



FEASIBILITY OF SUGARCANE BASED INTERCROPPING SYSTEMS FOR SUBTROPICAL INDIA

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Abstract

Now days there is great need in country to increase agricultural production and productivity through more intensive cropping systems. In sugarcane farming systems, improving productivity is of paramount importance considering the mounting cost of production with consequent decreased profit margin to the farmers and millers and the need for higher production with serious limitations for expansion of area under the crop. Intercropping in sugarcane (*Saccharum officinarum* L.) assumed also great importance as it gives early cash to the farmers. Intercropping with sugarcane is not only a profitable proposition, but a useful technique of utilizing the natural resources. Instead of allowing weeds to grow and compete with sugarcane, growing of another short duration crop in between two rows of cane has become an adoptable practice, wherever labour and irrigation facilities are available. Research studies clearly indicated that for successful intercropping with sugarcane, there are certain requirements as (i) intercrops should be short duration and complement with sugarcane, (ii) shading effect of intercrops on sugarcane should be minimum and (iii) the time of peak nutrient demands of intercrops should not overlap with sugarcane.

Key words: Feasibility, Sugarcane, Intercropping, Subtropical India.

FEASIBILITY

As we know, sugarcane is grown in subtropical states the rows of cane ranging in width from 60 to 120 cm, the most common being 90 cm. The initial growth of sugarcane is slow and it takes about 90 to 120 days for complete canopy closure in subtropical belt. During this initial 3 to 4 months period, much of the solar radiant energy and land is wasted. During the formative phase of sugarcane, the mean light interception is less than 30 percent (Ramanujan and Venkataramana, 1999) and upto the 70 percent of the land between cane rows is left unutilized. The sugarcane rhizosphere occupies less than one – third of the soil during this period. In the interspaces, weeds grown and affect the sugarcane tillering and growth (Sundara, 1987, 1998). During this period we can profitably exploit the three valuable natural resources (radiant energy, soil and space) by growing short duration inter crops. Planting of cane in autumn season gives about 15–20% higher cane yield and 0.5 units higher sugar recovery than spring cane (Verma *et al.*, 1981). During

3-4 months after planting the sugarcane crop renders ample scope for intercropping with some rabi cereals like wheat, pulses, oil seeds, green manures, spices and vegetables etc. and these had been tried by earlier researchers and found more remunerative. Apart from these crops also possess peculiar odour, which may serve as a repellent to the insects pests of sugarcane. Tiwari & Om Prakash (1980) and Verma *et al.*, (1981), observed a significant reduction in top borer incidence when spices were intercropped with sugarcane.

Merits with intercropping in sugarcane:- Several outcomes can be derived by intercropping in sugarcane. They are given below as:

- (a) Intercropping provides additional employment for the farm family and / or to the agricultural labourers.
- (b) Farmers can get extra income and need for other food crops (cereals, pulses, vegetables and spices) could be met partly or in full by intercropping.
- (c) Effective use of crop production resources *viz.*, radiant energy, land space and water can be utilized.

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Table 1: Intercropping of vegetables with autumn cane.

Treatments	Intercrop yield (q/ha)	Cane yield (t/ha)	% increase or decrease in cane yield	Net profit (Rs/ha)
Autumn cane alone	-	91.91	-	151143
Autumn cane + Cauliflower	180.20	93.69	(-)0.87	188219
Autumn cane + Cabbage	222.20	94.19	(-)0.34	192851
Autumn cane + K. Khol	259.20	92.54	(-)2.08	200514
Autumn cane + Turnip	329.00	92.01	(-)2.65	196982
Autumn cane + Carrot	-	-	-	-
Autumn cane + Radish	400.00	84.92	(-) 10.15	176412
Autumn cane + Potato	288.10	102.39	(+)8.38	227745

Source: Agronomy Division: U.P.C.S.R., Shahjahanpur (U.P)

Table 2: Intercropping of oil seed with sugarcane.

Treatments	Intercrop yield (q/ha)	Cane yield (t/ha)	% increase or decrease in cane yield	Net profit (Rs/ha)
Autumn cane alone	-	96.51	-	155310
Spring cane alone	-	83.47	-	129421
Autumn cane + Lahi	13.07	93.28	(-)3.35	174127
Lahi + Spring cane	14.92	73.58	(-) 23.76	136177
Spring cane + Moong	10.30	74.57	(-) 22.02	132720
Spring cane + Urd	14.92	73.58	(-) 23.76	136177

Source: Agronomy Division: U.P.C.S.R., Shahjahanpur (U.P)

- (d) In row interspaces the weed growth checked effectively.
- (e) Significant amount of our pulses and oil seeds production could be derived through inter cropping in sugarcane.
- (f) Leguminous intercrops fix atmospheric nitrogen and thus help sugarcane by enriching the soil with N and organic matter by their residues when incorporated into the soil.
- (g) Intercrops could help by improving soil physical

Table 3: Intercropping of spices with autumn cane.

Treatments	Intercrop yield (q/ha)	Cane yield (t/ha)	% increase or decrease in cane yield	Net profit (Rs/ha)
Autumn cane alone	-	95.65	-	153487
Autumn cane + Coriander	12.27	85.22	(-) 10.90	184912
Autumn cane + Ajwain	5.35	82.76	(-) 13.48	170233
Autumn cane + Saunf	20.62	86.22	(-)9.86	211316
Autumn cane + Mangrail	4.21	88.95	(-)7.00	168241
Autumn cane + Garlic	33.78	103.80	(+)8.52	236995
Autumn cane + Methi	16.71	80.99	(-) 15.33	197447
Autumn cane + Banarasi rai	5.58	80.86	(-) 15.46	163116

Source: Agronomy Division: U.P.C.S.R., Shahjahanpur (U.P)

condition and also help in utilization of nutrients available in various soil layers.

- (h) Certain intercrops (garlic, onion, mentha) help in controlling certain insect pests also.

Disadvantages with intercrops: There should be no disadvantages by intercropping if the intercrop and the sugarcane are managed properly. However, some difficulties that have been reported are:

- (a) Reduced tillering of sugarcane leading to reduced stalk population resulting in around 10 percent cane yield loss.
- (b) Difficulties in managing sugarcane with respect to irrigation manuring and weed control.
- (c) Additional labourers are required to manage sugarcane and harvest the intercrops.
- (d) If there is no addition provision for drainage then loss of nutrients and water are possible.

Suitable intercrops and research findings: A large number of experiments on intercropping has been carried out at U.P. Council of Sugarcane Research, Shahjahanpur (U.P) and also throughout the country since early sixties. Suitability of crops have been identified. Suitable intercrops for subtropical regions are given below.

(1) Pulses: Important pulse crops, namely, black gram, green gram, clusterbean and cowpea can be profitably intercropped during spring. Pea, gram, lentil, frenchbean during autumn season proved better in U.P.

(Rathi and Tripathi, 1974). Green gram and black gram have been reported to be suitable intercrops in Tamil Nadu, Andhra Pradesh, Maharashtra (Kannappan *et al.*, 1990).

(2) Vegetables: vegetables like radish, potato, turnip, knop – khol, cow pea, carrot, amaranthus, cauliflower, cabbage have been found to be compatible with sugarcane in tropical and subtropical region (Jayabal and chokalingam 1990 and Nankar, 1990). Among vegetables potato with one row recorded better profit and proved an ideal intercrop for subtropical region.

(3) Spices: Spices like garlic, coriander, black pepper, onion, ajwain, saunf, fennel, jeera, chillies, methi and rai Banarasi have been gave better net return compared to cane alone. Among spices garlic increased the cane yield (100.16 t/ha) about 8.25% and gave maximum net return of Rs. 84952 per hectare (Table 3). However, little works has been done so far to grow spices as inter crops with autumn planted sugarcane. As spices are highly remunerative and labour intensive, their intercropping in autumn cane may increase the income level as well as employment potential for small farmers. These crops also possess peculiar odour, which may serve as a repellent to the insect – pests of sugarcane.

(4) Green manures: Several investigations have been carried out on intercropping with green manure crops and in situ incorporation (Nasir Ahmed, 1999, Guru *et al.*, 2000). The results indicated positive influence on the cane crop. However, a recent study by this author on sunhemp intercrop showed increased shoots, stalk population and cane yield. But there was residual effect on the ratoon crop with higher cane yield in the plots where intercrop was incorporated in the plant crop.

Management of sugarcane based intercropping system

Management practice to be followed varies with the intercrop concerned. However, some of the important basic considerations are (1) spacing of sugarcane rows (2) spacing to be followed between sugarcane and intercrop rows (3) Intra or within the row spacing of intercrops (4) number of intercrop rows (5) rate and time of manuring (6) Intercultural operations (7) harvest of inter crop, (8) intercrop residue management and (9) most intercrops sugarcane management. Normal row spacing of sugarcane (120 cm) as well as growing of intercrop is ideal in subtropical region from the sugarcane crop management point of view. Under the intercropping system east – west row arrangement may be ideal to avoid mutual shading between the crops as far as possible. The total quantity of fertilizers nutrients applied is equal to the full requirement of sugarcane + requirement of the

intercrop. Timing and method of manuring, planting of the intercrop, other agronomic practices like irrigation, weed control etc. should be follow in best way on proper time. Harvesting of the intercrop in the earliest opportunity is the best so that the main crop can put its growth rapidly.

Economics of intercropping: It depends upon various factors such as any reduction in cane yield, the intercrop yield, its market price, etc. Managing intercropping system in such a way that there is no reduction in cane yield as compared to sole crop of sugarcane. Assured market with high value crop with not to high labour and input requirement must be choosed so that cost of cultivation is relatively low and thus higher net profit could be derived.

Constraints for low adoption of intercropping in subtropical region:

1. Due to labour scarcity timely operation with intercrops are not successful.
2. The intercrop management is somewhat an inconvenient practice.
3. Due to improper management cane yield loss is not covered by growing intercrop.
4. No concerted effect is made to popularize intercropping systems.

Conclusions

Intercropping is feasible in sugarcane by choosing appropriate intercrops and crop varieties and by suitable crop management practices as suggested in this article. Special emphasis must be given to manage sugarcane after the harvest of the intercrop.

Nutrients requirements should be fulfilled separately for sugarcane and intercrop. On the basis of various research findings it has been suggested that potato, garlic, french bean, and pea with autumn cane and moong, urd with spring cane could be profitable as compared to sugarcane planted alone in both the seasons. Wheat, maize, barley, radish with autumn cane and sunflower soyabean and cotton with spring sugarcane caused more detrimental effect on cane yield.

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