

Enhancing income of sugarcane farmers in subtropical India: Potential technologies

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The rise in farmers' income in India has not been in line as compared to many other sectors. On account of small holdings and rising cultivation costs a large number of farmers cultivating cash crop like sugarcane, mostly procured by the sugar factories, are feeling the brunt. As the present business as usual approach is not sufficient to tackle these problems, new innovative ways of linking the technology/interventions in a holistic manner and its pro-active implementation in a participatory mode is required. The realisation about a shift from present strategy in the agricultural sector is on account of the explicit recognition about farmers' welfare that is directly linked with their income levels. It is also known that quantum of increase in farm productivity is not necessarily reflected in similar increase in farmers' income.

Key words: Cane seed, Post-harvest, Sucrose loss, Sugar recovery, Sugarcane

A considerable area in subtropical parts of Uttar Pradesh is devoted to sugarcane but realized farm income is low and state per capita income (₹ 40,373 at 2014-15 prices) is less than national average (₹ 86,879). The reasons include lower cane productivity; lack of diversified farming systems; small category size sugarcane cultivation and higher input cost, hence the profit margins are under stress. This calls for technology driven interventions and others in a holistic framework for faster delivery to the farming community. Based on our earlier results and interactions with farmers and millers, two such potential technologies that have promise in lowering cost of cultivation and minimizing post-harvest sucrose losses are presented in this paper.

Technologies

The improved technologies related to establishment of sugarcane and its post-harvest management have the potential to empower the farmers, especially the youth and

disadvantaged population for raising their income at a shorter timeframe besides faster adoption of superior varieties in a large area.

Transplantation of bud chip and STP technology based settlings: As most of the planting operations are done by women, improved planting technologies are effective in reducing drudgery, improving field performance and increasing spread of superior varieties.

The conventional practice in cultivation of sugarcane is by planting portions of cane stalk known as seed cane or cane sett that are 3 bud pieces. Huge quantity of cane stalks

cuttings (10-12 t/ha) is therefore required. This is one of the main expenditures for establishment of cane. Now, there are techniques based on bud chip settlings that address this issue and have the potential to reduce the cost of cultivation considerably.

Little part of stem with a bud is known as bud chip. The procedure of their use involves several steps for achieving higher success rates. Such chips are scooped out with an appropriate bud scooping device from freshly harvested cane (8-10 month old) of desired variety and having good intermodal length (7-8 cm) and

Table 1. Comparison of conventional, bud chip settlings and STP technology in sugarcane cultivation

Attributes	Conventional 3 bud setts planting	Bud-chip settling	STP technology
Requirement of cane seed (t/ha)	10-12	1-2	2-4
Seed multiplication rate	1:10	1:40	1:40
Food reserve (g sugar)	6.0-8.0	1.2-1.8	2.0-4.0
Tiller number per clump	1+2	1+5	1+6
Shoot population (lakh/ha)	0.75	1.4	2.5
Plant height (cm)	305.49	311.23	320.5
Leaf area index	3.36-4.96	3.48-5.62	3.94-6.24
Cane yield (t/ha)	70-75	90-95	105-120



Preparation of bud chip using bud-chippers, raising of settlings from bud chips in trays/cups and adjacent to planting farm, transplanting of 40-45 days old settlings and mature crop from bud chip technology.

free from diseases/pests. The chips are soaked in specially formulated plant growth regulator (PGR) solution for 2 hr. Soaking bud chips overnight in ethephon (2-chloroethyl phosphonic acid) @ 100 ppm and 0.1% calcium chloride solution promotes sprouting by over 90%. Thereafter, they are treated with fungicide/Bavistin (0.1%) for 20 minutes. Such chips are dried under fan and stored in polythene bags at low temperature ($10 \pm 1^\circ\text{C}$) if it is to be stored (8-10 days) for long distances.

Such pre-treated chips are planted in plastic cups/trays filled with soil mixture containing soil, organic matter and sand in a ratio of 1:1:1. Also, bud chip nursery may be raised in mini plots near the actual planting fields. The healthy settlings are ready in about 4-5 weeks for field

transplant. Under good management conditions establishment of such transplanted seedlings is high (90-100 %). A comparison of conventional and bud chip settlings is presented in Table 1.

Bud chip settlings apart from the food reserve, they are superior in other attributes and with careful execution of this technique the seed requirement is reduced to about 1 tonne/ha. Under STP (Spaced Transplanting) technique, settlings are raised in nursery beds using single bud sett placing them vertically. About 6-week-old settlings are transplanted vertically in fully fertilized and irrigated furrows at a spacing of 0.54 cm^2 ($90 \text{ cm} \times 60 \text{ cm}$). Such settlings are transplanted in field with wider spacing. This facilitates optimum utilization of abundant solar radiation falling in

the region and improved soil aeration enhances the tiller formations. In this technology synchronization of tillering is achieved and seed multiplication ratio increases from 1:10 to 1:40. Adoption of this technique has led to faster spread of new varieties.

A recent study from Odisha on farmers' field indicated that this improved method of field establishment along with standard package of practices recorded higher gross return of ₹ 271,320.00/ha, B:C ratio (3.86) and profitability (₹ 609.6/ha/day) with additional net return of ₹ 190,080/ha over local check of conventional method in that area (Table 2).

Management of post-harvest sucrose losses

The wide spread adoption of



Placing of single bud setts in vertical position to raise STP settlings and their transplanting

Table 2. Effect of improved method of sugarcane planting on farmers' profitability

Practice	Cost of cultivation (₹/ha)	Gross return (₹/ha)	Net Return (₹/ha)	B:C ratio	Profitability (₹/ha/day)
Improved practice (Bud chip method)	70150	271320	201170	3.86	609.6
Farmers practice (Conventional method)	83160	194250	111090	2.34	333.6

(based on sale price of sugarcane in 2013-14).

proven technology to minimize post-harvest sucrose losses in collaborative mode with sugar mill and other partners, including farming community will increase overall profitability. The quality of sugarcane juice at harvest is measured by high concentration of sucrose and low concentration of non-sucrose contents. The delay in cut-to-crush beyond 3 days results in considerable

loss in the sucrose content. Such post-harvest quality losses lead to low sugar recovery and affect mill profitability that has indirect implications to farmers in the form of non-payment for their produce in time and less expenditure towards corporate social responsibility (CSR) funds.

The post-harvest may be categorized into two categories,

primary and secondary. In the former category sucrose losses occur due to inversion process, delayed harvests (over stands) and delays in delivery to sugar mills from the fields. As per estimates, the sugar industry (mill capacity 5,000 TCD) loses profit to the tune of ₹ 3-5 lakh/ day on account of crushing stale cane beyond 3 days. In the latter category losses are on account of unhygienic processing of cane juice in the mills. The technology to avoid such losses to the maximum possible extent has been standardized at farm and factory level.

Farm level: Application of anti-bacterial and anti-inversion chemicals benzalkonium chloride (BKC) + sodium meta silicate (SMS) on harvested cane has considerable



Scenario of post-harvest losses of sucrose at different stages of cane transport: storage at cane centre and application of chemical formulation and covering with cane trash to avoid action of invertase, enzyme causing sucrose inversion

potential to improve sugar recovery. The aqueous formulation(s) are sprayed over freshly harvested cane (whole stalk and billets) and treated cane is covered by a thick layer of dried cane leaves (trash). Most effective formulation is a mixture of BKC and SMS. It improves sugar recovery over 0.5 units and is effective till one week. Spraying of QUAT (eg. BKC) based formulation and anti-inversion chemical, viz. SMS on harvested cane followed by covering with trash saved 0.5 to 1.0 unit of sugar recovery over control.

Factory level: The approach is based on an effective integrated mill programme. It involves regular thorough washing and steaming with hot water, application of biocide viz., Kilbact TM @ 20 ppm and treatment with dextranase enzymes to remove dextran. The issue of post-harvest sucrose loss is more evident in subtropical India. Proper management of these in light of available technologies will improve sugar recovery and better returns (10-15% over present) to the sugar farming community.

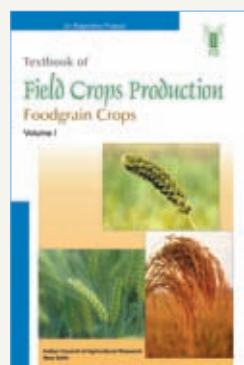
SUMMARY

A supply chain in sugarcane sector based on bud chip based planting material and wide scale adoption of available technologies in minimizing post-harvest sucrose losses will open up newer avenues for enhancing farmers' income. Such an effort will complement the on-going efforts on promotion of desirable superior varieties and other agronomical packages.

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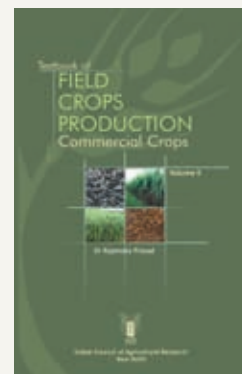
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