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Bud chip nurseries – history, methods of raising, results of germination studies



Conventional method of sugarcane cultivation

- Sugarcane is a vegetatively propagated crop
- Cane cuttings with one, two or three buds known as setts are used as seed
- In India, for conventional system of sugarcane cultivation, about 6 – 8 tonnes seed cane /ha 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 and storage of seed cane and undergoes rapid deterioration thus reducing the viability of buds and subsequently their sprouting.



Bud chips

- 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.**
- The left-over cane can be well utilized for preparing juice or sugar or jaggery



History of bud chip

- The famous sugarcane researcher, van Dillewijn(1952) stated that a small volume of tissue and a single root primordium adhering to the bud are enough to ensure germination in sugarcane.
- After a long gap of 22 years, Indian sugarcane experts, Narasimha Rao and Satyanarayana (1974) showed the feasibility of eliminating the internode part of the seed piece and using only buds for commercial planting.
- In year 1977, Andhra Sugars has fabricated bud chip machine and Ramaiah et al demonstrated bud chip technology using three varieties, Co 419, Co 975 and Co 997

- **Further, several other workers had established that about 80% seed material can be saved by bud chip seed material** (Gokhale 1977; Balasundaram, 1978, Reddy et al 1986; Nagendran and Sekar , 1988, Narendranath 1992; Iqbal et al. 2002; Prasad and Sreenivasan 1996, Tamil selvan 2006).
- In Tamil Nadu, Nagendran and Sekar 1988 working at NPKRR Cooperative sugar Mills reported that bud chip seedlings transplanting technique as most suitable technology for Cauvery delta
- **At SBI, Coimbatore Prasad and Sreenivasan 1996 used the bud chip method as low cost technology for exchange of seed material. This facilitated easy carrying and transport of Co canes as bud chips in carton boxes across the country for the regular varietal development programme**
- Tianco (1995) in Philippines and Iqbal et al (2002) in Bangladesh Sugarcane Research Institute used polybag raised seedlings for sugarcane cultivation

- In subtropical region of India, another significant technique, Spaced Trans Planting (STP) has been developed at Indian Institute of Sugarcane Research (IISR), Lucknow. In this technique, single bud nursery is raised and seedlings transplanted in the field with wider spacing to facilitate the availability of abundant solar radiation and soil aeration that enhances high levels of tillering (Srivastava, Narasimhan and Shukla 1981).
- Inspired by the success of 'System of Rice Intensification' under WWF-ICRISAT project, Biksham Gujja and his Team extended this concept to sugarcane and the 'Sustainable Sugarcane Initiative' (SSI) was born (WWF-ICRISAT, 2009). The method using bud chip raised seedlings was taken up on large scale in several states and also training on the methodology was given to farmers from the states of Tamil Nadu, Andhra Pradesh, Maharashtra, Punjab and Orissa under WWF-ICRISAT project.

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.

Methods of raising bud chip settlings

- Select freshly harvested sugarcane stalks free from disease /pests (at 8-10 month's age)
- Scoop out bud chips with bud scooping device.
- Soak bud chips in specially formulated plant growth regulator (PGR) solution for 2 hrs.
- Treat with fungicide, Bavistin (0.1%) for 20 min.
- Keep under fan to dry if it is stored for long distance transport (even for 8-10 days).
- Store in polyethylene bags at low temperature conditions ($10\pm 1^{\circ}\text{C}$).



- Plant these pretreated bud chips in plastic cups/trays filled with soil mixture containing soil, organic matter and sand in a ratio of 1:1:1.
- To make this technology more economical, bud chip nursery was also raised in mini-plot near experimental field.
- Spray nutrients with PGR solution at 3rd week.
- Healthy settlings were transplanted in well prepared field after 4-5 weeks with row spacing of 90 cm and 30 cm between the two settlings.
- After establishment of settlings, cultural practices were similar to conventional method of sugarcane cultivation are followed.



Results of germination studies

- 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.
- **Bud chips exhibited about 80% bud germination after 10 days of storage at low temperature conditions than one stored at room temperature (about 40%).**
- **Moisture content of bud chips was within the range of 70-77 % during storage similar to 0 day moisture content.**

Soaking bud chips in ethephon (2-chloroethyl phosphonic acid) @ 100 mg per litre and calcium chloride (0.1%) solutions promotes sprouting (90%), root growth, plant vigor and tillering by altering some of the key biochemical activities; acid invertase activity and reducing sugars contents, essential for their early growth and better establishment compared to untreated bud chips (Jain et al 2010 a & b, 2011)



- **Establishment and survival of bud chips raised settling were about 80%.**
- **Tiller per clump was about 1+5 as compared conventional system of cane cultivation (1+2)**
- **Shoot population was approximately 1.4 lakh per ha as compared to conventional system (0.75 lakh/ha)**
- **Single shoot weight was about 1.0 kg fresh wt**



Conclusions

- Bud 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.
- **The problem of establishment and initial growth could be addressed by application of appropriate plant growth regulators and essential nutrients**
- Plant mortality rate could be reduced using bud chip raised settlings
- Shoot population and cane yield could be enhanced using bud chip raised settlings

Thanks to you all

