

Successful Sugarcane Crop with Intercropping

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Abstract: World population is increasing day by day to fulfil its' food requirements. An important strategy are been practised to utilise per unit area of available land. Intercropping, the agricultural practice of cultivating two or more crops in the same space at the same time, to match efficiently crop demands to the available growth resources and labour. The most common advantage of intercropping is the production of good crop yield on a same land by making more efficient use of the available growth resources. Sugarcane is a long duration crop and takes about 90-120 days for canopy development, which allows for growing intercrops during the early stage. Taking advantage of this, sugarcane cultivators grow various short duration crops like pulses, vegetables, etc. as intercrops to get interim return since small sugarcane grower's cannot wait for a long time to get financial return from sole sugarcane crop. Since sugarcane is an important commercial crop all over the world and is most suitable for intercropping, this review focuses on sugarcane based intercropping system.

Keywords: Sugarcane, intercrops, subtropics, intercropping financial returns, yield

1. Introduction

India is the second largest producer of sugar after Brazil. Over five million farmers are involved in the cultivation of sugarcane in tropical and subtropical India, the two distinct agro-climatic regions of the crop in the country. Subtropical region shares about 45% and 55% of the total sugarcane area and production in the country. Intercropping refers to growing two or more crops simultaneously on the same piece of land with a definite row-planting pattern to obtain higher productivity per unit area. Rapidly increasing population, increased demand for food, limited scope for extension of cultivation to new areas, diversified needs of small farmers for food and cash, etc. have necessitated the adoption of intercropping systems. In the case of sugarcane, much of the space between two rows of sugarcane remains unutilized for an initial period of 90-120 days, due to slow crop growth. Companion cropping offers an opportunity for profitable utilization of available space. Sugarcane growers take advantage of this and grow various short duration crops like cereals, pulses, vegetables and spices as intercrops to obtain interim return. Small sugarcane growers need not wait until the harvest of the sole crop to obtain financial returns. Intercropping of economically important short duration crops with sugarcane through utilization of the present limited land resources would help to sustain sugarcane cultivation and provide interim return to marginal and small farmers, besides meeting the ever-increasing demand for vegetables and pulses. In this review, information on various aspects of intercropping in sugarcane is presented.



Scope for intercropping in sugarcane

Great potential exists in India for increasing crop production and productivity through wider use of multiple cropping. In long duration crops like sugarcane, intercropping holds much promise. Due to slow establishment of sugarcane during the first 90-120 days, the greatest scope for complementary effect lies in the addition of annual intercrops to the temporal system to improve resource use efficiency in the early crop growth period. Vegetables, Legume intercrops in cropping systems enhance soil fertility through the excretion of amino acids into the rhizosphere. The nitrogen fixed by the legume intercrop may be available to the associated sugarcane in the current season itself, as sugarcane remains in the field for over nine months after the harvest of the legumes. A further possibility of soil fertility improvement is through addition of crop residues, which on decomposition adds to the fertility of the soil. Since considerable addition of nutrient occurs through intercrop, there is a possibility of reducing N application through fertilizer. In general; the optimum row spacing recommended for sugarcane is 90 cm which is widely followed in tropical India. Reduced row spacing is often preferred to accommodate higher cane population and increase cane yield in short duration and early maturing varieties. With the introduction of very high tillering and high yielding varieties of sugarcane, there is a possibility to adopt wider row spacing and still sustain cane productivity. Such wide row spacing permits intercropping without adversely affecting the cane yield and thus increases the overall productivity and profitability of the system. The present problem of labour shortage may worsen in future affecting the survival of sugar industry and cane growers. Wide row spacing becomes an important agronomic consideration in future in developing countries (Ma. For example, 150 cm row spacing was successfully attempted in the cane area of Uttar Pradesh state, India, which recorded higher yield than 75 cm row spacing. High tillering and low tiller mortality in wide row spacing helped achieve such high yields in spite of the lower seed rate used. Wide row spacing of 150 cm is preferable for sugarcane based intercropping systems.

Sugarcane based intercropping systems in Subtropical region

In the subtropical region, sugarcane is normally planted in autumn (September- October), i.e. before the onset of winter or during the spring season (February-April), i.e. after the cessation of winter. The cane planted in the autumn season germinates before the onset of winter and remains in the field without much growth until the spring sets in. During this period, the cane does not make much demand for the growth resources. This facilitates rising of any Rabi crop as intercrop with autumn planted sugarcane. Several studies demonstrated that the total productivity of crops in sugarcane + rabi crop intercropping system is substantially higher than the total productivity of crop in winter followed by sole sugarcane planted in spring season

Intercropping in Sugarcane

Different crops are being cultivated as intercrops at various locations though not all crops are ideal soils. The crop should put forth its biomass early and cover the land surface so that weed growth is minimised and essentially it should come to harvest within 75-80 days of sugarcane planting. Most important is that at which time which crop is favourable for intercrop For example sowing is in autumn and spring, so we need to plan according to season of sowing.

2. Experimental Details

Time of sowing/planting

T1 solo sugarcane

T2 Sugarcane+ Potato second week October autumn sowing

T3 Sugarcane+ Onion second week of October autumn sowing

T4 Sugarcane +Chilly February spring sowing

Treatments comprising three cropping systems viz. sole sugarcane, sugarcane + potato, sugarcane + onion, and were tested in randomized block design with three replications. Autumn cane was planted in second week of October. , Two rows of onion and one row of potato were sown in between two rows of sugarcane on second week of October. Sugarcane was fertilized with 200:80:80 kg of NPK. Whereas, intercrops were fertilized on the basis of their



Potato has been reported to be promising intercropping autumn planted sugarcane in subtropical India with row spacing of 150 cm row to row in sugarcane crop. The results of the experiments carried out on the effect of intercropping of potato in sugarcane were reviewed by Rathi and Singh (1979). There have been several studies on intercropping of potato in sugarcane in Uttar Pradesh (Yadav and

population ratio in sole and intercropping situations with RDF. Other operations were done as per recommended package of practices for the respective intercrops. Sugarcane was given with full phosphorus and potassium and half nitrogen as basal and remaining half nitrogen top dressed in four three splits after harvest of intercrop

3. Intercropping in Autumn Sugarcane

1) Sugarcane + onion



Onion as a spice and vegetable was evaluated as intercrop with cane row of 150 cm row to row. The yield of onion could be increased under paired row system of cane plantation by accommodating higher intercrop population compared to the single row system. The yield of onion under paired row systems was 4.4 t/awhile it was 2.25 t/ha under single row system. Intercropping onion with paired row cane showed the highest potential for increasing the net returns per unit area. Compared to other crops, onion exerted least detrimental effect on the emergence, tiller, millable cane and yield of sugarcane. Higher yield of cane due to intercropping with onion was reported. Growing of onion in the intercropping system with sugarcane was also studied in Indonesia (Darmodjo 1991) and Egypt (Zohry 1999).Therefore, cultivation of short duration spices and vegetables like onion, garlic and coriander as intercrops in sugarcane can be a successful package as it provides the needed income during the early stages and increases the total productivity without affecting the cane yield in the system

2) Intercrop Sugarcane +potato

Prasad1991, Karanjeet Singh Dhaliwal2016), Punjab (Kanwar et al. 1990), Maharashtra (Nankar, 1990; Solanke et al. 1990), Madhya Pradesh (Sharma and Dubey 1994).

Intercrop of potato + sugarcane is quite profitable ,if we plant sugarcane with a distance of 150cm row to row its easy

to take one row of potato as intercrop both crops dose not disturbed each other in yield .

Both the corporate sector and small growers are involved in potato production, the former accounting for about 52% of production. About 42% of the potato is produced by small growers who do not have land and who rent interrows of sugar cane from sugar estates.

Potato is planted in every interrow of plant cane, and in alternate interrows of ratoon cane, and is harvested before the cane canopy closes. The potato does not reduce cane yields, nor does cane reduce potato yields. A package of husbandry practices has been developed and has been widely and rapidly adopted. The system is easy to manage, and most cultural practices are, or can be, mechanized.

Important is harvesting of potato take place after 80 days of sowing. After potato harvesting all sugarcane operations are easy to be done.

3) Intercropping in spring

Sugarcane +Chilly



Chilly: It is known as the most valuable crop of India. It is used as a principle ingredient of various curries and chutneys, also used in vegetables, spices, condiments, sauces and pickles.

Sugarcane practice with intercrop chilly was been practiced in spring season and got great results as chilly crop is harvested in 110-120 days.

Intercrop of chilly + sugarcane is quite profitable ,if we plant sugarcane with a distance of 150cm row to row its easy to take one row of chilly as intercrop both crops dose not disturbed each other in yield.

Both the corporate sector and small growers are involved in chilly production, the former accounting for about 38% of production. About 20% of the chilly is produced by small growers who do not have land and who rent interrows of sugar cane from sugar estates.

Expanded trial programme

After the initial trials had indicated that there were indeed potential benefits to be gained from intercropping cane with food crops, the trial programme was expanded considerably to investigate these benefits under a number of different climatic conditions. Specific trial sites were chosen in areas where large numbers of small scale growers were based.

Table 1: Economic analysis of intercropping with sugarcane

Cropping system	Yield(t ha)		Return (Rs ha)		Net profit (rs ha)	% increase in profit
	Cane	Intercrop	Cane	intercrop		
T1)Solo sugarcane	77	-	242550	-	177560	-
T2)Sugarcane +potato	85	29.0	267750	232000	350500	197.1
T3)Sugarcane+onion	83	1.60	261450	60800	226500	92.11
T4)Sugarcane+chilly	84	1.5	264600	72000	220600	87.11

Sugarcane yield increase by 17-24 t/ha, whereas farmer earned additional profit ranging between 103000 to 233000(table 1)

Economic aspect:

The economics of different intercrops with sugarcane were worked out and are presented in the data revealed that cane + onion proved to be best combination, found similar results with sugarcane + onion, sugarcane + potato and many other crop combination. Maximum income increased 38% IN Uttar Pradesh respectively under sugarcane + onion intercropping system and the second highest income was 26.73% under sugarcane + potato intercropping revealed that the highest adjusted cane yield of 96.20 t ha⁻¹ at Palia kalan kheri was obtained

From the above discussion it is inferred that cultivation of short duration intercrops like onion and potato followed by sesame with sugarcane in paired row system were found profitable over sole planted sugarcane. Hence, both crop combinations may be suggested for achieving higher cane

yield as well as to get interim benefit from a same piece of land

Ready crop after taking Intercrop of **Karanjeet Singh Dhaliwal** in Palia kalan kheri, Uttar Pradesh



4. Conclusion

The review clearly brings out the positive effects of combining crops in sugarcane based cropping systems. Though there are overall biological advantages in intercropping system, most of the studies have indicated depressing effect of intercrops on the base crop of sugarcane. Although intercropping has been practiced traditionally for thousands of years and is widespread in many parts of the world, it is still poorly understood from an agronomic perspective and research in this area is far less advanced than comparable work in monoculture. This is due in part to the wide use of pure crop cultures in the developed world, in part to the relative lack of resources in the developing world, but not least to the complexity of the problems involved. Thus, more research is needed to better understand how intercrops function and to develop intercropping systems that are compatible with current farming systems. For an intercrop combination to be biologically advantageous, agro-techniques such as fertilizer application, seed rate of intercrop and base crop, and selection of suitable genotypes must be taken care of to reduce the depressing effect of intercrops on sugarcane and to increase the productivity and profitability of the intercropping system.

References

- [1] **Imam, S.A., A. Ali and M.A. Razzaque, 1982.** Performance of intercropping with sugarcane under several crop combinations. *Bangladesh J. Sugarcane*, 4: 32-41.
- [2] **Kanwar, R.S., 1975.** Scope of inter cropping in sugarcane in north India. *Sugar News*, 7: 5-8.
- [3] **Miah, M.A.M., S.A. Sabur and M.S. Islam, 1994.** Comparative economics of sugarcane with intercrops in Jaipurhat sugar mill area. *Bangla. J. Sugarcane*, 16: 5-9.
- [4] **Muhammad, I.S., I.M. Ayaz and I. Ahmad, 2000.** A glance at the agronomic study of sugarcane intercropping with three other crops. *Pak. Sugar J.*, 15: 18-22.
- [5] **Rahman, M.S., M.F. Haq, M.S. Islam, M.K. Bashir, N. Ara and P.K. Sardar, 1994.** Sugarcane based intercropping in selected areas of Rajshahi sugar mills zone. *Bangladesh J. Sugarcane*, 16: 44-48.
- [6] **Roodagi, L.I., C.J. Itnal and R.B. Khandagave, 2000.** Influence of planting system and intercrops on sugarcane tillering and yield. *Indian Sugar*, 12: 605-609.
- [7] **SRTI Annual Report, 1979.** Annual report special issue, (1973-78). Sugarcane Research and Training Institute, Ishurdi, Pabna, pp: 33-48.
- [8] **Singh, V.S., K. Kothari and H.N. Tripathi, 1986.** Studies on intercropping in sugarcane in central Uttar Pradesh. *Indian Sugar J.*, 35: 559-562.
- [9] **Sinha, U.P. and K.C. Jha, 1990.** Intercropping of potato with sugarcane in relation to row arrangement and nitrogen levels. *Indian J. Agric. Sci.*, 60: 317-321.
- [10] **Verma, R.S., R.A. Yadav and K. Sing, 1986.** A new planting technique of potato for intercropping in autumn sugarcane. *Indian Sugar*, 36: 19-20
- [11] **Govinden N (1990).** Intercropping of sugarcane with potato in Mauritius: a successful cropping system. *Field Crops Res* 25(1-2): 99-110.
- [12] **Verma RS, Yadav RL (1988)** Productivity of sugarcane and potato in companion and sequential cropping systems. *Bharatiya Sug* 13(4):45-48.
- [13] **Singh V, Kotham SK, Tripathi HN (1986)** Studies on Intercropping in sugarcane in central Uttar Pradesh.
- [14] **Indian Sug 35(10):559-562 Kirtikar RL, Bhoj RL, Kapoor PC (1972)** Intercropping in Sugarcane with onion for higher production and better returns. *Indian Sug* 22:321-323.
- [15] **Imam, SA, Hossain AHMO, Sikke LC, Mid More DJ (1990)** Agronomic management of potato/sugarcane intercropping and its economic implications. *Fld Crops Res.* 25(1-2):111-122.
- [16] **Santanu G, Ray BR (2003)** Studies on intercropping on productivity and profitability of autumn planted sugarcane in West Bengal. *Indian Sug* 53(3):179-182.
- [17] **Cadersa Y, Cheong Wong Yen K and Govinden N (2001).** Potato clones with larger canopies do not affect the growth, yield or yield components of intercropped sugarcane. *Afr Crop Sci J* 9(1): 59-6
- [18] **Willey RW (1979).** A scientific approach to intercropping research. Proceedings of an International Workshop on Intercropping, ICRISAT, Hyderabad, India
- [19] **Temple SR (1976).** Adapting varieties for intercropped systems in the tropics. pp 235-254 In: RI Papendick, PA Sanchez and GB Triplett (Eds) *Multiple Cropping*. American Society of Agronomy, Madison, Wisconsin, USA
- [20] **Panwar BS, Singh BV, Sharma JC.** Feasibility of intercropping in autumn planted sugarcane. *Indian Sugar.* 1990; 39(10):751-756.
- [21] **Saini LK, Kapur ML, Singh Makhani, Singh S.** Relative profitability of intercropping vegetables crops in autumn planted sugarcane. *Indian Journal of Sugarcane Technology.* 2002; 17(1&2):26-28.
- [22] **Singh JP, Singh M, Gangwar KS, Singh P, Pathak JN.** Economic security in sugarcane production through intercropping. *Indian Journal of Sugarcane Technology,* 2002; 17(1&2):47-49.