Sugar Tech (2010) 12(1) : 67-69

SHORT COMMUNICATION

Sugarcane bud chips: A promising seed material

Radha Jain · S. Solomon · A.K. Shrivastava · A.Chandra

Received: 15 February, 2010; Revised: 26 February, 2010; Accepted: 2 March, 2010

Abstract Sugarcane is normally propagated by stalk cuttings consisting of 2 to 3 bud sett. In conventional system, about 6 – 8 tons seed cane /ha is used as planting material. Establishing the sugarcane crop using bud chips in place of setts could save about 80% by weight of the stalk material, however this technology has not been scaled up at commercial levels due to poor survival of bud chips under field conditions. Present study is aimed at improving sprouting and establishment of bud chip seed stocks of sugarcane by pre-planting soaking in growth promoting chemicals. Treated bud chips recorded higher bud sprouting, root number, fresh weight of shoot and roots and plant vigor index. Studies have shown that bud chip could be one of the most viable and economical planting material in reducing the cost of sugarcane production.

Key words Sugarcane planting material, growth promoting chemicals, bud chips

Sugarcane (*Saccharum* spp. hybrid) is a large, perennial, tropical or subtropical grass widely grown in a zone around the world within 30°N and S of the equator. It is vegetatively propagated from axillary buds on the stem (or stalk) cuttings. The first "plant" crop is generally harvested from 12 to 24 months after planting; thereafter "ratoon" crops may be harvested at shorter to equal time periods. Ratoons may be grown from one to several cycles. The mature stalks contain about juice of 17-20% sucrose in cane juice. About 75% of the world's sugar (sucrose) is produced from sugarcane and the other 25% from sugarbeet. Besides being a source of animal feed, antibiotics, particle board, bio-fertilizer and raw material for generating electricity, sugarcane has lately emerged as an important base material for bio-ethanol production.

Sugarcane (*Saccharum* spp. hybrid) is commercially planted using stalk cuttings or setts and this method of cultivation is gradually becoming uneconomical as the cost of "Seed Cane" used for replanting accounts for over 20 percent of the total cost of production. In conventional system prevailing in India, about 6 – 8 tons seed cane /ha (nearly 10% of total produce) is used as planting material, which comprises of about 25-30 cm stalk pieces having 2-3 buds. This large mass of planting material poses a great problem in transport, handling and storage of seed cane and undergoes rapid deterioration thus reducing the viability of buds and subsequently their sprouting. 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.

According to van Dillewijn (1952) a small volume of tissue and a single root primordium adhering to the bud are enough to ensure germination in sugarcane. He has also stated that where growing conditions are favorable, cutting with only one bud did well as seed material for seed material. Indian sugarcane experts, Narasimha Rao and Satyanarayana (1974) and Ramaiah *et al*. (1977) showed the feasibility of eliminating the internode part of the seed piece and using only buds for commercial planting.

Extensive work has been done using different types of seed cane materials such as single bud settlings, bud chip

Radha Jain (✉) · S. Solomon · A.K. Shrivastava · A.Chandra
Indian Institute of Sugarcane Research, Lucknow-226002, India
email: radha_dinesh@yahoo.co.in

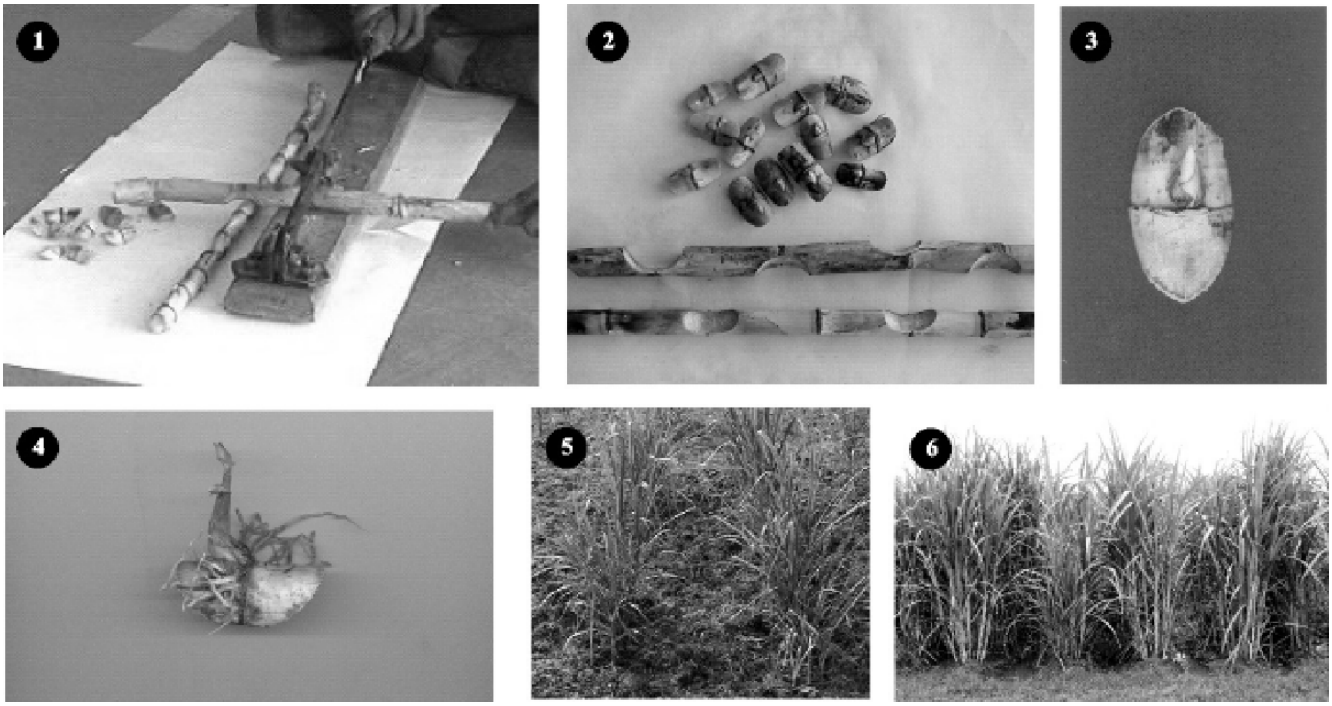

Fig. 1. Bud chip scooping machine; **2.** Sugarcane bud chips and stalks after scooping bud chip; **3.** Bud chips as seed material; **4.** Sprouted bud chip; **5.** Bud chip raised sugarcane plants; **6.** Bud chip raised sugarcane crop

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 (Reddy et al. 1986). It was observed that, due to saving in seed material, the maximum net returns were obtained with bud chips raised seedlings. Earlier studies established that about 80% by weight of the sett-planting seed material can be saved by planting bud chips (Narasimha Rao 1977; Gokhale 1977; Narendranath 1992; Iqbal, *et al*. 2002; Prasad and Sreenivasan 1996; Tamil selvan 2006).

Studies carried out at various locations in India and other places have pointed out various limitations in bud chip technology mainly due to their poor survival under field conditions. The bud chip seed material has relatively low food reserves (1.2-1.8 g sugars /bud) compared to conventional 3 bud seed material (6.0-8.0 g sugars/ bud). The food reserves and moisture in the bud chip depletes at a faster rate compared to 2 or 3 bud sett which is reflected in their poor sprouting and early growth without treatment. In view of manifold benefit of "Bud chip technology", extensive research work is being carried out at the Indian Institute of sugarcane Research, Lucknow to explore the physio-biochemical basis of bud chip viability for long duration storage, its treatment, storability, raising of seedlings and their establishment in farmers field. In recent past, several experiments were conducted to maintain the viability of bud chips for long duration storage. Bud chips stored in polyethylene bags after fungicide treatment and stored at low temperature conditions (10 ±1°C) exhibited about 80% bud germination after 10 days of storage than one stored at room temperature (about 40%). In bud chips moisture content was within the range of 70-77 % during storage similar to 0 day moisture content.

A locally fabricated bud chip scooping machine, sugarcane stalk and different stages growth of bud chip raised sugarcane plants are given in figure (1-6).

The inducing effect of ethephon (2-chloroethyl phosphonic acid) @ 100 mg l^{-1} and calcium chloride (0.1%) on the sprouting and early growth of sugarcane bud chips and a few physio-biochemical parameters which regulate the process of shoot emergence was also studied. Treatment with growth promoting chemicals improved the sprouting of bud chip seed-stocks which ranged from 32-36 per cent over control treatment due to ethephon and calcium chloride treatment, respectively (Table 1). Increase in sprouting with chemical treatment was closely associated with a corresponding increase in reducing

Table 1. Changes in bud sprouting and growth of bud chips raised settlings in response to ethephon and calcium chloride treatments in sugarcane

Treatment	Bud sprouting (%)	Shoot weight (g Fwt)	plant vigor Index	Root weight (g Fwt)	Root number
Control	50± 2.65	1.202± 0.074	250± 10	0.111± 0.017	13± 2
Ethephon (100mg l^{-1})	66± 1.00	1.798± 0.020	495± 23	0.2874± 0.048	18± 3
$CaCl_2$ (0.1%)	68± 2.65	1.428± 0.057	449± 14	0.263± 0.041	12± 2

sugars and acid invertase activity in sprouting buds. Earlier studies carried out in sub tropical India using ethephon and calcium chloride as growth promoter has shown positive results on the sprouting of sugarcane sett and underground buds (Solomon *et al*. 1998; Jain *et al*. 2009). Solomon *et al*. (1998) have shown an enhancement of about 13-17% in sett sprouting in ethephon treated seed cane pieces. Improvement in sprouting by calcium application may be due to enhanced activity of ATPase and amylase activity in presence of calcium ions (Jain *et al*. 2009). Besides, calcium is a key nutrient in cell wall strength, cellular adherence and also essential for cell elongation. Treated bud chips showed significantly increase in root number and weight; increase was about 38 percent and 8 per cent in root number and about 160 per cent and 137 percent in root weight by ethephon and calcium treatment, respectively (Table 1). Similarly, shoot weight increased significantly due to the both the treatments (Table 1). Higher root emergence due to chemical treatment helps in early and better establishment of bud chip seed stocks under field conditions. The plant vigor of bud chip raised settlings was enhanced due to chemical treatment; enhancement was found higher in ethephon treatment (Table 1). Further research work in relation to impact on bud chip storage following treatment with growth promoting chemicals is underway. These initial studies have shown that budc chip technology could be one of the most viable and economical alternatives in reducing the cost of sugarcane production, provided necessary precautions are taken in handling and storage of bud chip seed material and their subsequent multiplication in the field. This, technique would immensely help sugarcane development workers to exchange their valuable cane seed with less risk, assured survival, and good establishment. Additionally, transporting the treated bud chips instead of whole stalks from one location to other would greatly reduce the chances of transmission of sett-borne diseases and help in seed multiplication of new and improved cane varieties.

References

Gokhale MN (1977) A new approach to cane seed nurseries. Sugar technologists Association of India. sixth joint convention, p. 163-166.

Iqbal MT, Eusufzal SUK, Rukshana, F (2002) Performance of sugarcane bud chip settlings. *Indian J Sugarcane Technol* 17: 88.

Jain R, Solomon S, Lal P, Shrivastava AK (2009) Nutrient application improves stubble bud sprouting under low temperature conditions in sugarcane. *Sugar Tech* 11: 83-85.

Narasimha Rao G (1977) Chip bud method. *The Hindu* , July 9, 1977.

Narasimha Rao G, Satyanarayan Y (1974) Studies in control of sett borne infection of red rot of sugarcane. *J Res Andhra Pradesh Agric Univ* 1: 83-86.

Narendranath M (1992) Cost-effectiveness of transplanting nursery-raised sugarcane bud chip plants on commercial sugar plantations. *Proc 11th Inter Soc Sugar cane Technol*, Poster paper, p. 332.

Prasad RN, Sreenivasan, TV (1996) Developing technology for sugarcane varietal exchange through bud chips. *Indian J Sugarcane Technol* 11: 25-28.

Ramaiah BB, Narasimha Rao G, Prasad GH (1977) Elimination of internodes in sugarcane seed piece. *Proc Inter Soc Sugar Cane Technol* 1509-1513.

Reddy TB, Reddy TY, Reddy DS, Murthy CK, Rao MRM and Reddy GHS (1986) Effect of different types of seed material on growth and yield of sugarcane. *Cooperative Sugar,* 17: 947-949.

Solomon S, Singh I, Madan VK(1998) Effect of 2-chloroethyl phosphonic acid on early growth and advancement of maturity in sugarcane. *Proc 60th Annual Convention of the Sugar Technologists Association* of India, Shimla.

Tamil selvan N (2006) Sugar cane response to chip bud method of planting. *Inter Soc Sugar Cane Technol*, Agronomy Workshop, Khon Kaen, Thailand, 23-26 May, 2006.

van Dillewijn C (1952) The Chronica Botanica Co. Waltham, USA, p. 352.