International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(3): 1726-1729

Received: 10-03-2019
Accepted: 12-04-2019

Kabita Mishra
Scientist (Agronomy), Krishi Vigyan Kendra, Ganjam-II, Berhampur, Odisha, India

Correspondence
Kabita Mishra
Scientist (Agronomy), Krishi Vigyan Kendra, Ganjam-II, Berhampur, Odisha, India

Evaluation of bud chip method for enhancing yield and economics of sugarcane

Kabita Mishra

Abstract
The present study was conducted by Krishi Vigyan Kendra, Ganjam-II during 2015 -16 in Rabi in village Giria under the jurisdiction of KVK, Ganjam-II. The KVK scientists has conducted frontline demonstration in sugarcane bud chip method with the active participation of farmers with the objective to demonstrate the improved technologies in crop. The results of demonstration showed that farmers could increase the sugarcane productivity notably by switching over to improved bud chip technology rather in conventional method. The demonstration results showed that the improved practice of bud chip method recorded 37.3% higher cane yield (122.6 t ha-1), extension gap (33.3 t ha-1) than farmer's practice of conventional method. The same also produced higher tillers plant-1 (16.8) and number of millable canes clump-1 (14.1) with survival 92.6%. The improved practice also recorded the higher gross return of Rs. 281980 ha-1, B:C ratio (3.94) with additional net return of Rs.210416 ha-1 over local check of conventional method which can effectively be replaced in the existing farming situation for higher productivity.

Keywords: Bud chip, cane yield, economics, extension gap, sugarcane

Introduction
Sugarcane (*Saccharum officinarum* L.) is an important commercial crop of India next only to cotton and it is one crop that spreads across both in the tropics and the subtropics. Sugarcane area hovers around 5 million ha every year with a cane production of 350 million tonnes or thereabout, ranking second in the world after Brazil. The sugar industry is expanding over the years tremendously. It is one of the most important agro-based industries in India. Sugarcane is a versatile crop and is one of the most efficient converters of solar energy into dry matter. Sugarcane is a significant crop in terms of its contribution to the national economy and livelihood support to millions of farmers. In India, sugar is a 550 bilillion rupees worth industry and more than fifty million sugarcane farmers and their dependents and a large mass of agricultural laborers are involved in sugarcane cultivation, harvesting and ancillary activity. (Sugar Economy 2011). Globally, it is cultivated on area 24.5 m ha with an annual production of 1850 m t with an average productivity of 75.5 t ha-1. India ranks 2nd in the world next to Brazil in terms of area (5.30 m ha) and production (366 m t) with an average productivity of 69.1 t ha-1 (27.1 m t sugar) contributing 19.98 per cent in world's total sugarcane production (Anon., 2015). India is 2nd largest consumer of sugar in the world (15.59 m t) and ranks 14 th in exports (0.21 m t) and 5th in the world for imports (0.67 m t). In India, Uttar Pradesh nearly occupies half (2.25 m ha) of the total area followed by Maharashtra (1.04 m ha). Tamil Nadu has highest productivity (105 t ha-1) followed by Karnataka (85.5 t ha-1) and Andhra Pradesh (71.8 t ha-1). Sugarcane is in great demand for various other uses like fodder, fibre, bio-fuels and co-generation. Sugar industry is 2nd largest industry (Rs. 30, 000 crore industry) in the agro-processing sector, next to textiles and represents the principal livelihood of 35 million farmers.

By 2030 AD, India will require nearly 33 million tonnes of white sugar for domestic consumption alone. It is estimated that by 2030 AD, about 520 million tonnes of sugarcane with average sugar recovery of 10.75 per cent (60 per cent cane will be utilized for white sugar, and 15 per cent will go for ethanol production) will be required. The population of the country is expected to swell to 1.65 billion by 2050, which needs 51 m t of white sugar [considering per capita consumption of sweetener - 35 kg (28 kg white sugar and 7 kg gur). To meet the growing demand of sugar and energy by 2050 in India, around 630 m t of sugarcane with a recovery of 11.5 per cent will be required.

Production of alcohol for partial replacement of fossil fuel and use of bagasse in cogeneration of electricity has great potential in future and thus requirement of cane will increase further. This will entail an average cane productivity requirement of 105 t ha-1, as the area under sugarcane cultivation may not increase beyond 6.0 million hectares. So, it is high time we amend our usual, high inputs intensive method of sugarcane cultivation and lookout for some innovative, resource saving methods of sugarcane cultivation. Cane cultivation is facing a rough path ahead due to increasing input and labour costs and lack of any alteranate innovative technologies to boost the productivity. So it is essential not only to increase the cane productivity but also to maintain it sustainability by conserving scarce resources over period of time. To acheieve this there is a strong need for some alteranate methods of cane production that should improve the cane yield on the principles of "more with less".

Cane cuttings with one, two or three buds, known as setts, are used as seed (Jain *et al*., 2010) [3]. Sugarcane is planted commercially using stalk cuttings or setts (25-30 cm stalk pieces having 2-3 buds each). This method of cultivation is gradually becoming uneconomical as the cost of sugarcane used for replanting accounts for over 20 percent of the total cost of production. The reasons for low yield include conventional planting methods, costly inputs, heavy weed infestation, improper land preparation, less than recommended seed rate, imbalanced fertilizer application, shortage of irrigation water, illiteracy, less support price Under conventional system of sugarcane cultivation, about 6–8 tons seed cane ha-1 is used as planting material, which comprises of about 32,000 stalk pieces having 2-3 buds. This large mass of planting material poses a great problem in transport, handling, seed storage etc. The huge stuff of seed is also prune to disease' attack and undergoes rapid deterioration thus reducing the viability of buds and subsequently their sprouting. Thus more and more seed is required to get recommended amount of healthy seed, from the stock, for cultivation.

One alternative to reduce the mass and improve the quality of seed cane would be to plant excised axillary buds of cane stalk, popularly known as bud chips. These bud chips are less bulky, easily transportable and more economical seed material. The bud chip technology holds great promise in rapid multiplication of new cane varieties. A small volume of tissue and a single root primordium adhering to the bud are enough to ensure germination in sugarcane. Indian sugarcane experts indicated that the feasibility of eliminating the internode part of the seed piece and using different types of seed cane materials such as single bud settings, bud chip raised seedlings, 1-3 bud setts for crop establishment and then determining the effect of the planting material on growth and yield of sugarcane in India. It was observed that due to saving in seed material, the maximum net returns were obtained with bud chips raised seedlings.

Using bud chip settlings with application of improved production technology for nursery management, settling transplanting methods and time, plant spacing, weed control, nutrient requirement, irrigation scheduling and optimum time of cane harvesting, good cane yield of 100 t/ha can be realized at farmer's field. Farmers can increase their income as well as increase sugarcane yield using bud chip settlings with good management practices [2]. In Odisha with a total coverage of 35340 hectare which is only 0.4% of the total cultivable area of the state. Area under sugarcane crop in Ganjam district of the state is 2251 hectare with a productivity of 76.6 t ha-1. Keeping in view such problems and objectives, farmer's participatory field demonstration was conducted to study the effect of bud chip method on growth, yield, economics in sugarcane planting.

Materials and Methods

Krishi Vigyan Kendra, Ganjam-II conducted front line demonstration (FLD) on sugarcane bud chip method at the farmer's field of Giria of Hinjilicut block of Ganjam district during Rabi season of 2016. The district of Ganjam lies in two agro climatic zones i.e. East & South Eastern coastal plain zone and North Eastern Ghat Zone of Odisha extending from $18^0$13'N to $19^0$10' North latitude to $82^0$5' to $83^0$23' East longitude. The Average Normal Rainfall of this district is 1276.2 mm and more than 75% of the precipitation is received over five months i.e. June- October. Agriculture is the primary occupation of inhabitants of this district. The maximum and minimum temperature of this district is 39^0C and 18.9^0C respectively. The initial soil status of demonstration plot was acidic in reaction (pH 5.6-6.4), loam in texture, with medium in organic carbon content() medium in Nitrogen() low in phosphorous(), medium in potash().

Five farmers were selected and they were supplied with input like Pro-tray and polythene sheet. The sugarcane crop (variety-CO 62175) was raised during 2nd week of February' 2015 and harvested during 2nd week of January' 2016 with recommended package of practices in 0.4 ha by the farmer during the year Single budded chips, carefully removed from healthy canes are used for raising nursery. Leaves were removed and bud chips were excised manually using Bud Chipping Machine. The improved practice included collection of eye (5500/acre) with help of bud chipper from 7-9 month sugarcane setts, The average weight of a bud was nearly 9g. The selected buds are placed in trays filled with cocopith (coconut coir waste) to raise the seedlings. Bud chips were planted in an upright position. Then it was tightly covered with polythene sheets and keep it for 7-8 days in the same position to protect from cool temperature and maintain suitable humidity. Within seven days, the polythene sheet cover was removed. The trays with sprouted buds were aligned side by side in beds on the ground to facilitate watering and other nursery management practices. Fertilizers was applied at the rate of 1g Urea 46% per bud on 15th and 25th day after planting. Healthy seedlings were transplanted in well prepared field. By raising nursery high percentage of germination can be achieved within a week depending on the agro climatic conditions. The young seedlings raised in the nursery are transplanted to main field at the age of 25-35 days. With spacing (5×2) ft and agronomic management practice which produce more shoot and tillers. Thus, reduced the plant mortality and expenses and enhances the cane yield.

For the introduction of the technology, different extension approaches through regular field visit and interpersonal communication were made by the scientists of Krishi Vigyan Kendra, Ganjam-II. Trainings on farmers and farm women were conducted for the awarmess among the farmers and field days were conducted for the horizontal spread of technology. Also leaflets and pamphlets on improved package of practices on bud chip method of sugarcane cultivation were distributed among the farmers in the villages.

Observations on different yield parameters were taken and economic analysis was done by calculating cost of cultivation, gross return, net return and B: C ratio. Final crop yield (cane) were recorded and the gross return were calculated on the basis of prevailing market price of the produce. Production

efficiency value was calculated with using formula by (Tomar *et al*. 1990) [7]. Extension gap as calculated by the formula suggested Samui *et al*., (2000) [6].

Extension gap = Demonstration yield-Farmers yield**.**

B: C ratio = Net income (Rs. / ha) / cost of cultivation (Rs. / ha)

% increased over farmers practices = Improved practices – Farmers practices / farmers practices x 100

Tabular analysis involving simple statistical tools like mean was done by standard formula to analyze the data and draw conclusions and implications.

Results and Discussion

In Table 1 the major differences were observed between demonstration method and farmer's practices (conventional method) are regarding setts, nursery preparation, sett treatment, method of sowing, fertilizer dose, method of fertilizer application, weed management and plant protection measures.

Data in Table 2 showed that in the demonstrated practice of bud chip method produced higher tillers/plant (16.8) and number of miliable canes/clump (14.1). the results clearly indicated that percentage of survival was higher (92.6%) in bud chip methods than conventional method. The analysis of data revealed that higher cane yield was recorded in the bud chip method of sugarcane planting (122.6t/ha) than farmer practice (89.3t/ha) which was 37.3 per cent higher than conventional method. The improved practice of bud chip method also showed higher extension gap (33.3t ha-1). This extension gap should be assigned to adoption of improved transfer technology in demonstrations practices resulted in higher yield than traditional farmer practices. This emphasized the need to educate the farmers through various means for more adoption of improved high yielding varieties and newly improved agricultural technologies to bridge the wide extension gap. Latest production technologies will subsequently change this alarming trend of galloping extension gap. The new improved technologies will eventually lead to the farmers to discontinue the traditional method and to adopt new technology.

The economics of sugarcane bud chip method under front line demonstrations have been presented in Table 3. The results of economic analysis of sugarcane bud chip method revealed that cost of cultivation is less in demonstration practice (Rs 71,564/ha) as compared to Farmers practice plot check (Rs 82,654/ha). It was observed that front line demonstrations recorded higher gross returns (Rs 2,81,980 /ha) and net returns(Rs 2,10,416 /ha) whereas in farmers practice the gross returns (Rs 2,05,390/ha) and net returns(Rs1,22,736 /ha) The benefit cost ratio of demonstration practices (3.94)was also more than the farmers practice (2.49) to higher net return. The variation in net return and benefit-cost ratio may be attributed to the variation in the price of agri inputs and produce. (Mohanty *et al*.) [5]

Conclusion

It is concluded from the study that sugarcane bud chip method could be a viable and economical alternative in reducing the cost of sugarcane production, if necessary precautions are taken in handling and storage of bud chip seed material and their subsequent multiplication in the field. This saves several thousand tons of raw material that could be used for extracting sugar. Additionally, transporting the bud chips instead of whole stalks from one location to other would greatly reduce its cost and help in propagation of new and improved cane varieties. Seedlings raised in pro trays is recommended due to their higher survival percentage (95%) in the field. The use of single bud seedlings raised in nursery saves 60-70% of the seed cost apart from better growth and yield. The per cent increment in yield of sugarcane to the extent of 37.3 in demonstration over the farmers practice created greater awareness and motivated the other farmers to adopt the improved bud chip method of sugarcane cultivation. The existing farmer's practice of conventional method can effectively be replaced by bud chip method in sugarcane in the existing farming situation for higher productivity and profitability. From the study it was concluded that FLD programme is an effective tool for increasing the production and productivity of sugarcane and changing the knowledge, attitude and skill of the farmers. This has not only resulted in socio-economic security but also helped in attaining food and nutrition security to the community.

Acknowledgement

The author is thankful to the Director, ICAR-Agriculture Technology Application Research Institute (ATARI), Zone-VII, Jabalpur for providing support towards conducting the front line demonstration

Table 1: Difference between Conventional and Bud chip methods of Sugarcane Cultivation in demonstration

Particulars	Conventional Method	Bud chip method
Setts	48000 buds(16000 three budded setts/acre)	5000 buds(5000 single budded chips/acre)
Nursery preparation	No	Yes
Planting	Direct planting of setts in the main field	Transplanting of 25-35 days old young seedlings raised in a nursery
Spacing	1.5 to 2.5 ft between rows	5ft between rows
Water Requirement	More (flooding of field)	Less (maintenance of moisture in the furrows)
Mortality rate among plants	High	Low
No of tillers per plant	Less (10-15)	More (20-25)
No of millable canes achieved per clump	5-8	10-15
Accessibility to air and light	Low	High
Scope for intercrop	Less	More

Table 2: Effect of Bud chip method of sugarcane planting on yield

Methods	Survival (%)	Number of tillers/plant	Number of millable canes/clump	Yield (t/ha)	% increase in yield over farmer practice	Extension Gap(t/ha)
Farmers practice (conventional method)	66.2	8.1	7.3	89.3	37.3	
Demonstrated practice (Bud chip method)	92.6	16.8	14.1	122.6		33.3

Table 3: Effect of Bud chip method of sugarcane planting on economics

Methods	Cost of cultivation(Rs/ha)	Gross return(Rs/ha)	Net Return(Rs/ha)	B:C ratio
Farmers practice (conventional method)	82654	205390	122736	2.49
Demonstrated practice(Bud chip method)	71564	281980	210416	3.94

Sale price of sugarcane Rs 2300/t for the year 2015-16

References

1. Anonymous, www.indiastat.com/ Ministry of Agriculture, Govt. of India, 2015.
2. Chandrasekaran R, Suveetha M, Pradhan BJ, Sampathkumar T, Muralidharan S. Sugarcane cultivation through sustainable sugarcane initiation. Indian Farming, 2014; 63(10):22-25.
3. Jain R, Solomon S, Shrivastava AK, Chandra A. Sugarcane bud chips a promising seed material. Ind. J Sugar Tech. 2010; 12(1):67-69.
4. Kapur R, Duttamajumdar SK, Krishna Rao K. A breeder's perspective on the tiller dynamics in sugarcane. Current science. 2011; 100:183-189.
5. Mohanty M, Das PP, Nanda SS. Introducing SSI (Sustainable Sugarcane Initiative) technology for enhanced cane production and economic returns in real farming situations under east coast climatic conditions of India. Sugar Tech., 17(2), 116-120.
6. Samui SK, Maitra S, Roy DK, Mondal AK Saha D. Evaluation on front line demonstration on groundnut (*Arachis hypogea* L.). Journal of Indian Society Coastal Agricultural Research. 2000; 18:180-183.
7. Tomar S, Tiwari AS. Production and economics of different crop sequences. Indian Journal of Agronomy. 1990; 35(1/2):30-35.