

INTERCROPPING FOR HIGHER RETURNS UNDER SEMI ARID TROPICS*

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Intercropping of greengram (S-9), sorghum (CSH-6), redgram (UPAS-120) and soybean (Bragg) with two plant populations for each component crop (50 and 100% of their normal population) in a paired row system was studied on sandy loam soil at Dryland Research area of Haryana Agricultural University, Hissar, during *Kharif* 1979 and 1980. Highest gross returns were obtained from sorghum+redgram (Rs. 6512.72/ha) followed by redgram+greengram (Rs. 6477.56/ha) in 1979 whereas in 1980, sorghum+greengram (Rs. 5937/ha) gave highest returns followed by redgram + greengram (Rs. 5234.12/ha). Normal population of both the component crops in intercropping system gave higher returns.

Intercropping systems are unique features of traditional subsistence farming in the tropical and subtropical regions. In the Indian context, mixed cropping, intercropping and monocropping are age-old practices (Chowdhury, 1979). Crop mixtures/intercrops have several benefits e.g., risk distribution, better utilization of labour resources and natural endowments, better quality product, higher productivity/income.

For well-known reasons of energy requirements, the productivity of cereals in physical terms, is higher than that of grain legumes/oil seeds. In case of grain legumes/oilseeds the comparative loss in production is more than compensated by the two to three times higher prices. Hence even a small reduction (25% or more) in the yield of 'high value' component considerably lowers the total income from an

intercropping system compared with the total income from either of the two sole crops (Chowdhury, 1979).

Many experiments have showed that intercropping in sorghum has given higher returns than sole cropping Satyanarayan and Raddi, 1979).

Different workers have also indicated that intercropping of grain pulses (greengram, blackgram and soybean) in redgram have given higher returns (Saxena and Yadav, 1979).

MATERIALS AND METHODS

The experiment was conducted at Haryana Agricultural University, Hissar during *kharif* 1979 and 1980. The rainfall during the experimental period of 1979 and 1980 were 341.2 and 198.4 mm respectively. The soil

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of the experimental field was sandy loam, poor in nitrogen, medium in phosphorus and rich in potassium.

The experiment was laid out in factorial randomised block design with three replications. The gross plot size was 6m x 5 m and net plot size was

3m x 5 m. The treatments consisted of sole crops of sorghum (CSH-6), redgram (UPAS-120), greengram (S-9) and soybean (Bragg) each at 100 per cent (normal population) population (1.8, 1.0, 2.0 and 4.0 lakh/ha respectively).

Intercrop combinations were :

Sorghum + Redgram (PR)	X	100% + 100%	} of normal plant population
Sorghum + Greengram (PR)		50% + 50%	
Sorghum + Soybean (PR)		100% + 50%	
Redgram + Greengram (PR)		50% + 100%	
Redgram + Soybean (PR)			

PR = Paired row (30/90 cm)

The total number of treatments were twentyfour.

The experiment was sown on 17th July during 1979 and 1980. The sole crop had twelve rows spaced at 50 cm whereas the intercropping treatments had five pairs of each component crop alternated with each.

100 : 100 } The first digit refers to the
50 : 50 } base crop and second to
the intercrop.

100 : 50 } These figures represent per
50 : 100 } cent of their normal
population.

Gross returns in rupees per hectare were calculated for all the sole crops and intercropping treatments by taking into consideration the following approved market rates paid by Director of Farms, HAU, Hissar.

	1979		1980	
	Rupees / quintal)			
	Grain	Straw	Grain	Straw
Sorghum	150	27	150	28
Redgram	225	5	265	7
Greengram	380	5	400	7
Soybean	200	5	200	7

Table 1. Grain yield (q/ha) of base crops of sorghum and redgram as influenced by intercrops and plant population.

With base crop of:		Sorghum			Redgram	
		1979				
Sole sorghum = 17.83					Sole greengram = 14.41	
Sole redgram = 12.38					Sole soybean = 15.61	
		Intercrops			Intercrops	
		RG	GG	SOY	GG	SOY
Pl. Popl.	100:100	17.33(5.64)*	17.86(3.88)	16.71(2.12)	8.29(9.88)	13.02(7.10)
(%)	50 : 50	16.02(5.89)	10.77(4.20)	8.11(3.67)	9.63(10.31)	11.79(7.17)
	100 : 50	17.70(3.51)	14.98(4.01)	12.66(2.13)	12.42(9.25)	11.01(4.86)
	50 :100	13.83(11.68)	8.81(5.91)	13.89(4.66)	11.42(11.74)	13.02(6.24)
		1980				
Sole sorghum = 15.63					Sole greengram = 10.56	
Sole redgram = 6.21					Sole soybean = 1.91	
Pl. Popl.	100:100	11.12(1.14)	11.07(6.60)	20.16(0.84)	4.89(10.01)	4.04(0.62)
(%)	50 : 50	9.27(1.95)	4.99(5.46)	8.91(0.56)	4.09(9.40)	4.19(1.08)
	100: 50	5.64(0.67)	8.98(4.64)	9.52(0.30)	4.04(8.46)	2.98(0.31)
	50 :100	7.48(1.24)	7.80(7.46)	10.34(1.10)	2.26(11.25)	4.18(0.95)

*Values in bracket indicate grain yield of intercrops

I = Intercrop; RG = Redgram, GG=Greengram; SOY = Soybean; Pl. Popl=Plant population.

RESULTS AND DISCUSSION

Returns during second year were less than first year because of drought and reduced yields. Averaging the gross returns over two seasons, it was observed that sorghum+greengram and redgram+greengram combinations gave better economic returns. Sorghum + redgram and sorghum + soybean combinations were less remunerative. Greengram crop possesses two special attributes. It is stable in production on one hand and sells at a higher market rate on the other

hand. Probably the stability in production of greengram is due to the fact that it escapes the drought as rains are received till mid August. Later on in the event of drought with one supplemental irrigation at the time of flowering, it can give satisfactory yield and higher returns. When it is combined with sorghum, no doubt, its yields are reduced but it is compensated by sorghum which fetches higher returns due to its higher straw as well as its grain yield. In the first year due to the better performance of redgram, sorghum + red-

Table 2. Gross returns (Rs./ha) of different cropping systems as influenced by intercrops and plant population

With base crop of :		1979			1980	
		Sorghum			Redgram	
Sole sorghum = 5527.59					Sole greengram = 5655.55	
Sole redgram = 2970.50					Sole soybean = 3245.15	
		Intercrops			Intercrops	
		I	I	I	I	I
		RG	GG	SOY	GG	SOY
Pl. Popl.	100:100	6528.60	6542.93	5593.34	5795.35	4527.35
(%)	50 : 50	5979.70	5399.46	4090.24	6299.35	4241.65
	100: 50	6105.00	5892.91	4763.54	6533.00	3585.90
	50 :100	7437.59	5443.43	5624.11	7282.55	4330.35
	Mean	6512.72	5819.68	5018.30	6477.56	4171.31
		1980				
Sole sorghum = 4695.10					Sole greengram = 4428.33	
Sole redgram = 1936.15					Sole soybean = 509.19	
	100:100	4927.46	7145.58	6441.12	5612.40	1409.01
	50 : 50	3966.23	4727.93	3965.91	5182.65	1496.31
Pl. Popl.	100: 50	2973.89	5706.06	4577.17	4759.87	1037.55
(%)	50 :100	3281.10	6169.02	4325.30	5381.56	1499.65
	Mean	3787.17	5937.14	4827.37	5234.12	1360.63

I = Intercrop; RG = Redgram; GG = Greengram; SOY = Soybean; Pl. Popl. = Plant population

gram, followed by redgram+green-gram combination gave the highest returns. But during 1980, there was drastic reduction in redgram yield. As such the total returns from sorghum + redgram also reduced. Similar was the case with redgram when grown with greengram. Soybean as an intercrop was not suitable due to its susceptibility to termites which devastated almost the whole crop in second year which was a drought year. So there is lot of risk in growing soybean due to uncertainty of the seasons

Among the plant population, 100 : 100 for redgram, greengram and soybean with sorghum gave the highest returns. The reasons may be that sorghum as a dominant crop would suppress the yields of intercrops and thus they may not be able to add much to the gross returns. Whereas intercropped sorghum would yield more or less same as its sole crop. Thus the greater portion of the returns is obtained by sorghum when it is at its normal population. In case of redgram, greengram as an intercrop

at 50 : 100 plant population gave the maximum returns. It may be due to higher yields of greengram at its full population and also to lesser intercrop competition as redgram is at 50 per cent of its normal population. Although redgram + soybean gave higher returns at 100 : 100 plant population, it may not be a suitable intercropping system due to uncertainty of soybean performance. Next best population among the different cropping systems would be 50 : 100 for main and intercrop but 100 : 100 is the best combination in case of redgram and greengram.

Calculation of Land equivalent ratio (LER) is one of the ways to assess the intercropping advantages (Willey, 1979). Merely based on LERs if one

is to select a combination, it might give a wrong picture. LER for sorghum + greengram combination would be quite low. But this combination gave high returns. On the contrary, redgram + soybean combination during 1979 would indicate a higher LER but its returns were the poorest. Thus the LERs would only indicate the yield advantage over their sole crops with respect to the grain yield and not the returns in all the cases.

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REFERENCES

- CHOWDHURY, S. L. 1979. Paper presented at the International Workshop on Intercropping, 10-13th January, 1979. Proceedings of the International Workshop on Intercropping, Hyderabad, India.
- SATYANARAYAN, D. V. and M. R. REDDI. 1979. Studies on intercropping in grain sorghum. *Indian J. Agron.* 24 : 223-224.
- SAXENA, M. C. and D. S. YADAV. 1979. Parallel cropping with short duration pigeonpea under the humid subtropical conditions at Pantnagar. *Indian J. Agric. Sci.* 49:95-99.
- WILLEY, R. W. 1979. Intercropping-Its importance and research needs. *Field Crop Abst.* 32 : 1-10 and 73-85.