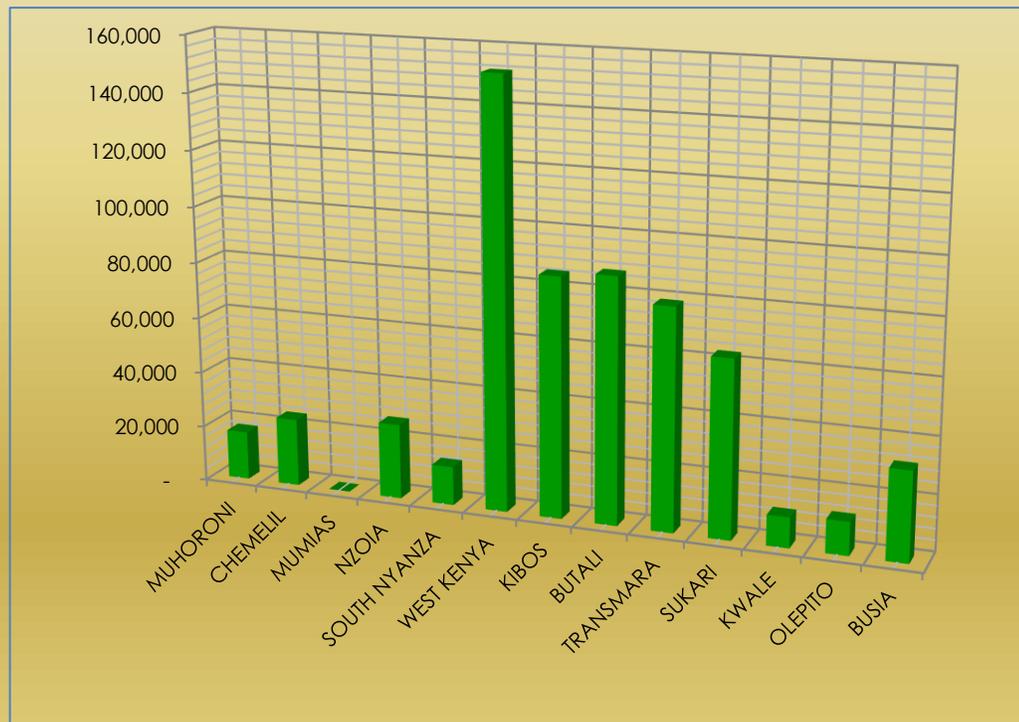




## YEAR BOOK OF SUGAR STATISTICS 2020

COMPARATIVE SUGAR PRODUCTION IN 2020 (MT)



TELEGRAMS: "KENSUGAR"

LANDLINES: (254-020) - 8018750-3 OR 2023316/9

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# KENYA SUGAR INDUSTRY YEAR BOOK OF SUGAR STATISTICS 2020

*The Crops Act, 2013 consolidates and repeals various statutes relating to crops, to provide for the growth and development of agricultural crops. As a result, all the institutions earlier established under the repealed laws ceased to exist and with the commencement of the Crops Act in August 2014 became directorates of AFA. The Sugar Directorate is one of the eight Directorates under the Agriculture and Food Authority (AFA).*

## **AFA MISSION**

*"To sustainably develop and promote scheduled crops value chains through effective regulation for economic growth"*

## **AFA VISION**

*"To be a world class regulator in the agricultural sector"*

## **CORE VALUES**

*Professionalism, Integrity, Customer Focus, Team work and Innovativeness*

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## DEFINITIONS AND ACRONYMS USED IN THE SUGAR INDUSTRY

<b>AFA</b>	Agriculture and Food Authority
<b>Annual Maintenance</b>	The longer period set aside for comprehensive equipment rehabilitation and some new installations. In the tropics, it is erroneously referred to as out-of-crop (OOC), yet <u>cane is not seasonal and is available in the farm all year round</u>
<b>Ash content</b>	Solid residue determined gravimetrically after incineration in the presence of oxygen. In analysis of sugar products, sulfuric acid is added to the sample, and this residue as sulfated ash heated to 525 °C is taken to be a measure of the inorganic constituents. Sometimes determined indirectly by measurement of electrical conductivity of the <u>product in solution (see conductivity ash)</u>
<b>Bagacillo</b>	1. Fine fraction of bagasse obtained by screening or pneumatic separation, <u>generally used as a filter aid in filtration</u> 2. Very small particles of bagasse separated either from pre-clarification juices or from <u>the final bagasse for filtration or other purposes</u>
<b>Bagasse</b>	Cane residue leaving mills after extraction of juice
<b>BOD<sub>5</sub></b>	Five days biological oxygen demand
<b>Boiling house</b>	That part of the sugar mill in which the processes of production of sugar from raw juice are carried out. It is also referred to as back end or raw house
<b>Boiling House Recovery</b>	The percentage ration of pol actually recovered in sugar to sucrose in mixed juice. If based on pol in mixed juice it is referred to as Boiling House Pol Recovery
<b>Brix</b>	1. Measure of dissolved solids in sugar liquor or syrup using a refractometer, otherwise referred to as refractometric dry solids. For solutions containing only sugar and water, Brix = % sugar by mass. Spindle Brix is determined using a hydrometer, but is now <u>seldom used</u> 2. Refractometer brix - the term used when a refractometer equipped with a scale, based on the relationship between refractive indices at 20°C and the percentage by mass of total soluble solids of a pure aqueous sucrose solution, is used instead of a hydrometer to test the solids concentration of a sucrose containing solution. The sugar industry is now standardized on refractometer brix
<b>Bulk Density</b>	The mass of material per unit of total volume occupied
<b>Cane to Sugar Ratio</b>	Tonnes of cane required to produce one tonne of <i>tel quel</i> sugar
<b>Color</b>	Attenuation index, determined by absorption of light under defined conditions. Generally measured using the ICUMSA method at 420 nm and referred to as ICUMSA <u>units or IU</u> .
<b>Conductivity Ash</b>	Estimate of ash content by measurement of the conductivity of the solution.
<b>Crystal Content</b>	The percentage by mass of crystalline sugar present in a massecuite, magma or similar <u>material</u>
<b>CU</b>	Capacity utilization
<b>Dissolved solids</b>	All solute material which is in solution, including sucrose, monosaccharides, ash and other organic impurities
<b>Dry Substance</b>	1. The material remaining after drying a product to constant mass, or for a specified period. The mass of dry substance can also be found by deducting from the mass of the product, the mass of moisture, as determined in a specified manner 2. A measure of total solids obtained from evaporating a solution or massecuite under <u>vacuum to dryness</u>
<b>Extraction</b>	1. Proportion of sugar extracted from cane in the extraction plant; equals mass of sugar in raw juice as a percentage of mass of sugar in cane 2. The percentage ratio of sucrose in mixed juice to sucrose in cane. If based on pol it is referred to as Pol Extraction

## DEFINITIONS AND ACRONYMS USED IN THE SUGAR INDUSTRY

<b>Extraneous matter</b>	All cane leaves and tops, mud, soil, roots, rocks, stones and tramp iron delivered with the cane.
<b>Fibre</b>	<p>1. The dry fibrous insoluble structure of the cane plant. Generally taken to mean all insoluble material in the cane delivered to a mill, and therefore includes soil or other extraneous insoluble matter in cane</p> <p>2. The water insoluble matter of cane and bagasse from which the brix-free water has been removed by drying. Where associated with brix-free water, fibre is often called natural fibre</p>
<b>Filter Cake</b>	The residue removed from process by filtration including any added filter aid.
<b>FTE</b>	Factory Time Efficiency
<b>ICUMSA</b>	International Commission for Uniform Methods of sugar analysis
<b>Imbibition</b>	<p>1. The process of adding water to the extraction plant to increase extraction. Sometimes incorrectly referred to as maceration (steeping cane in juice). Water added is called imbibition water</p> <p>2. The process in which water or juice is put on bagasse to mix with/dilute the juice present in the latter. The water so used is termed imbibition water. General terms in use are: single imbibition, double imbibition, compound imbibition, depending on the manner in which water is applied</p>
<b>Invert sugar</b>	Mixture of approximately equal parts of glucose and fructose (monosaccharides) resulting from the hydrolysis of sucrose (inversion)
<b>ISO</b>	International Sugar Organisation
<b>ISA</b>	International Sugar Agreement
<b>KEBS</b>	Kenya Bureau of Standards
<b>kg</b>	Kilogram
<b>Molasses</b>	The mother liquor separated from the crystals by centrifuging A, B, or C massecuites. Molasses is derived from the corresponding massecuites. C molasses is also referred to as final molasses
<b>MT</b>	Metric Tonnes
<b>Nonsugar</b>	Common overall term for dissolved solids other than sugar contained in any process stream
<b>Nonsucose</b>	Dissolved solids contained in any process stream other than sucrose
<b>OTE</b>	Overall Time Efficiency
<b>PI</b>	Preparation Index
<b>Polarization (or pol)</b>	<p>1. Relative rotation of plane polarised light as a measure of sucrose concentration</p> <p>2. The apparent sucrose content of any substance expressed as a percentage by mass and determined by the single or direct polarisation method. The term is used as if it were a real substance</p> <p>3. The apparent sucrose content expressed as a mass percent measured by the optical rotation of polarized light passing through a sugar solution. This is accurate only for pure sucrose solutions</p>
<b>ppm</b>	Parts per million

## DEFINITIONS AND ACRONYMS USED IN THE SUGAR INDUSTRY

<b>Purity</b>	1. The true purity is the sucrose content as a percent of the dry substance or dissolved solids content. The solids consist of sugar plus nonsucrose components such as invert, ash, and colorants. Apparent purity is expressed as polarizability divided by refractometer Brix, multiplied by 100.
	2. The percentage ratio of sucrose (or pol) to the total soluble solids (or brix) in a sugar product. The following terms are in general use:Refractive apparent purity: The percentage ratio of pol to refractometer brix. G.C. sucrose refractometer brix purity: The percentage ratio of GC sucrose to refractometer brix.
<b>R-</b>	Reduced or parameters standardise at agreed conditions
<b>Raw Juice</b>	Juice obtained from the cane extraction process. Also referred to as mixed juice (from mills) or draft juice (from diffusers).
<b>Raw Sugar</b>	Brown sugar produced in a raw sugar mill generally destined for further processing to white sugar in a refinery.
<b>RBHR</b>	Reduced boiling house recovery
<b>Reducing Sugars</b>	Generally referred to and /or interpreted as invert sugar determined by measuring reducing substance content by laboratory analysis.
<b>Refining</b>	Purification of sugar through chemical and physical methods generally including some or all of clarification, filtration, decolorization and recrystallization.
<b>Refractometric dry solids (RDS)</b>	Measurement of total dissolved solids in a sugar liquor or syrup using a refractometer. For solutions containing only sugar and water, % RDS = % sugar by mass.
<b>Rendement</b>	Sugar made % cane
<b>RME</b>	Reduced Mill Extraction
<b>ROR</b>	Reduced Overall Recovery
<b>Safety factor</b>	Number to indicate keeping quality of raw sugar, calculated from pol and moisture content (Moisture (g)/100g sugar)/ (100-pol).
<b>Sonysugar</b>	South Nyanza Sugar Company Limited
<b>Sucrose</b>	The pure disaccharide $\alpha$ -D-glucopyranosyl- $\beta$ -D-fructofuranoside, known commonly as sugar.
<b>Sugarcane</b>	Botanically a tall grass of the genus Saccharum and agriculturally the crop produced from hybrids which are the progeny of a number of Saccharum species commonly referred to as cane. For determination and payment of sucrose in cane it is the raw material accepted at the mill for processing.
<b>SD</b>	Sugar Directorate
<b>SRI</b>	Sugar Research Institute
<b>TC/TS ratio or TC:TS</b>	Cane and Sugar ratio by weight
<b>TCD</b>	Tonnes of Cane per Day
<b>tel qel</b>	Apparent quantity
<b>USD</b>	United State of America Dollar
<b>TREO</b>	Tax Remission for Export Office

## PARAMETERS AND COMPUTATION OF STATISTICAL DATA

PARAMETERS	No	METHOD
Weight of cane	1	Obtained by weighing
Weight of mixed juice	2	Obtained by weighing
Weight of imbibition water	3	Obtained by weighing
Moisture % bagasse	4	Mean of daily analyses
Pol ( or sucrose) % bagasse	5	Mean of daily analyses
Brix % bagasse	6	$\frac{\text{Pol \% bagasse (5)} \times 100}{\text{Purity last expressed juice}}$
Purity last expressed juice		Mean of daily analyses
Fibre % bagasse	7	$100 - \text{Moisture \% bagasse (4)} - \text{Brix \% bagasse (6)}$
Weight of bagasse	8	$(1) + (3) - (2)$
Bagasse % cane	9	$(8) \div (1) \times 100$
Weight of fibre	10	$(8) \times (7) \div 100$
Fibre % cane	11	$(10) \div (1) \times 100$
Mixed Juice % cane	12	$(2) \div (1) \times 100$
sucrose % mixed juice		Mean of daily analyses
Brix % mixed juice		Mean of daily analyses
Weight of Brix in mixed juice	13	$(2) \times \text{Brix \% mixed juice} \div 100$
Weight of sucrose in mixed juice	14	$(2) \times \text{sucrose \% mixed juice} \div 100$
Weight of Brix in bagasse	15	$(6) \times (8) \div 100$
Weight of sucrose in bagasse	16	$(5) \times (8) \div 100$
Sucrose In bagasse % cane	17	$(16) \div (1) \times 100$
Weight of absolute juice	18	$(1) - (10)$
Weight of Brix in absolute juice	19	$(15) + (13)$
Weight of sucrose in absolute juice	20	$(16) + (14)$
Brix % absolute juice	21	$(19) \div (18) \times 100$
Sucrose % absolute juice	22	$(20) \div (18) \times 100$
Gravity purity absolute juice	23	$(20) \div (19) \times 100$
Weight of absolute juice extracted	24	$(13) \div (21) \times 100$

## PARAMETERS AND COMPUTATION OF STATISTICAL DATA

PARAMETERS	No	METHOD
Absolute juice % cane	25	$(18) \div (1) \times 100$
Absolute juice extracted % cane	26	$(24) \div (1) \times 100$
Weight of absolute juice in bagasse	27	$(18) - (24)$
Imbibition water % cane	28	$(3) \div (1) \times 100$
Imbibition water % absolute juice	29	$(3) \div (18) \times 100$
Weight of dilution water	30	$(2) - (24)$
Dilution water % cane	31	$(30) \div (1) \times 100$
Dilution water % absolute juice extracted	32	$(30) \div (24) \times 100$
Evaporation % clarified juice	33	$\frac{(\text{Syrup Brix} - \text{Clarified juice Brix}) \times 100}{\text{Syrup Brix}}$
syrup Brix		Obtained by analysis
Weight of sucrose in cane	34	$= (20)$
Weight of Brix in cane	35	$= (19)$
Sucrose % cane	36	$(34) \text{ or } (20) \div (1) \times 100$
Java Ratio	37	$\frac{\text{sucrose \% cane } (36) \times 100}{\text{Sucrose \% 1st expressed juice}}$
Sucrose % 1st expressed juice		Obtained by analysis
Mill extraction (M.E)	38	$(14) \div (34) \times 100$
Reduce mill extraction (R.M.E)	39	$\frac{100 - [100 - (38)] \times [100 - (11)]}{7 \times (11)}$
Sucrose in bagasse % sucrose in cane	40	$(16) \div (34) \times 100$
Extraction ratio	41	$\frac{100 - (38) \times 100}{(11)}$
Mill Loss	42	$(16) \div (10) \times 100$
First mill extraction (stuart formula)	43	$\frac{(P_m - P_2) P_1 \times e^*}{(P_1 - P_2) P_m}$ where: $P_m$ = Pol % mixed juice $P_1$ = Pol % 1st mill juice $P_2$ = Pol % 2nd mill juice $e$ = mill extraction
Weight of raw sugar	44	Obtained by weighing
POL of raw sugar	45	Polarisation of mean sugar sample
Moisture %sugar	46	Moisture of mean sugar sample

## PARAMETERS AND COMPUTATION OF STATISTICAL DATA

PARAMETERS	No	METHOD
Dilution indicator (DI)	47	$\frac{(46)}{100 - (45)} \times 100$ Where: DI less than 35 is SAFE DI between 35-50 is DOUBTFUL DI above 50 indicates DETERIORATION DI below 25 is strong fire hazard
Weight of sucrose in raw sugar	48	$(44) \times (45) \div 100$
Boiling house recovery ( RHR)	49	$(48) \div (14) \times 100$
Reduce Boiling House recovery (RBHR) ( Purity mixed juice = 85)	50	$100 - \{ 100 - (49) \} \times \frac{\text{purity of mixed juice}}{5.667 ( 100\text{- pty. M.J})}$
Purity of mixed juice		$\frac{\text{sucrose \% mixed juice}}{\text{Brix \% mixed juice}} \times 100$
Purity of raw sugar	51	$\frac{45}{100 - (46)} \times 100$
SJM recovery ( available sucrose)	52	$\frac{S (J-M)}{J (S-M)} \times 100$ Where: S= gravity pty raw sugar J= gravity pty mixed juice M= gravity pty molasses
Weight of <u>available</u> sucrose in mixed juice	53	$(14) \times (52) \div 100$
Boiling house efficiency (BHE)	54	$(48) \div (53) \times 100$
Daily <u>estimation</u> of raw sugar production	55	$(14) \times (52) \times (54) \times \frac{100}{(45)}$
Overall recovery	56	$(48) \div (34) \times 100$
Reduced overall recovery	57	$(39) \times (50) \div 100$
Raw sugar extracted % cane	58	$(44) \div (1) \times 100$
Sucrose extracted % cane	59	$(48) \div (1) \times 100$
Weight of filter cake	60	Obtained by weighing
Sucrose (or Pol) % filter cake	61	Mean of daily analyses
Moisture % filter cake	62	Mean of daily analyses
Weight of sucrose (or pol) in filter cake	63	$(60) \times (61) \div 100$
Sucrose (or pol) in filter cake %cane	64	$(63) \div (1) \times 100$

## PARAMETERS AND COMPUTATION OF STATISTICAL DATA

PARAMETERS	No	METHOD
Weight of final molasses	65	Obtained by weighing
Sucrose of final molasses	66	Obtained by analysis
Weight of sucrose in final molasses	67	$(66) \times (65) \div 100$
Sucrose in final molasses % cane	68	$(67) \div (1) \times 100$
Total real losses % cane	69	$(36) - (59)$
Total industrial losses % cane	70	$(69) - (17)$
Undetermined losses % cane	71	$(70) - (64) - (68)$
Total crushing hours per day	72	Daily mill crushing hours
Hours of stoppages ( exclusive of cane shortage and planned stops)	73	Daily mill stoppage hours
Nett crushing hours per day	74	$(72) - (73)$
Tonnes cane crushed per hour	75	$(1) \div (74)$
Overall time efficiency	76	$\frac{74}{24(\text{hours})} \times 100$
Mechanical time efficiency	77	$\frac{74}{(74) + (73)} \times 100$

## SUMMARY OF RECOVERIES

PARAMETERS	No	METHOD
Weight of sucrose in mixed juice	4	
SJM Recovery	52	
Weight of available sucrose in mixed juice	53	$(53) = (14) \times (52) \div 100$
Weight of raw sugar	44	
weight of sucrose in raw sugar	48	$(48) = (44) \times (45) \div 100$
Boiling House Recovery, BHR	49	$(49) = (48) \div (14) \times 100$
Boiling House Efficiency, BHE	54	$(54) = (48) \div (53) \times 100$
Daily estimation of raw sugar to be produced	55	$(55) = \frac{(14) \times (52) \times (54) \times 100}{4.50E+01}$
Overall Recover, OR	56	$(56) = (48) \div (34) \times 100$
Reduced Overall Recovery, ROR	57	$(57) = (39) \times (50) \div (100)$

## PARAMETERS AND COMPUTATION OF STATISTICAL DATA

### SUMMARY OF LOSSES

PARAMETERS	No	METHOD
Weight of cane crushed	1	
Weight of sucrose in cane	34	
Sucrose % cane		$= (34) \div (1) \times 100$
Weight of sucrose in raw sugar extracted	48	
Sucrose extracted % cane		$= (48) \div (1) \times 100$
Weight of sucrose lost in filter bagasse	16	
Sucrose lost in bagasse % cane		$= (16) \div (1) \times 100$
Weight in sucrose lost in filter cake	63	
Sucrose lost in filter cake % cane		$= (63) \div (1) \times 100$
Weight of sucrose lost in molases	67	
Sucrose lost in molasses % cane		$(68) = (67) \div (1) \times 100$

### EXAMPLE FOR COMPUTING LOSSES

	METHOD	VALUE	Losses	
			% cane	% Sucrose
Weight of cane (1)	1	3,257,000.00	0	0
Weight of sucrose in cane (34)	34	420,390.00	0	0
Weight of sucrose in raw sugar (48)	48	376,230.00	0	0
Total weight of sucrose lost	$= (34) - (48)$	44,160.00	1	11
Weight of sucrose lost in bagasse	16	14,160.00	0	3
Weight of sucrose lost in filter cake	63	2,840.00	0	1
Weight of sucrose lost in final molasses	67	25,764.00	1	6
Total accountable sucrose losses	$= (16) + (63) + (67)$	42,764.00	0	0
Undetermined losses	71	1,466.00	0	0
Industrial losses	70	30,070.00	1	7