

IMPROVING SUGAR RECOVERY

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SUGAR RECOVERY

Sugar Recovery is the percentage of sugar production in metric ton to the sugarcane crushed in metric ton

QUALITY CANE

A quality cane should have the following characteristics:

- Should have accumulated peak sucrose content in juice
- Should have low level of non-sugars
- Should have high purity
- Should have optimum fiber content
- Should have negligible amount of unwanted materials
 - (Trash, binding materials, dead and dry canes, mud particles, water shoots etc.)
- Should have higher quantity of juice
- There should not be pith in the cane
- The cane should not have flowered

FACTORS AFFECTING CANE QUALITY

- Variety
- Flowering
- Climate

- Soil
- Age of the crop
- Fertilizer
- Irrigation water
- Pests and diseases

1) VARIETY

- Quality of juice is primarily a varietal characteristic
- Varieties differ with respect to their sugar content, juice composition and fiber content
- High fiber in cane results less extraction percent
- Higher percentage of fiber in cane results in higher proportion of residual juice in bagasse leads to a higher milling loss
- To maximize and to maintain uniform recovery continuously throughout the season, cane fields which have recorded above 16% pol and 85% purity alone are to be selected for harvest
- Identification of early maturing high sugar varieties with good juice quality, maintenance of longer duration in the field and possessing resistance to post harvest inversion is important in the selection of varieties

2) FLOWERING

- Flowering generally results in interruption of vegetative growth, leading to cane maturing and sugar accumulation
- If flowering occurs much earlier before the maturing of cane and the cane is allowed to be in the field for more than three months after flowering, deterioration in juice quality sets in due to inversion of sucrose into glucose and fructose

3) CLIMATE

- Temperature, humidity, and sun shine of a region during maturity are responsible for deciding cane quality
- Maximum temperature between 23 and 30° C and minimum between 7 and 14° C are favorable to better juice quality.
- Deterioration in juice quality sets in where maximum temperature comes down to between 7 and 13° C and the minimum fall below 3° C
- Rain in winter is normally followed by cold spell and this also brings down the juice quality
- Temperature higher than the optimum also deteriorates the juice quality
- When the crop is shaded by trees or where there are cloudier days during maturity phase, there is depression in quality
- When the crop is severely affected by drought, the juice contains optically active non-sugars. This gives an apparent increase in sugar content, and leads to an increase in unknown losses in manufacturing process
- Under high temperature condition, the juice records low sugars, higher reducing sugars and higher non-sugars
- In area, with longer growing periods, higher purities are recorded
- Bright sunshine during daytime and cool night improve quality

4) SOIL

- Soil is also an important factor, which influences the quality of cane
- The mineral composition of the juice is governed by the amount of water-soluble salts in the soil
- Salt affected soil produce cane of inferior quality

- mid-late varieties 12 months
- Late varieties 14 -15 months

6) FERTILIZER

- Sugarcane removes on an average 1.0 kg N, 0.6 kg P₂O₅ and 1.75 kg, K₂O per ton of cane
- The nutrition applied should be in required proportions. Excess or deficit of any one leads to imbalance in crop nutrition which affects not only yield, but also juice quality
- Excess or late application of nitrogen (usually beyond 90-120 days) depress the juice sucrose content and increase the non-sugar component of juice leading to poor recoveries
- High tissue 'Nitrogen' leads to continued vegetative growth and thus delays maturity. It produces late tillers and water shoots. It increases sheath moisture and soluble nitrogen content in the juice
- Low sucrose, high reducing sugar content and lower purities are common under excess nitrogen
- The phosphate content in juice is depressed with increase of nitrogen at higher doses, thereby giving higher values of N/P ratio. The N/P ratio is negatively associated with sucrose content in juice
- Amount of phosphate (about 300 PPM) is required for proper processing (Clarification)
- Potassium plays a very important role in juice quality
- Under drought and excess moisture conditions, late additional application of potassium helps in proper ripening of cane; excess

application of K in soil already rich in 'K' should be avoided as excess K in juice results in loss of sucrose in to molasses

- A balanced application of N, P and K in time based on soil test values will help in getting cane of good quality
- At least seven micro nutrients including Fe, Zn and Boron play important role in improving juice quantity

7) IRRIGATION WATER

- The quantity and quality of irrigation water also influences the juice quality to a large extent
- River water irrigation produces juice of better quality as compared to Sugarcane grown under well water
- Reduction in sheath moisture by increasing interval of irrigation at maturity phase is reported to be conducive for increased sucrose content in juice
- Gradual withdrawal of moisture one month before harvest is known to hasten maturity and improve quality
- Use of saline water leads to accumulation of salts in juice particularly that of sodium, Chloride, Potassium etc., leading to problems in sugar manufacture

8) PESTS AND DISEASES

- Pests and diseases affect cane, show lower sucrose content and higher non-sugar content in juice
- Often the juice from the infected / infested sugarcane particularly that of borers, red rot and smut disease affect the juice quality and cause considerable hardship affecting the sugar recovery

- The Red Rot disease has been reported to cause yield losses up to 30-70%. In addition, the major quality parameters of brix, pol and purity are severely reduced
- Smut infection in sugarcane adversely affects juice quality. Wilt infection resulted in reduction in sucrose recovery by 29%
- Sugarcane Mosaic Virus (SCMV) infected cane revealed significant reduction in brix, sucrose and purity values

STRATEGIES FOR IMPROVING SUGAR RECOVERY

- Varieties & varietal scheduling
- Staggered planting
- Use of early maturing high sugar varieties
- Healthy seed program
- Optimum age at harvest
- Peak maturity of cane
- Maturity survey based cutting orders
- Clean cane supply
- Optimum cane harvest rate to meet the crushing rate
- Efficient cane harvest labor force
- Efficient communication system
- Efficient cane harvesting program

VARIETIES AND VARIETAL SCHEDULING

- Choosing proper varieties suitable for individual factories is an important task

- Varietal performance varies among different zones and divisions within a factory area depending upon soil type, irrigation potential and quality, drainage facilities, pest & disease problem etc. These factors must be studied and varieties should be appropriately chosen

USE OF EARLY MATURING & HIGH SUGAR VARIETIES

- Early maturing / high sugar varieties are an essential component of recovery improvement
- Since the early part of the season is characterized by poor recoveries, inclusion of only early or a great percentage of early varieties would help improve the recovery
- Planting of the early varieties earlier in the season and crushing them early in the crushing would not only give higher recoveries but also higher yields

AVOIDING LODGING, BUD SPROUTING & AERIAL ROOTING

- Lodging, bud sprouting and aerial rooting reduce cane quality directly
- Good earthing up, deep planting, propping and paired row planting would help check lodging significantly
- De-trashing is a sound practice which reduces bud sprouting considerably
- Modus @ 300 ml/ha can be used in case of excessive growth varieties to minimize lodging

NEWER PLANTING TECHNOLOGIES TO OBTAIN QUALITY CANE

- Deep planting, ring system of planting and polybag transplanting are the newer planting technologies which give better quality cane and yield

HEALTHY SEED PROGRAM

- Under commercial cultivation most of the sugarcane varieties degenerate due to buildup of diseases (Particularly Red Rot, Smut, Wilt etc.) poor growing conditions (Salinity, Alkalinity, Moisture stress, waterlogging etc.) and improper crop management (less water and nutrients) varieties lose not only yield potential but also quality
- To maintain a high recovery levels, having a healthy seed nursery program is indispensable

OPTIMUM AGE AT HARVEST

- | | |
|----------------------|---------------|
| • Early varieties | 10 months |
| • Mid-late varieties | 12 months |
| • Late varieties | 14 -15 months |

PEAK MATURITY OF CANE

Characteristics of a good quality cane:

- Should have accumulated peak sucrose content in juice
- Should have low level of non-sugars
- Should have high purity
- Should have optimum fiber content
- Should have negligible amount of unwanted materials
- (Trash, binding materials, dead and dry canes, mud particles, water shoots etc.)

- Should have higher quantity of juice
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PRE HARVEST MATURITY SURVEY

- Pre harvest maturity survey helps in assessing maturity status of the crop and thus best quality cane can be ensured for each day's crush
- By pre-harvest maturity survey alone, the sugar recovery can be improved to an extent of 0.5 to 0.8 percent
- The economics of the Pre harvest maturity survey indicates a highly favorable net profits, with a benefit / cost ratio for the operation highly around 16

VARIETAL MIX

- To maintain a high level of recovery, a certain level of varietal mix involving a high quality cane would help rather than a single variety at any particular period of crushing

HARVEST OF FLOWERED CANE

- Flowered cane fields to be harvested within three month of flowering to get better recovery
- If the harvesting is delayed beyond 3 months of flowering, we will be wasting valuable sugar already accumulated in the crop

WEATHER CONDITION

- Moderately low maturity (45-65%), limited water, supply low night temperatures, warm and sunny days have favorable influence on the maturity of the grown up cane and sugar recovery

PRE HARVEST IRRIGATION

- Gradual with drawl of moisture one month before the harvest of cane, hasten maturity and sugar recovery
- During the maturity phase, the sheath moisture level should be brought down to around 74 to 76% from 84-85% during growth phase to get better recovery

CHEMICAL RIPENERS

- Spray of chemical ripeners like Polaris, Sodium, metasilicate, Ethrel etc., during early season improve cane quality and thus recovery

METHOD OF HARVEST

- Use of appropriate harvesting tools, ground level harvest of cane, low topping and avoidance of extraneous matter like water shoots, trash and binding materials etc., will help in improving sugar recovery

TRANSPORT OF CANE

- In transport management, harvesting rate, transporting rate and crushing rate should be synchronized and should match one another
- Only minimum yard balance should be made to meet crushing during any break in the transport system
- The waiting time for lorries, tractors or bullock carts in the yard should not be more than 2 hours

EFFECTIVE COMMUNICATIONS

- There should be an effective communication system to coordinate the harvest management activities