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Evaluation of intercropping patterns of soybean (*Glycine max*) in pigeonpea (*Cajanus cajan*)

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ABSTRACT

A field experiment was conducted during rainy season of 1995, 1996 and 1997 to evaluate the intercropping pattern of soybean [*Glycine max* (L.) Merr.] in pigeonpea [*Cajanus cajan* (L.) Millsp.] under protective irrigation. The highest soybean yield was obtained in sole soybean, however, it was at par with paired planting of soybean (30/90) + 1 row of pigeonpea and planting of soybean and pigeonpea in 3:1 row proportion. Sole planting of pigeonpea gave significantly highest pigeonpea yield. Planting of soybean and pigeonpea in 3:1 row proportion recorded the highest soybean-equivalent yield, land-equivalent ratio, benefit : cost ratio and maximum gross as well as net returns/ha.

Key words : Intercropping, Soybean, Pigeonpea, Soybean-equivalent yield, Net returns

India is deficit in both oilseed and pulse production. Intercropping of these crops is one of the ways to increase oilseed and pulse production as intercropping is more advantageous than sole cropping of either oilseeds or pulses (Prasad and Srivastava, 1991; Singh and Rajput, 1996). Pigeonpea is the dominant pulse crop of Maharashtra and area under soybean in Maharashtra is also increasing rapidly owing to better yield potential and market price. An information on intercropping of soybean with pigeonpea is meagre in Maharashtra, hence an experiment was conducted to evaluate the intercropping patterns of soybean in pigeonpea.

MATERIALS AND METHODS

A field experiment was conducted during rainy season of 1995, 1996 and 1997 to evaluate the intercropping pattern of soybean in pigeonpea under protective irrigation at Agharkar Research Institute's Experimental Farm, Hol, Pune. There were 7 treatments [T_1, sole soybean (cv. 'MACS 57'); T_2, sole pigeonpea (cv. 'ICPL 87'); T_3, alternate planting of soybean and pigeonpea; T_4, 2 rows of soybean + 2 rows of pigeonpea; T_5, paired planting of soybean (30/90) + 1 row of pigeonpea; T_6, soybean and pigeonpea planting in 2:1 row proportion; and T_7, soybean and pigeonpea planting in 3:1 row proportion], replicated

thrice in randomized block design. The soil was Vertisol with pH 8.4, medium in organic carbon (0.66%), low in available N 220 kg/ha) as well as P_2O_5 (5.13 kg/ha) and high in K_2O (431 kg/ha). Both the crops were sown on 21 July 1995, 5 July 1996 and 6 July 1997. A basal dose of N, P_2O_5 and K_2O @ 20,80 and 40 kg/ha to sole soybean and intercropping treatments and @ 25, 50 and 20 kg/ha to sole pigeonpea was applied. Rainfall of 621, 691 and 361 mm was received, distributed in 50, 58 and 53 days during cropping seasons of 1995, 1996 and 1997 respectively. One protective irrigation during first 2 years and 2 protective irrigations during third year of experiment were given. Soybean seed-equivalent yield was calculated by converting the seed yield of pigeonpea into soybean seed-equivalent yield on the basis of selling prices in respecstive years.

RESULTS AND DISCUSSION

Soybean yield

Sole crop of soybean recorded the highest soybean yield. Planting of soybean in association with pigeonpea reduced the soybean yield due to reduction in population (row) and competition effects (Table 1). Tomar *et al.* (1987), Holkar *et al.* (1991) and Joshi *et al.* (1997) also reported similar results. In pooled data, sole soybean gave significantly highest soybean yield among all the treatments except paired planting of soybean (30/90) + 1 row of pigeonpea and soybean and pigeonpea planting in 3:1 row proportion.

Pigeonpea yield

The highest pigeonpea yield was obtained in sole pigeonpea planting. Pigeonpea yields in intercropping treatments were significantly reduced compared to sole pigeonpea yield due to planting of soybean. Two treatments, viz. alternate planting of soybean and pigeonpea and paired planting of soybean (30/90) + 1 row of pigeonpea, gave significantly lowest pigeonpea yield in pooled analysis.

Soybean-equivalent yield

Planting of soybean and pigeonpea in 3:1 row proportion recorded significantly highest soybean-equivalent yield over rest of the treatments in all the years and in pooled analysis, except planting of soybean and pigeonpea in 2:1 row proportion during 1995 and 1996 where former treatment was at par with later one. Joshi *et al.* (1997) also reported higher soybean-equivalent yield due to planting of soybean and pigeonpea in 2:1 and 3:1 row proportions.

Land-equivalent ratio

All intercropping patterns of soybean with pigeonpea exhibited LER values >1 during all the years which indicated that these treatments were more efficient in utilizing available resources than sole cropping of either soybean or pigeonpea resulting in higher productivity per unit of space (Table 2). Planting of soybean and pigeonpea in 3:1 row proportion recorded the highest LER value (1.26), followed by planting of soybean and pigeonpea in 2:1 row proportion (1.20). These results corroborate the findings of Joshi *et al.* (1997). Prasad and Srivastava (1991) also recorded higher LER values for intercropping treatments.

Table 1. Soybean, pigeonpea and soybean-equivalent yield (q/ha) as influenced by intercropping patterns of planting

Treatment	Yield (q/ha)								
	1995		1996		1997		Pooled		Soybean-equivalent yield
	Soybean	Pigeon-pea	Soybean	Pigeon-pea	Soybean	Pigeon-pea	Soybean	Pigeo-pea	
Sole soybean (T_1)	30.62		32.38		33.15		32.05		32.05
Sole pigeonpea (T_2)		15.58		19.58		19.47		18.21	31.42
Alternate planting of soybean and pigeon-pea (T_3)	26.54	2.91	30.61	3.34	31.39	3.61	29.51	3.29	35.19
2 rows of soybean + 2 rows of pigeon-pea (T_4)	22.78	5.11	24.36	6.87	24.95	6.77	24.03	6.25	34.79
Paired planting of soybean (30/90) + 1 row of pigeonpea (T_5)	29.70	1.50	30.41	3.45	32.43	4.74	30.84	3.23	36.31
Soybean and pigeon-pea planting in 2:1 row proportion (T_6)	28.81	4.38	30.00	4.06	27.03	8.17	28.61	5.54	38.09
Soybean and pigeon-pea planting in 3:1 row proportion (T_7)	27.72	6.08	31.47	4.37	31.79	6.50	30.32	5.65	40.14
CD (P=0.05)	3.59	1.19	2.11	0.56	2.14	0.69	1.75	0.56	1.11

Table 2. Effect of intercropping patterns of planting on LER and its economics (average data of 3 years)

Treatment	LER	Gross returns (Rs/ha)	Net returns (Rs/ha)	Benefit: cost ratio
T_1	1.00	30,028	18,348	2.57
T_2	1.00	29,466	17,555	2,47
T_3	1.10	33,035	18,840	2.33
T_4	1.09	32,634	20,794	2.76
T_5	1.14	34,115	20,839	2.57
T_6	1.20	35,665	23,783	3.00
T_7	1.26	37,579	25,744	3.18

Details of treatments are given in Table 1

Sale price of soybean (Rs/q) : 850, 975, and 980; sale price of pigeonpea (Rs/q) : 1,600, 1,650 and 1,650 in 1995, 1996 and 1997 respectively

Net returns

Based on the average data of 3 years, planting of soybean and pigeonpea in 3:1 row proportion gave the maximum gross as well as net returns. Dubey *et al.* (1991) reported 32% more net returns due to planting of pigeonpea and soybean compared to sole pigeonpea. Similar results were also observed by Joshi *et al.* (1997). Planting of soybean and pigeonpea in 3:1 row proportion exhibited the highest benefit : cost ratio of 1 : 3.18.

Thus intercropping of soybean with pigeonpea is more remunerative. Soybean and pigeonpea may be planted in 3:1 row proportion to get higher returns than sole cropping of either soybean or pigeonpea.

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