

Quality seed production

and seed cane economy for better resource use efficiency

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Seed is the most significant basic input and is alone responsible for improving crop productivity by 15–20%, ensuring the production and supply of high-quality seed is the key to agricultural production stability. Higher cane and sugar productivity per unit area is mostly dependent on steady supplies of high-quality seed canes that are genetically pure, pest and disease-free and nutritionally sound. A new variety takes 8–10 years to establish itself in a farmer's field using the traditional form of seed multiplication (3 budded setts), which has a multiplication ratio of 1:10. Some of the seed saving techniques such as bud chip, polybag and tissue culture raised plants are less voluminous and easy to handle with care and are free from pests and diseases. Though propagation through polybags is labour intensive and development of tissue culture plants is tough in farmers' fields. Bud chip technology allows for saving a lot of seed (80%) and is also called seed saving technology. Insect pests and diseases can be avoided during bud scooping when sugarcane is cultivated utilizing the bud chip method. Bud chip is a simple, reliable, and farmer-friendly technology for replicating seeds of newly released varieties quickly.

Keywords: Quality seed production, Resource use efficiency, Seed cane economy

SUGARCANE cultivation is important on a global scale since it is one of the most important energy crops, providing sugar, ethanol, bioelectricity, and derivatives. Low production and sugar recovery are influenced by a variety of issues on the farm, one of which is a lack of quality seed delivered on time. In general, farmers purchase seed cane from other farmers at a higher price which is poor in quality, produced through imbalanced use of nutrients and water resulting in low cane productivity. The benefits of improved new varieties will not reach farmers unless the good-quality seed of the variety is produced in sufficient quantities and delivered in a timely manner. In most crops, a better-quality seed may boost yields by 10–15%. Continued production of high-quality seeds of the new variety is also necessary to maintain the variety's high output potential. To reach the full potential of the variety over a longer period of

time, it must be assured that the seed produced is genetically pure and free of diseases and pests. Sugarcane, being a vegetative propagated crop, is more prone to disease and insect infestations during production. It is critical to producing high-quality seed that is free of seed-borne diseases and pests in order to maintain crop productivity. To raise the profitability of the sugar industry, there is a constant need to improve crop yield efficiency while lowering cultivation costs through the use of viable agronomic approaches, one of which is the use of good-quality planting material. In contrast to sugarcane crops grown for crystalline sugar, enhanced production of cane shoots must be prioritized in order to achieve higher seed cane yields per unit area. Seed cane is one of the most expensive parts of the sugarcane production system. In India's traditional system, roughly 5–7 tonnes of seed cane per hectare is

required as planting material, which consists of 25–30 cm stalk lengths with 2–3 buds. This huge quantity of seed cane material is difficult to carry and handle, and it quickly deteriorates, lowering the moisture in buds and, as a result, sprouting. Planting only a section of stem tissue together with buds of the cane stalk, also referred to as bud chips, is one option for reducing the quantity and improving the quality of seed cane. In comparison to the conventional method of planting sugarcane, bud chip technology has become popular in recent years. Good seed cane yield can be achieved by integrating bud chip settlings with improved production technologies for nursery management, settling transplanting techniques, planting geometry, weed control, fertilizer management, irrigation scheduling, and harvesting at the optimal time.

Use of talc-based pectinolytic microbial formulation i.e. CRIJAF SONA was successfully

demonstrated for faster retting of jute and fibre quality improvement across the jute and mesta growing states, viz. West Bengal, Assam, Bihar, Odisha, Meghalaya and Andhra Pradesh. The talc-based microbial formulation consisted of three strains of *Bacillus* spp, viz. *Bacillus safensis*, *Bacillus velezensis* and *Bacillus altitudinis* identified.

Characteristics of good quality seed cane

The seeds in real meaning must possess the following characteristics:

1. The seed cane must be healthy, pure, and free of contaminants.
2. It must be true to type and have a consistent shape and size.
3. It must be viable and have sufficient germination potential.
4. The seeds are grown with good care and under close supervision to ensure that they do not deteriorate soon.
5. There must be no seed-borne diseases on the seed cane.
6. Other farm inputs have a synergistic effect

Types of seeds

Based on nature and the precautions taken during production the seeds are categorized into the following classes (Table 1, 2):

1. **Nucleus seed:** It is genetically pure and is produced and maintained by the concerned breeder/institute that developed the variety. The entire row should be rejected and uprooted if there is any change in morphological features or the incidence of pests and diseases if any.
2. **Breeder seed:** These seeds are produced at the breeder level or under the direct supervision of the respective institute. These seeds are 100% genetically pure and devoid of pests and diseases.
3. **Foundation seed:** This is the third stage of the seed multiplication process. Under the guidance of the breeder, a foundation seed will be produced from the breeder seed. Depending on the spread of a variety, a large amount of foundation seed

Table 1. Time of inspection for different types of seed

Type of seed	Period of inspection (Days after transplanting)				
	First	Second	Third	Fourth	Fifth
Foundation seed	50	120	150	200	15 days before harvesting
Certified seed	120	200	15 days before harvesting	-	-
Commercial seed	120	200	15 days before harvesting	-	-

Table 2. Tolerance limit of pests and diseases at the time of last inspection

Diseases/ insects	Number of the infested clump (%)			
	Breeder seed	Foundation seed	Registered seed	Commercial seed
<i>Disease</i>				
Red rot, wilt, smut, grassy shoot	0	0	0	0
<i>Insect</i>				
Scale insect	0	5	5	5
Plassey and Gurdaspur borer	0	0	0	0
Other borers	10	20	20	40

may be required. Because the research station's infrastructure may not allow for such large-scale production of foundation seed, it is grown in Government Seed farms or sugar mill farms under strict supervision and control. The seed crop must be kept free of known seed-borne diseases and pests, in addition to ensuring varietal purity through regular roguing.

4. **Certified seed:** The state department / sugar factories will obtain the foundation seed that has been generated. To preserve genetic purity and the health of the seed crop, regular inspections of seed production plots are required. State Seed Certification Agencies will check and certify the certified seed plot. Certified seed should be utilized for commercial cultivation. After 3–4 crop cycles, it is a better idea to replace the certified seeds with a new batch of certified seeds.
5. **Commercial seed:** Commercial seed plots are planted in specially designated farmers' fields and disseminated throughout the sugar mill's reserve area. This approach eliminates the need

to transfer bulky seeds over long distances. Seed plots are inspected in accordance with the seed certification standard. The cane is harvested when it is 9–10 months old and sold as a commercial cane.

Package of practice

Management of bud chips under nursery condition

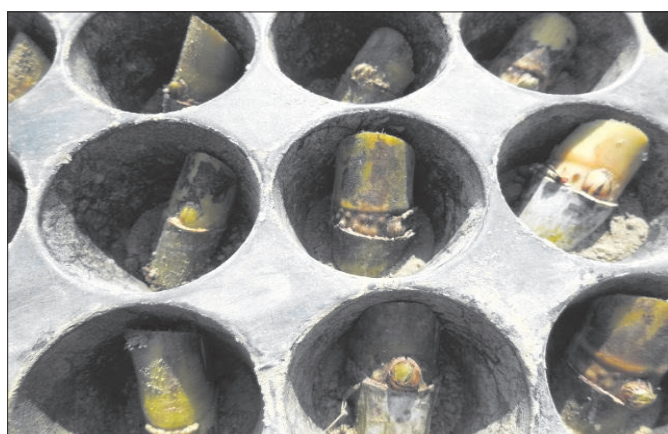
1. Obtain a healthy seed cane from a reputable source/standard agency that is free of any insects, pests, and diseases. Seed cane must be obtained from adequate nutrient and irrigation supplied fields.
2. Age of seed canes should be less than 10 months.
3. Using a bud chipper machine, to remove bud chips from healthy stems.
4. Make a carbendazim solution of 1 g/litre of water and soak the bud chips in it for 10 minutes.
5. Fill portrays or polythene bags (15 cm × 10 cm) with a homogeneous mixture of equal parts soil, sand, and compost.
6. Make a small hole at the bottom of the polybags to facilitate drainage and plant the bud chips upright.



Cutting of bud chips by using bud chipping machine



Treatment of bud chip with carbendazim



Placement of bud chips in pro-tray



Bud chip plant at early formative stage

7. Ensure that water is sprayed on a regular basis using a rose cane or an overhead sprinkler system in a poly house.
8. Just after the 15th day of propagation in the nursery, spray 1% urea solution.
9. Take effective insect, pest, disease, and nutrient deficiency control measures.
10. 25–30 days old seedlings, along with the intact mass of soil, should be transplanted in shallow pits with proper planting geometry in the main field.

Transplanting of bud chips to main field

Field preparation: A well-prepared field is necessary for a successful crop establishment. Because sugarcane is a deep-rooted crop, it requires at least one deep ploughing with MB plough or disc plough, as well as twice harrowing and planking before it can establish itself in the main field. At the time of the last ploughing, apply 200 q/ha of well-rotted farmyard manure or

press mud.

Planting time/season

Sugarcane is planted twice a year in the subtropics, in October–November (autumn) and February–March (spring). In the subtropical region, 75–80% of sugarcane is planted in the spring, while the remaining 20–25% is planted in the autumn season. The autumn planted cane gives about 20% higher cane yield, even though the area under the autumn crop is lesser due to late vacation of land after harvest of rice crop.

Method of planting

A good planting method improves land-use efficiency, lowers production costs, reduces the use of market-purchased expensive inputs, and makes the sugarcane production system more sustainable. In subtropical India, the following planting methods are widely used:

Flat/furrow planting: This method involves one or two thorough ploughings, followed by harrowing and planking, to prepare the land for planting. Shallow furrows of 10–

15 cm depth are opened to retain soil moisture, and bud chip seedlings are placed in furrows at a distance of 90 cm in autumn and 75 cm in spring.

Paired row planting: Pairing row planting at 30:120 cm spacing can substitute single row planting at 90 cm spacing. The furrow is opened at 120 cm, the base of the furrow is widened by 30 cm, and seedlings are placed on both sides, resulting in a seed rate of around 50% higher than with the conventional furrow method. In the paired row method, two cane rows are brought together, followed by a big gap before the next set of two rows. By properly earthing up, it is possible to avoid lodging. Additionally, the method permits for better light absorption by the crop, resulting in higher yields.

Trench method: Because of higher input use efficiency, this technology is quickly spreading in sugarcane-growing areas of the subtropics. Trenches of 30 cm broad and deep with a center to center distance of 120 cm are dug and bud chip

raised settlings are placed along both sides of the trench (30:90 cm). The method is particularly suited for mechanized operation because it needs less labour and increases water use efficiency. This form of planting allows farmers to get a higher seed cane yield.

Spacing/planting geometry

In order to maximize sugarcane yield, optimal planting density is critical. Row to row and plant to plant spacing has long been recognized as an important component in determining the optimal plant population and executing cultural operations like weeding, pesticide spraying, irrigation, propping, and other field operations. The bud chip raised settlings should be transplanted at a spacing of 90 cm × 45 cm or 120 cm × 45 cm in the main field.

Nutrient management

The seed crop should be given a higher and balanced dose of NPK. For Bihar, the fertilizer recommendation for the normal crop is 150 kg N, 85 kg P₂O₅ and 60kg K₂O/ha. The half of N and the entire dose of P and K are applied at the time of planting. From the rest of the half nitrogen dose, one-fourth of the total N was applied 45 days after transplanting followed by inter-culturing. The remaining one-fourth dose was applied in the last week of June followed by earthing-up. However, sugarcane planted with bud chip raised settlings has very low productivity due to a lack of food material and inadequate nutrient availability. On the basis of 3 years of experimentation conducted at Sugarcane Research Institute, Pusa, Bihar, bud chip raised settlings responded significantly up to 150% (225 kg N, 127.5 kg P₂O₅ and 90 kg K₂O/ha) higher doses of NPK fertilizer.

Irrigation

The first light irrigation should be given at the time of transplanting for the proper establishment of settlings. Second irrigation should be given after a week. The subsequent irrigation should be given whenever required. After the start of the monsoon, there is no need for irrigation but in case of



Light irrigation at the time of transplanting

prolonged drought irrigation may be required.

Earthing-up

Earthing-up should be done in the last week of June with the help of Bihar senior ridge. This may help to provide anchorage to plants and also provide sufficient drainage for the removal of excess water. The remaining 25% nitrogen along with 25 kg/ha cartap hydrochloride 4 G should be applied at this stage. It also checks further tillering and suppresses weed growth.

Propping

Propping was done in August using the trash-twist method to prevent the cane from lodging. Two adjacent rows of cane were brought together to form an arch, and the lowest leaves of the cane were twisted into the shape of rope in this method.

Plant protection measures

To safeguard the crop from diseases and pests, standard plant protection techniques should be used. Insect and the disease-free seed should be used as planting material followed by sett treatment with carbendazim 1 g + imidacloprid 17.8 SL @0.5 ml/litre water. Application of Fipronil 0.3 G @33 kg/ha at the time of transplanting of bud chips in furrows, will protect the crop from insect pests. Dead hearts should be removed at the interval of 15 days from germination to the last tillering stage to control shoot/root/top borer and its further spread. Cartap hydrochloride 4 G @25 kg/ha should

be applied at the time of earthing-up.

Harvesting

At the time of harvesting, every effort should be made to minimize bud damage. Detrashing should be avoided if the seed is intended for long-distance transport to avoid bud damage. Staling harvested cane would reduce germination. Desiccation of buds can be avoided by sprinkling water on harvested canes. At 9–10 months of age, seed cane should be harvested.

SUMMARY

The regular supply of enough quantities of good quality seed cane is essential for continued high sugarcane output with better recovery. As a result, the key limiting constraint in sugarcane cultivation is the availability of adequate quantities of good-quality planting material of improved varieties in a timely manner. The use of bud chip technology can result in the production of quality sugarcane seed. Diseased and insect-infested cane can easily be seen during bud separation. The planting materials developed by bud chip settling could provide an alternative practical, cost-effective, and easy way that saves a lot of seed.

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