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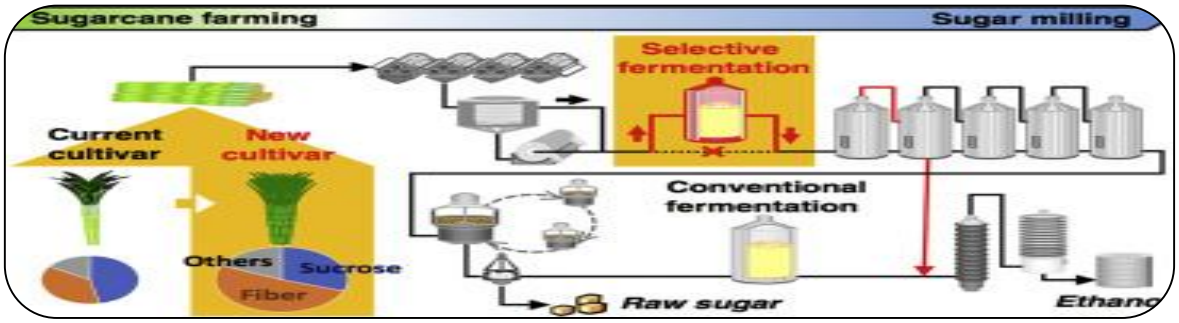

DETIORATION OF SUGARCANE INDUSTRY —A CRITICAL REVIEW

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ABSTRACT :

Sugar has emerged as a significant commodity for both human consumption and trade during the current period of economic liberalization. One of the organized sectors is the sugarcane industry. One of the nation's most important economic enterprises is in this sector. Sugarcane should be processed quickly into sugar because it is a perishable commodity. One of the most serious issues in the sugar recovery process is the loss of sucrose from the harvested cane as a result of delayed transportation and unfavorable environmental conditions. According to research, the sugarcane plant loses between 20% and 30% of its total sucrose production at various stages of raw material handling and sugar mill processing. One of the most alarming issues facing the sugar industry is post-harvest sugar loss, which has received a lot of attention in recent years.However, if crushed within 24 hours of harvest, there is little risk. Cane weight is significantly reduced when stalled for longer than 24 hours due to the loss of moisture and the inversion of juice sucrose.The study of cane quality parameters is essential for assessing post-harvest losses due to canestaling. This is a pressing need today.

KEYWORDS : *Deteoration, cursh, brine, juice su crose, sugarcane.*

INTRODUCTION :

One of India's most important cash crops, sugarcane contributes to the expansion of the rural economy and employs a large number of people.In India, the sugar production chain employs 3.5 lakh skilled and unskilled workers and nearly 35 to 40 million farmers.Sugarcane accounts for 70% of all white crystal sugar produced worldwide, earning the cultivar the moniker "kalpavriksha" (meaning "wonderful crop").However, the framers and sugar factories are currently facing difficulties as a result

of cane harvesting without crop maturity and scientific harvesting methods.The inversion and subsequent reduction of stored sucrose are significantly influenced by the maturity of cane.The amount of sucrose lost increases with physiological maturity.To reduce sugar losses, it is best to avoid harvesting cane that is either too young or too old.The crop is grown in almost every state in India, with the exception of the cold ones, under a variety of conditions.Sugarcane is grown on 5.02 million hectares in India, producing 342.1 million tons and producing 68.1 t/ha.According to Cooperative Sugar (2012), the cultivation area in Andhra Pradesh is 1.80 million ha, and the yield is 140.4 million tons at a productivity of 78.0 t/ha.

In the Indian tropics, sugarcane harvesting typically begins in November and continues until April, or in some cases, until May or June, depending on recommendations from the government and the availability of raw materials. This causes sugar losses as high as 15 kilograms per tonne of cane in the summer, and high sugarlosses have also been reported from high-temperature regions in Tamil Nadu and Andhra Pradesh.According to Uppal and Sharma (1999) and Uppal et al., Indian sugar mills typically lose between 5 and 10 kilograms per tonne of cane.2000.

Solomon and others,According to 1997), during the peak crushing season, the average sugar recovery in India's cane growing belts is between 8.5% and 9.5%.The harvesting of mature crops has a negative impact on sugar recovery and is currently a significant financial issue for sugar mills in India and many other countries that produce cane.Cane quality declines primarily as a result of chemical (acid) and enzymatic inversions brought on by microbes that enter through damaged stalks or cut ends.The differences in post-harvest deterioration are caused by a large number of factors, including ambient temperatures, variety, storage period, and maturity status (Solomon et al.,2007).Sugarcane yields, on the other hand, have increased over time as a result of agromanagement practices and the release of high-yielding clones.However, the sugar recovery is stable and largely dependent on mill efficiency, cane quality, planting and harvesting dates, and staling due to delayed crushing after harvest.Cane yield and sugar recovery are heavily influenced by clone genetic potential.

All of the cane clones are susceptible to post-harvest deterioration, but their rate of moisture loss may vary depending on their physical, chemical, and biochemical makeup and the environment in which they are grown.The morphological characteristics of cane, such as thickness, rind hardness, and wax coating, as well as the genetic nature of the clone.determines the extent of deterioration after harvest.Impact of staling period on juice quality and yield ofcane :Due to the entangled air bubbles, the cane juice is an opaque liquid covered in froth.Depending on the coloring substance in the crushed cane rind, the juice can be light gray to dark green.It consists of all soluble substances, primarily sucrose, with albumin, wax, clay, colorant, and small amounts of fine bagasse particles.This chapter briefly discusses research on the effect of storage time on the juice quality of harvested sugarcane varieties.

BRIX PERCENT:

Kadam et al.,2007) showed that, when compared to other genotypes and the standard Co 86032, the promising genotype Co M0254 had the highest brix (23.05).Kulkarni et al.2010) also reported that the genotype Co0312 had a brix that was significantly higher than that of the standard check Co C 671 (22.32 percent) at both the main crop and the second crop.Imdad Ali Sohu and others2011) found that the brix content of sugarcane juice decreased consecutively after a delay of up to eight days in processing the harvested cane during the screening process.When compared to the variety Q-88, which had a brix content of 20.28 percent, the variety GT-7 had a brix content of 20.43 percent.

PERCENT JUICE SUCROSE

According to Lionnet (1986), temperature had a significant impact on purity drop rate; an increase of 10°C resulted in a drop that was three to four times faster than the cane variety NCo376.Solomon and co.Invertase activity and juice quality in sugarcane were evaluated in 1990, and it was found that an increase in sucrose inversion following harvest was primarily caused by an increase in moisture loss during storage.During post-harvest storage, the variety Co 94012 had a low rate of inversion and minimal sucrose loss.

According to Niraj Kumar and Singh (2003), BO128 (a ratoon crop variety) had the highest sucrose percentage in juice, followed by BO 130, Co87263, BO 91, Co P 9302, and BO110.The study came to the conclusion that the high sucrose percentage juice and high cane yield of the variety BO128 meet the needs of mill management as well as cane growers.Rakkiyappan and othersCo 94005, Co 92020, Co 95007, Co 95003, and Co 95006 were identified as superior clones during an evaluation of some promising sugarcane clones. These clones had high pol percent, juice sucrose percent, and juice volume with low fiber percent and non-sugars.Thangavelu and co.According to Clonean of Eight Stages (2003), Co C 671 had the highest purity (89.88%), while Co 1148 had the lowest (80.70%). However, Co 1148 had the lowest purity (57.70%) at six months, while Co C671 had the highest purity (93.15%) at ten months.According to the findings, the average purity of the various stages ranged from 72.06 percent at six months to 89.67% at twelve months, before falling to 88.82 percent at thirteen months.

According to Thangavelu (2004b), the varietymean percentage of cane ranged from 7.24 in Co6304 to 11.88 in Co C 671.From 2.32 in POJ 2878 at six months to 15.08 in Co C671 at eleven months, the Polish percentage varied significantly.However, the findings revealed that the stage mean percentage of cane increased from 4.47 percent at six months to 11.93 percent at twelve months.Bhite and co.2006 a) looked at eight promising clones and three released, high-sugar varieties for the post-harvest inversion of stored sucrose between 0 and 108 hours after harvest.After 108 hours of growing, the high-sugar variety Co 94012 had a maximum sucrose percentage of 21.66, and among the clones, CoM0254 had a maximum sucrose percentage, demonstrating their tolerance for losses after harvest.Bhite and co.2006 b) The variety CoM-7125—resistant to inversion losses—was found to have a high ratio of sucrose (1.96) and low ratios of reducing sugars (2.44) during an evaluation of ten promising sugar cane varieties to post-harvest sucrose losses.Bhite and co.2007) also reported that the promising genotype CoM0417 and the variety Co 86032 experienced minimal sucrose loss, indicating their resistance to losses after harvest.In contrast to the other genotypes and standard Co 86032, the promising genotype CoM0254 displayed a higher sugar percentage (22.54%) during storage, indicating its tolerance to post-harvest losses (Kadam et al.,2007).

Hapase et al., (2008) showed that when compared to the standard Co C671, the genotypes VSI 434 and Co 94012 had the highest sucrose percentage at the 10th month, while the genotype VSI 434 had the highest sucrose percentage at the 12th month.Studies on the assessment of sugarcane quality deterioration between harvest and crushing period in the Telangana region of Andhra Pradesh concluded that sugarcane clones 97R129 (19.42%) and 97R183 (19.36%) recorded higher juice sucrose percentage at harvest, which is on par with checks Co6907 (19.18%) and Co7219 (19.26%). However, the genotypes VSI 434, VSI 435, CoVSI2000-01, and CoAdditionally, these clones maintained a higher percentage of juice sucrose up to 64 hours after harvest (Mukunda Rao et al.,(Lontom et al., 2008)Canes that were kept at room temperature for a longer period of time lost more weight, sugar, and soluble acid invertase activity.Priyanka Singh and othersAccording to a study published in 2009, during the late milling season, there is a significant loss of sucrose in relation to two enzymes—invertase and dextran sucrase—with a significant decrease in CCS percent and increase in enzyme activities.

For juice sucrose at harvest, the clones Madhumati (18.86 percent), CO C 01-061 (18.80 percent), and 98 A 108 (18.54 percent) were found to be significantly superior to Co 6907 (17.40 percent) (Raja Rajeswari et al.,2009 a). A study on how sugarcane deteriorates after it is harvested, with a focus on quality loss, found that different varieties of sugarcane had higher sucrose levels up until the 13th month, then decreased.Inversion of sucrose occurs and pol% decreases post-harvest (Rakkiyappan et al.).(Siddhant et al., 2009)According to a study published in 2009, the less fibrous early maturing group (CoS95255, Co S96268 and CoS8436) is more tolerant of sucrose loss following harvest than the more fibrous late maturing group (CoSe 92423, CoS97261, and CoS8432), which resulted in the conclusion that the less fibrous early maturing group is more resilient.Kulkarni and others2010) reported that the genotype Co0312 outperformed the standard check Co C 671 (21.42%) in sucrose percentage in both primary and secondary crops.Likewise, Mukunda Rao et al.2010) reported that sugarcane clones Co Co1061, 2000 A 63, 2000 A 226 and 2000 A 70 had higher juice sucrose concentrations at all crop-age months (11th, 12th, and 13th), indicating that they were tolerant of losses after harvest.

Pavan Chandra Reddy and coworkers,2010) reported that of the four clones (97R 129, 97R 401, Co 99004, and Co 99006), 97R 129 maintained its cane quality up to 72 hours after planting while exhibiting a minimum of a 1% decrease in sucrose content (4.07%).Imdad Ali Sohu and others2011) found that delayed milling of harvested cane resulted in sugar recoverable losses during the determination of post-harvest deterioration in forthcoming sugarcane varieties. However, the sugar recovery losses of Q-88 (2.44%) and GT-7 (2.34%) were not significantly different from one another.2011) assessed pre-releasesugarcane clones and inferred that the clones2000A226, 2000A70, 2000A6, 2001A63, 2000A175, Co C 01061 and 2001A85 have recorded fundamentally higherjuice sucrose percent over the standard Co 6907 undermoisture stress at developmental stage.

COMMERCIAL CANE SUGAR PERCENT

Karamathullah and others2003) reported that in the early season, Si 88033 and C93388 were found to have higher sugarcane yield, commercial cane sugar percent, and sugar yield on par with checks in the study with two plant crops and one ratoon crop.Midway through the season, the check CoG 93076 outperformed the tested clones in terms of cane and sugar yield.

Bhite and co.2007) found that after 72 hours of staling, the genotype Co M0503 lost 39.20 percent of CCS, while the variety Co86032 lost 12.76 percent. The promising genotype CoM0254 lost 16.40 percent more CCS than the standard Co 86032 (Kadam et al.,(Kulkarni et al., 2007)2010) reported that genotype Co0312 outperformed the standard check for cane yield and CCS yields, with CCS yields exceeding 16.04 percent at harvest Co C 671 (15.37 percent).According to Indrajith and Natarajan (2011), the standard variety Co 86032 outperformed the variety CoV 92102 in terms of commercial cane sugar percentage (12.7).Due to the maximum cane yield and comparable values of commercial cane sugar percent above the standard, the variety CoV 92102 recorded the maximum sugar yield.Parasuraman and others2011) reported that the clone Co 141 had the highest CCS percentage of 12.1 percent and the highest brix and POL percentage of any of the clones (99SiO10,99Si104), indicating that the 20C141 clones had excellent juice quality.

PURITY PERCENT

Steel and Trost (2006) found that the presence of bacteria reduced the purity of sugar, which may be the reason for the reduction in purity upon staling, in their studies on the control of microbial losses prior to cane delivery during sugar processing.Kadam and others2007) reported that the promising genotype Co M0254 had a purity of 97.82 percent higher than the standard genotype Co 86032.Imdad Ali Sohu and others2011)during screening of two sugarcane assortments concludedthat there was antagonistic impact on virtue percent in juicewith every day postpone in handling of collected stick.Variety GT-7 had a higher purity percentage than Q-88, according to the varietal effect.

REDUCING SUGARS

Rakkiyappan and othersAccording to research conducted in 2003, clones 85 R 186 (1.002%), Co 95005 (1.027%), Co 95006 (1.037%), Co 95001 (1.05%), and Co95003 (1.061%) performed better than the standard Co6304 in terms of lowering sugar levels.Bhite and co.2006 b) reported that the variety Co 92020, which is susceptible to inversion losses, had a higher ratio of reducing sugars (6.95) and an activity ratio of acid to neutral invertases, indicating that cut-to-crush delays cause excessive cane drying and heavy sucrose inversion due to respiration.Bhite and co.2006 a) reported that high-sugar variety Co 94012 recorded a minimal increase in reducing sugar from 0.32 at harvest to 0.90 after 108 hours of staling, demonstrating that the variety is tolerant of substantial sucrose loss during inversion.Bhite and co.2007) also showed that after 108 hours of staling, the variety Co M0265 had an increase in reducing sugar (20.83 fold), while the promising genotype CoM0503 had an increase in reducing sugar (25.00 fold) over the variety.Jia-Yong Liu and others2009) observed a gradual increase in reducing sugars between the two varieties, namely,CYZO2-588 (0.61%) and CYZO2-1826 (0.93%) which proportionately shown decrease in sucrose content.Lontom and co.In studies on the effects of storage temperature and duration on sucrose catabolism in harvested sugar cane stalks, researchers found that cane stored at high ambient temperatures increased reducing sugars and soluble acid invertase activity.Rakkiyappan and othersAccording to their findings from 2009, the percentage

increase in reducing sugars increased at a faster rate with increasing staling time and crop age at harvest.According to the findings, sucrose inversion to reducing sugars occurred more quickly in canes harvested at 14 months than at 12 months.As the staling time increased from 0 to 120 hours, the juice's sugar content decreased by four to five times.

Surekha Bhatia and others2009) reported that during the 12-day storage of canes, there was a gradual increase in reducing sugars, TSS percent, dextran, titrable acidity, activities of acids and neutral invertases, resulting in high sucrose invertases.MukundaRao and co.2010) reported that Madhurima and the sugarcaneclones Co 6907, 2000 A 105, 2000 A 213, and 2000 A 56 had higher reducing sugars, indicating a greater decline in cane quality.

Juice pH

Raja Rajeswari and others2009 b) examined various genotypes for their tolerance to post-harvest determination at various months (11, 12 and 13 months) and came to the conclusion that juice pH decreased throughout the crop's age and sampling intervals.The decrease in pH was high in 96 A 3, 87 A 298 and 96 A136 at the entire long stretches of gather and examining.Surekha Bhatia and others2009) reported that postharvest changes in juice quality parameters in relation to storage time under various environmental conditions resulted in a decrease in pH and a significant increase in TSS percent, dextran, titrable acidity, activities of acids and neutral invertases, and cane yield during 12 days of storage for all genotypes in all environmental conditions.Mukunda Rao and othersThe clones Co 6907, 2000A 105, 2000 A 213, 2000 A 56, and Madhurima showed a greater decrease in pH, indicating a greater level of cane deterioration, according to a 2010 report. However, all clones showed a progressive decrease in pH at all months (the 11th, 12th, and 13th months).

JUICE EXTRACTION PERCENT

When sugarcane clones were evaluated for juice extraction percent, Thangavelu (2004a) came to the conclusion that juice extraction decreased from immature to mature cane and that there was a significant difference between clones and stages.Surekha Bhatia and others2009) reported a steady decline in juice extraction percentages, as well as a gradual rise in moisture loss percentages, TSS percentages, dextran, and titrable acidity for canes that had been stored for 12 days in all environmental conditions.

CANE YIELD

Pechiappan et al. () identified varieties suitable for delayed harvest.2001) reported that the variety Co86249 outperformed all other varieties and produced more sugar and cane after 14 months of harvesting.According to the findings, early varieties as well as middle and late varieties can be harvested between 10 and 13 months.Nasir Ahmed and others2002), in their evaluation studies of sugarcane clones, the clones Co 92365 and Co 92479 registered superior cane yield, commercial cane sugar percent, and sugar yield in plant and row crops to the controls CoG93076 and Co 85019.According to Niraj Kumar and Singh (2003), when sugar cane varieties were evaluated for cane yield and juice quality, BO 110 had the highest cane yield, followed by BO 128, BO 91, BO 130, and BO 109.Kadamet et al.2007) discovered that the promising genotype CoM 0265 outperformed the other genotypes in terms of cane yield (97.19 t/ha) and CCS yield (14.37 t/ha), as well as variety CO 86032 and genotypes COM 0251, COM 0261, COM 0327, and COM 0301.

Naidu and co.Under limited irrigation and late-planted rainfed conditions, 97A85 was found to be superior to standards for cane yield (125.35 t/ha) and sugar yield (14.8 t/ha).Hapase et al. (During experimental studies on the performance of promising sugarcane genotypes at the Vasantdada Sugar Institute in Pune, Takalkar and Pawar (2008) reported that four genotypes—Co VSI 9805, Co VSI 9938, Co 98013, and Co VSI 2000-01—recorded significantly higher cane yields than the standards Co C671 and Co 86032. During seasonal effect on cane yield and sugar recovery studies, Takalkar and Pawar (2008) reported that Charumathi and co.According to a 2009 report, the popular standard Co 6907 was found to be inferior to the clones CoA 03081 and Co V 93101 in terms of cane yield and the number of millable canes.Raja Rajeswari and others2009 a) During the identification of sugarcane clones suitable for rainfed conditions, Kulkarni et al. found that the clone 99 A 5 yielded 89.28 t/ha more cane than the

popular clone Co6907 (69.3 t/ha).2010) reported that the genotype Co0312 yielded 114.02 t/ha more cane than the standard Co C 671 (78.09 t/ha), while the genotype Co VC9982 yielded 115.76 t/ha more cane than the genotype Co 0312.Charumathi and co.2011) during genotype screening, the cane and sugar yields of 2008 A104, 2008 A110, 2008 A113, 2008 A188, 2008 A236, 2008 A241, 2008 A272, 2008 A319, and 2008 A453 were found to be superior.CoV 92102–an elite cultivar in the deltaic region of Tamilnadu was evaluated by Indrajith and Natarajan (2011). They found that the variety had a high single cane weight, which had a positive impact on cane yield.Parasuraman and others2011) found that when early season clones were evaluated, clone Co C 141 had the highest mean cane yield in plant and ratoon crops, 173 t/ha and 115 t/ha, respectively, and the highest cane sugar yield in plant and ratoon crops, 21.3 t/ha and 13.7 t/ha, compared to standard varieties (Co 86032, Co 86241, Co C 98061, and Co C 90063).

CONCLUSION

Sugarcane should be processed quickly into sugar because it is a perishable commodity. Sugarcane plant loses between 20% and 30% of its total sucrose production at various stages of raw material handling and sugar mill processing. Post-harvest sugar loss has received a lot of attention in recent years. Sugarcane accounts for 70% of all white crystal sugar produced worldwide, earning the cultivar the moniker "kalpavriksha" (meaning "wonderful crop"). In India, the sugar production chain employs 3.5 lakh skilled and unskilled workers and nearly 35 to 40 million farmers.

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