

Sugarcane Cultivation: A Mechanized Approach

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ABSTRACT

This paper explores mechanization in sugarcane cultivation in India. Sugarcane is one of the primary crops produced all over the world. India does not hold an exception. From the preparation of the land to sowing, harvesting, detrashing, and ratoon management-all stages of sugarcane cultivation are under discussion in this paper. Mechanization has emerged as one of the few ways to combat labour shortages, ensure timely operations, and so on. It includes the utilization of heavy, modern farming machinery, for example, sugarcane planters, harvesters, detrashers, and ratoon managers, to increase efficiency, avoid drudgery, and increase general productivity. This discussion also gives a fair view of the environmental effects of sugarcane trash management. Mention is made about the necessary role played by sustainable practises, like trash management, and ratoon management, in reducing adverse effects.

INTRODUCTION

India is the second largest sugarcane producer globally after Brazil. Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Bihar, Gujarat, Haryana, Punjab, Andhra Pradesh & Uttarakhand are the major sugarcane- growing states contribute about

96.52% of the total production in India (source- E&S, DAC, New Delhi, 3rd Adv. Est.-2022-23). In India, 21% of the agricultural area is used for Sugarcane production. The country produces about 22% of the total sugarcane in the world. Seedbed preparation,

cultivation, harvesting, and transportation are the major tasks involved in any crop cultivation. In this context, I have discussed some of the machinery or implements used in the cultivation of the sugarcane crop. Mechanical power is cheaper, more accurate, and more efficient than manual or animal power. Nowadays, agricultural labour is decreasing in numbers due to migration to urban areas, leading to a scarcity of labour. Agriculture is an industry or sector where timely operations must be carried out according to the monsoon or season. This has increased the demand for agricultural machinery in recent times. Timely operations result in better yields or production. It is also proven that farm power availability leads to increased productivity. (S.P. Singh 2021)

Stages in sugarcane mechanisation

1. Land and seedbed preparation
2. Sowing
3. Weeding
4. Harvesting and detraging
5. Trash shredding
6. Ratoon management

1) Land and seedbed preparation: A good seedbed is essential for Sugarcane. Primary Tillage: Land preparation is done using indigenous or local tools like plough, mould board plough, disc plough, rotavators, subsoilers, and other locally available tools. Secondary Tillage: Cultivators, rotavators, heavy harrows are applied. The primary objectives are to prepare a favourable soil structure for the seedbed, to produce the optimum environmental condition for plant growth and establishment, to allow rapid infiltration and retention of rainfall, to ensure sufficient air capacity and exchange

within the soil, and to reduce resistance to root penetration.

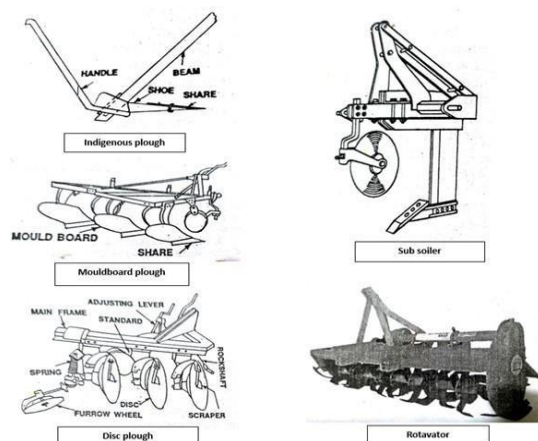


Image Source: Elements of agricultural engineering, by Dr. Jagadishwar sahay

2) Sowing: High-quality, disease-free, and pure seeds are utilized and are sown into the soil after loosening and ploughing the soil. Sugarcane is divided into small pieces or setts with a cane knife or bud chipper before manual sowing. In mechanized sowing, the sugarcane planter cut and sowed the setts. The planters are drop-type; hence they cut the whole canes into three-bud setts either manually or with a power-operated set-cutting machine. The setts are thereafter fed manually into the planter, which automatically performs the remaining operations like opening furrows, applying fertilizer, insecticide, and fungicide, covering the setts with soil, and compacting the soil cover.



Sugarcane planter

3) Weeding: Intercultural operations associated with sugar cane cultivation include weed management, moisture conservation and optimization of the environment in which plants grow. Weeds

reduce the yield considerably through rivalry with crops over basic resources such as water, nutrients, and sunlight. Directly, they can also affect profits through effects on harvest operations and crop quality and emissions of chemicals toxic to growth of crops - allelopathy. Losses in sugarcane yield because of weeds may vary from 12% to 72% in India. If weeds are allowed to grow initially, then yield loss can go as high as about more than 17.5 tons per ha. Moreover, for the first seven weeks of growth, weeds use four times the amount of nitrogen and phosphorus, and 2.5 times the potassium, compared to that absorbed by the sugarcane. This involves the application of some principles and proper methods to obtaining the desired crop. Vigor and uniformity of stand. Uprooting, covering, or cutting off weeds are part of this aspect. Historical Indian farming had been dependent on hoes, spades, and khurpas used for uprooting weeds manually. At present, there are numerous mechanical weeders in place, starting from tractor-drawn cultivators, wheel hoes, power weeders, to even robotic systems, which would make easier and more efficient performance.



Hand hoes



Wheel hoe



Power weeder



Robot

Image source: power weeder- kalgudi, Robot- ducksized, hoes-elements of agricultural engineering by Dr. jagadiswar sahay

4) Harvesting: It is advisable to harvest sugarcane at its best time, which falls during the peak maturity period. This is where proper techniques are applied in harvesting to obtain the highest mass of harvestable canes with the minimum field losses within a particular growing environment. Harvesting the cane either when it is immature or it has overripened using improper techniques degrades the yield of cane, reduces sugar recovery, lowers juice quality, and produces milling problems by extraneous material.

There are two primary harvesting methods:

1. Manual harvesting: This is done by using traditional hand tools such as cane knives, cutting blades, or even hand axes. It requires skilled labourers because improper harvesting leads to the loss of cane and sugar yield and poor juice quality.

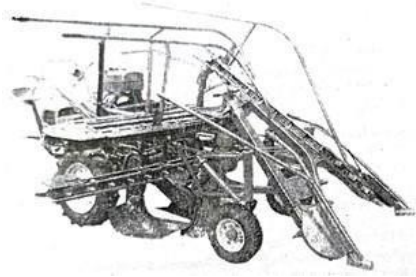


Cane cutter (Image source: Wikipedia)

2. Mechanical harvesting: Sugarcane is harvested mechanically where mechanical harvesters move along the rows cutting off the leafy tops, leaving the stalks cut up into short pieces or billets. These billets are loaded into bins towed beside the harvester. The bins are taken to the sugar mill through road when the bins are full. The field capacity in mechanical cane harvesting varies but it often occurs within a range of 2.5 to 4 hectares per day in eight hours of work time.



Sugarcane combine harvester



Sugarcane harvester

Sugarcane Detrasher: For de-trashing the sugarcane leaves. Detrashing can be accomplished through either manual or mechanical processes.



Manual detrasher



Mechanical detrasher

5) **Trash management:** Burning of trash in the field is often found during sugarcane cultivation due to labour shortages, along with a slow decomposition rate of the sugarcane trash, due to high carbon-to-nitrogen ratio, along with an overall lack of awareness concerning the associated nutrient benefit of trash. Burning trash in the field causes the loss of organic matter by the release of pollutants like smoke, carbon dioxide, and carbon monoxide into the atmosphere. The burning also kills the rich microorganisms of soil and earthworms, just like the intense heat produced during burning. Windrowing and baling the trash after harvest has also been another alternative suggestion. Dry and fresh sugarcane trash can be processed using tractor operated or power tiller operated shredders, resulting in its

incorporation into the soil to improve soil fertility.



IISR Trash handling



Trash shredder

Sugarcane stubble shaver

It is a single row stubble shaver with an operating capacity of 0.26 ha/hr. This also aids in the improvement of ratoon emergence in sugarcane. The tractor attachment for the sugarcane stubble shaver is suitable for use on any tractor having a minimum of 35 horsepower. The innovative design makes it cut only one row in a pass, while the traditional swinging blade shavers cut two rows at a pass.



Sugarcane stubble shaver

6) **Ratoon management:** A ratoon manager is a tractor-drawn implement that is attached to the three-point linkage and also powers itself through the PTO. It has the functions of stubble shaving, off-baring, and harrowing. The fertilizer and pesticide applicators can be added as attachments. Ratoon managers are highly effective when working with field

preparation on a tractor and fit for different row spacings. They shave the stubbles evenly, and it helps in the trimming of the roots.



Ratoon manager (Image Source: ARB Attachment)

CONCLUSION

It is a move to mechanize sugarcane cultivation in India. These shifting trends have been largely for the reasons of reduced agricultural labour, necessity of timely operations, and probable increase in yield. The paper considers the various stages of mechanization of sugarcane such as land preparation and seedbed preparation up to harvesting, detrashing, trash management, ratoon management, and even weed control. Though many conventional forms of manual methods are still widely used, mainly in detrashing, quite a few mechanical tools are on offer to organize sugarcane production; these in turn will help in increasing efficiency, decreasing drudgery, and alleviating labour shortages as well. With the continuous development and adaptation of these mechanized tools, the well-being of sustainable practices like trash shredding on soil health will be seen to improve sugarcane production in India.

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