of sunflower yield in intercropping with methi was 13%, with coriander was 11% and with linseed was 12.3% when compared to sole sunflower with normal spacing (60 cm x 30 cm).

Table 1 : Productivity of sunflower based intercropping systems under rainfed condition during Rabi season

Sr. No.	Treatments	Sunflower yield (kg/ha)			Inter crop yield (kg/ha)			Sunflower equivalent yield (kg/ha)		
		2006	2007	Pooled	2006	2007	Mean	2006	2007	Pooled
1.	Sole Sunflower-SF (60 x 30)	1261	1134	1198	-	-	-	1261	1134	1198
2.	Sole Sunflower-SF (120 x 15)	1198	1097	1148	-	-	-	1198	1097	1148
3.	Sole Linseed (30 x 10)	-	-	-	398	517	458	-	-	-
4.	Sole Methi (30 x 10)	-	-	-	407	630	519	-	-	-
5.	Sole Coriander (30 x 10)	-	-	-	241	534	388	-	-	-
6.	Sunflower (60 x 30) + Methi (1:1)	1138	1014	1076	104	161	133	1283	1226	1254
7.	Sunflower (120 x 15) + Methi (1:3)	1116	901	1009	241	292	267	1452	1286	1369
8.	Sunflower(60 x 30) + Coriander (1:1)	1101	1031	1066	95	260	178	1404	1682	1543
9.	Sunflower(120 x 15) + Coriander (1:3)	1146	972	1059	144	292	218	1194	1641	1418
10.	Sunflower (60 x 30) + Linseed (1:1)	1125	1020	1073	171	185	178	1387	1302	1344
11.	Sunflower(120 x 15) + Linseed (1:3)	1102	951	1027	230	216	223	1424	1267	1346
	S.E.±	37	34	35				32	44	26
	C.D. (P=0.05)	111	102	105				95	132	78

Intercrop yield:

Intercrop yields were also reduced significantly compared to their sole crop yields. Between two row ratios, the yield reduction in 1:1 was more compared to 1:3 in all the intercrops. Among the intercrops, methi suffered maximum (49% to 74%) followed by linseed (51% to 61%) and the least was with coriander (44% to 54%). Maximum yield loss with methi might be due to spatial and temporal competition for growth factors especially the moisture for a prolonged period and their susceptibility to shading.

Sunflower equivalent yield:

The total sunflower equivalent yield differed significantly due to row ratios and various intercrops over their sole crops. Among the intercrops sunflower + coriander realized significantly higher sunflower equivalent yield (1543 and 1418 in 1:1 and 1:3 row ratios, respectively) over methi (1254 kg/ha and 1369 kg/ha) and linseed (1344 kg/ha and 1346 kg/ha). The higher sunflower equivalent yield with coriander was due to less reduction of component crop yield in intercropping system and more market price compared to other intercrops such as linseed and methi.

Competition function:

Intercropping system of sunflower with methi, coriander and linseed resulted in land equivalent ratio (LER) greater than one, indicating intercropping advantages (Table 2). The pooled LER ranged from 1.22

to 1.44, indicating that intercropping system had a greater impact on the productivity of the system. Intercropping of sunflower + coriander (1:3) (120 cm x 15 cm) recorded maximum biological efficiency (1.44) of the system. This yield advantage due to intercropping may possibly be attributed to the combined effect of better utilization of natural resources than sole cropping of companion crops, resulting in higher productivity per unit area. Intercropping of sunflower + methi (60 cm x 30 cm in 1:1) recorded lowest LER of 1.22 indicating inefficient system.

Economic analysis:

Intercropping of sunflower with methi, coriander and linseed at various row proportions realized higher net returns than their respective sole crops (Table 2). The intercropping of sunflower + coriander (1:3) and (1:1) recorded higher net returns (Rs. 27,743/ha and Rs. 27,245/ha, respectively) and was closely followed by sunflower + linseed (1:1) and (1:3). Intercropping of sunflower + coriander in 1:3 ratio recorded an additional net return of Rs. 5562/ha and 1:1 ratio realized Rs. 5064/ha. With respect to income equivalent ratio (IER) all the intercropping systems showed superiority to sole crops by recording greater than one IER. Among the companion crops, sunflower + coriander recorded maximum IER (1.32). The intercropping systems sunflower + methi and sunflower + linseed recorded the lowest IER of 1.11. Intercropping of sunflower + coriander (1:1) also found to be remunerative with higher gross and net returns IER, LER and sunflower equivalent yield.

Table 2 : Gross returns (Rs/ha), net returns (Rs/ha), income equivalent ratio and land equivalent ratio of intercropping systems involving sunflower

Sr. No.	Treatments	Gross returns (kg/ha)			Net returns (kg/ha)			Income equivalent ratio			Land equivalent ratio		
		2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled
1.	Sole Sunflower-SF (60 x 30)	27,127	31,750	29,438	19,862	24,500	22,181	1.00	1.00	1.00	1.00	1.00	1.00
2.	Sole Sunflower-SF (120 x 15)	25,757	30,716	28,236	18,507	23,466	20,986	1.00	1.00	1.00	1.00	1.00	1.00
3.	Sole Linseed (30 x 10)	11,940	19,129	15535	5,815	13,004	9,410	1.00	1.00	1.00	1.00	1.00	1.00
4.	Sole Methi (30 x 10)	18,722	22,680	20,701	11,722	35,840	23,781	1.00	1.00	1.00	1.00	1.00	1.00
5.	Sole Coriander (30 x 10)	13,134	21894	17,514	7,564	16,234	11,899	1.00	1.00	1.00	1.00	1.00	1.00
6.	Sunflower (60 x 30) + Methi (1:1)	27,588	34,349	30,969	17,888	24,649	21,269	1.15	1.08	1.11	1.16	1.29	1.22
7.	Sunflower (120 x 15) + Methi (1:3)	31,224	36,032	33,628	20,324	25,132	22,728	1.27	1.17	1.22	1.47	1.38	1.42
8.	Sunflower(60 x 30) + Coriander (1:1)	28,042	46,548	37,295	17,992	36,498	27,245	1.03	1.46	1.25	1.26	1.39	1.33
9.	Sunflower(120 x 15) + Coriander (1:3)	31,263	47,072	39,168	19,813	35,672	27,743	1.15	1.48	1.32	1.49	1.40	1.44
10.	Sunflower (60 x 30) + Linseed (1:1)	29,788	36,145	32,967	20,813	27,170	23,992	1.09	1.13	1.11	1.31	1.25	1.28
11.	Sunflower(120 x 15) + Linseed (1:3)	30,602	35,484	33,043	19,902	24,784	22,343	1.18	1.15	1.17	1.45	1.27	1.36
Market Price(Rs/q):		Sunflower			Methi			Coriander			Linseed		
2006		2150			3000			4600			3300		
2007		2800			3700			6800			4100		

From the results it could be inferred that, companion cropping of sunflower and coriander proved to be economical compared to other intercropping systems.

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Received : May, 2010; Accepted : July, 2010