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Performance of Soybean and Some Other Crops as Intercrop with Paired Row Transplanted Sugarcane

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ABSTRACT

Experiments were conducted at the Bangladesh Sugarcane Research Institute farm, Ishurdi, Pabna during 1992-93 and 1993-94 cropping seasons to investigate the suitability of soybean and some other pulses and oil seed crops as intercrop with paired row transplanted sugarcane. Results of the studies indicated that these intercrops help earn additional economic return and add about 3.5 to 4.5 t ha^{-1} biomass to soil which is useful for maintaining soil organic matter and ultimately sustainable productivity of soil.

INTRODUCTION

Intercropping of short duration field crops with sugarcane increases total productivity per unit area of land which lead to increase food production and farmers' income. This system makes possible to produce higher yield through better utilization of sunlight, land and water (Nankar, 1990).

Sugarcane is a long duration field crop, planted in widely spaced rows. Crop growth for the first 12 week is slow, and this crop does not require first earthing up until 12-16 week after planting. To take the advantage of the slow initial growth and less lateral spread across the vacant space between rows of sugarcane, one or two crops can be grown simultaneously with sugarcane. The practice of intercropping may be more effective and economic by adopting paired row system of spaced transplanting technique for sugarcane which helps obtain desired number of plant population of sugarcane and increases space for accommodating higher number of intercrops population. The system also facilitates for growing a second intercrop after harvesting of the first one. Various rabi crops such as wheat, potato, onion, cabbage, garlic, peas, radish, turnips, raya, mustard, berseem, senji, gram, linseed, lentil, coriander and tobacco were tried to grow as intercrop with sugarcane with varying success (Rathi *et al.*, 1974; Akhade *et al.*, 1975; Rathi and Tripathi, 1975; Behi and Nawal, 1977; Tripathy and Singh, 1977; Verma *et al.*, 1981 and Imam *et al.*, 1990).

Considering the importance a good number of pulses and oil seed crops has been tried in Bangladesh to accommodate in intercropping pattern with sugarcane. Pulses and oil seeds have similar land requirement and planting time as demanded by sugarcane. The growing need of the pulses and oil seed crops can be meet up by accommodating them in intercropping system without utilizing further land for those crops. Soybean has been emerged as a potential intercrop among the leguminous crops. It contains 40-45% protein and 20-22% oil. It produces about 3.5 to 4.5 t ha^{-1} biomass which may be incorporated in the soil to partially replenish the depleted soil organic matter. The crop is also capable of fixing atmospheric nitrogen through the nitrogen fixing bacteria available

in the nodules of the crop. In view of the above consideration, an investigation was conducted at the Bangladesh Sugarcane Research Institute (BSRI) Farm.

MATERIALS AND METHODS

Experiments were conducted at the Bangladesh Sugarcane Research Institute farm, Ishurdi, Pabna during the 1992-93 and 1993-94 cropping seasons. The agronomic practices used for these studies were as follows: After preparation of the land, sugarcane settlings raised in polybags were transplanted in November for each cropping year with 45cm interplast spacing for pair rows of 60 cm spacing while spacing between two paired rows was 140 cm. Simultaneously, the soybean, peanut, linseed, mutard, lentil, pea and kheshari as first intercrop and sesame, summer mungbean and sesbania were planted as second intercrop after harvesting of first intercrop. Each crop received fertilizers and cultural practices according to recommendation. The experiments were fitted in the randomized complete block design with three replications. Informations on various treatments in each experiment are presented in the Table 1.

Table 1. Summary of the experimental details.

Experiments	Year	Treatments
Expt. 1. Comparative performance of different oil seeds and green manure (GM) crop as intercrop with paired row transplanted sugarcane.	1992-93	T-1. PRC* control T-2. PRC + (3 lines soybean - *Sesbania rostrata* as GM) T-3. PRC + (3 lines peanut - *Sesbania rostrata* as GM) T-4. PRC + (3 lines sesame - *Sesbania rostrata* as GM) T-5 .PRC + (3 lines linseed- *Sesbania rostrata* as GM)
Expt. 2. Comparative performance of different oil seeds and summer mungbean as intercrop with paired row transplanted sugarcane.	1993-94	T-1. PRC* control T-2. PRC + (3 lines soybean - summer mungbean) T-3. PRC + (2 lines mustard - summer mungbean)
Expt.3. Comparative performance of different pulses and sesame as intercrop with paired row transplanted sugarcane.	1993-94	T-1. PRC* control T-2. PRC + (3 lines soybean - sesame) T-3. PRC + (3 lines lentil- sesame) T-4. PRC + (3 lines kheshari - sesame) T-5 .PRC + (3 lines pea - sesame)

*PRC - Paired Row Cane.

Analyses of data collected in each year were done separately. The yields of all crops on a particular combination were converted to the cane yield and has been designated as adjusted yield. Partial budget analysis (Horton, 1982) was used to compare the intercropping technique on net income against that derived from sugarcane alone. All variable costs related to intercropping treatments which differed from those of sole cane production, were included in the analysis. Total returns were calculated on the basis of yield and the local market price. Net benefits, difference between the extra return attributable to intercropping, and the extra variable costs involved, are presented.

RESULTS AND DISCUSSION

The results of the experiments are presented in the Table 2. It is evident from the table that no significant adverse effects of intercropping was found in any experiment on the yield of sugarcane, it might be due to adjustment of the spacing of sugarcane

maintaining constant population, while the increased space for intercrops between paired cane rows, had minimal effects on the final cane yield (Imam *et al.*, 1990).

Table 2. Yield and economics of intercrop combination with sugarcane.

Experiments	Treatments	Yield (t ha^{-1})				Net benefit Taka ha^{-1}
		Sugarcane	Intercrop		Adjusted	
			1st	2nd		
Expt. No.1	T-1. PRC* control	79.7	-	-	79.7	-
	T-2. PRC + Soybean -*S. rostrata* as GM)	86.2	0.6	12.6	97.1	10400
	T-3. PRC+ (Peanut - *S. rostrata* as GM)	78.4	0.5	8.0	86.7	1000
	T-4. PRC+ (Sesame-*S. rostrata* as GM)	85.6	0.4	11.0	92.6	6600
	T-5 .PRC+ (Linseed- *S. rostrata* as GM)	76.8	0.5	10.5	87.9	2200
	LSD(5%)	NS				
Expt. No. 2	T-1. PRC * control	80.0	-	-	80.0	-
	T-2. PRC + (Soybean -summer. mungbean)	82.0	0.5	0.20	93.0	7000
	T-3. PRC + (Mustard - summer mungbean)	79.0	0.3	0.20	85.0	500
	LSD (5%)	NS				
Expt. No. 3	T-1. PRC * control	84.0	-	-	84.0	-
	T-2. PRC + (Soybean - sesame)	80.0	0.34	0.10	96.8	6300
	T-3. PRC + (Lentil- sesame)	96.0	0.11	0.10	99.4	9400
	T-4. PRC + (Kheshari - sesame)	86.0	0.34	0.10	90.1	100
	T-5 .PRC + (Pea - sesame)	88.0	0.31	0.11	95.7	4700
	LSD (5%)	NS				

Note: Price (Taka kg^{-1}) Sugarcane = 1.00 Soybean = 16.00 Peanut = 15.00 Sesame = 14.00
Mustard = 10.00 Lentil = 18.00 Khashari = 8.00 Pea = 20.00
Sesbania (GM) = 0.10 Linseed = 20.00 Mungbean = 15.00

The highest cane yield was obtained from the T_2 treatment where soybean was the first intercrop followed by *S. rostrata* as second intercrop. However, sugarcane yield did not differ significantly over control and other intercrop combinations. Among the different intercrops combinating, soybean showed the best performance in the first and second experiment while lentil was the best in the third experiment. *S. rostrata* as second intercrop produced 8 to 12 t/ha green matter which was incorporated in the soil. Considering the adjusted yields (where other crops yields were converted into cane yield), it is noticed from the experiment No. 1 that better intercrop combination was PRC + Soybean-S. rostrata as GM (97.1 t ha^{-1}), followed by PRC + Sesame - *S. rostrata* as GM (92.3 t ha^{-1}); in the experiment No. 2, PRC + Soybean - Summer munggean (93,6 t/ha) followed by PRC + Mustard - Summer mungbean (85.0 t ha^{-1}); and in the experiment No. 3 the best intercrop combination was PRC + Lentil-Sesame (99.4 t ha^{-1}) and followed by PRC + Soybean - Sesame (96.8 t ha^{-1}). Pure stand paired row cane produced the lowest adjusted yield in all the experiments.

Economic analyses of the experiments indicated that intercropping soybean, peanut, sesame, linseed, mustard, lentil and pea crops resulted in higher additional income over growing sole cane crops. The highest net benefit (Tk. 10400 t ha^{-1}) was earned from the treatment PRC + Soybean - *Sesbania rostrata* as GM and the lowest (Tk. 1000/ha) was from the PRC + Peanut - *Sesbania rostrata* as GM under the experiment No. 1. In the experiment No. 2, combination with soybean also earned the highest net benefit (Tk. 7000 ha^{-1}) and the lowest was from the combination with

mustard (Tk. 500 ha^{-1}). PRC + Lentil - Sesame performed the best in relation to net benefit (Tk. 9400 ha^{-1}) followed by PRC + Soybean - Sesame (Tk. 6300 ha^{-1}), and the lowest net benefit (Tk. 100/ha) was from the PRC + Kheshari - Sesame under the experiment No. 3.

The profitability of intercropping soybean over other intercrop combinations tested in all experiments under paired row transplanted sugarcane is clear (Table 2). In all experiments sowing of soybean as an intercrop with sugarcane significantly did not reduce the yield of the sugarcane compared to sole cane. Further more, in the experiment 1 and 2 sugarcane yield was increased by intercropping soybean, although it was not significant.

Beneficial effects of intercropping soybean with maize has been reported elsewhere (Fengchao *et al.*, 1985; Zhiming, 1985; Bo-Hang and Xun-Zhog, 1985 and Yan-Zhang, 1985). They reported that maize-soybean intercropping has been adopted extensively in China. The experimental result indicated that soybean has the potential for growing as intercrop with sugarcane to maintain sustainable agricultural production and will also protect the rapid depletion of soil organic matter leading to improve which intern will sustain the productivity of the soil.

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