Proinde

Loading sugar in Brazil

Pratical Guidance

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Practical Guidance

Content

Foreword

While the early history of sugar production in Brazil is inextricably associated with slavery and intensive labour, the industry was modernised from the turn of the century, making the country the world's top producer and exporter of this millennial commodity. The country is the second producer of ethanol, behind the United States, and has the largest automotive fleet running on biofuels, a fine example of a circular economy.

Last year, Brazil produced over 41 mmt of sugar, mostly exported, yielding an all-time export record. Despite an estimated reduction for 2020/21, sugar production and exports are expected to continue at very high levels for years to come.

Considering the high volumes of sugar shipments departing from Brazil each year, the incidence of significant cargo damage or shortage claims is relatively low. However, because most bulk terminals are only designed to load cargo, removing large amounts of sugar spoiled during loading can often be rather challenging and expensive.

To help our clients and associates doing business in the country better understand why the traditional commodity stands out as one of the vital agriproducts that help boost the Brazilian economy – and keep ports busy –, we have condensed this guide with comprehensive information about the national sugar industry, the local practices and regulations.

Firstly, we briefly walk through the history of sugarcane in Brazil, its production, export, and port handling volumes, along with statistical information. We then summarise the applicable national and international grading standards and legal framework for quantifying, loading, and carrying sugar cargoes and allocating liabilities among the various stakeholders.

Following the guidelines of international authorities and leading P&I clubs, we have put together some practical advice on the main risks of loading sugar in Brazil and best practices for carrying the sweet commodity preventing, or at least minimising, cargo losses.

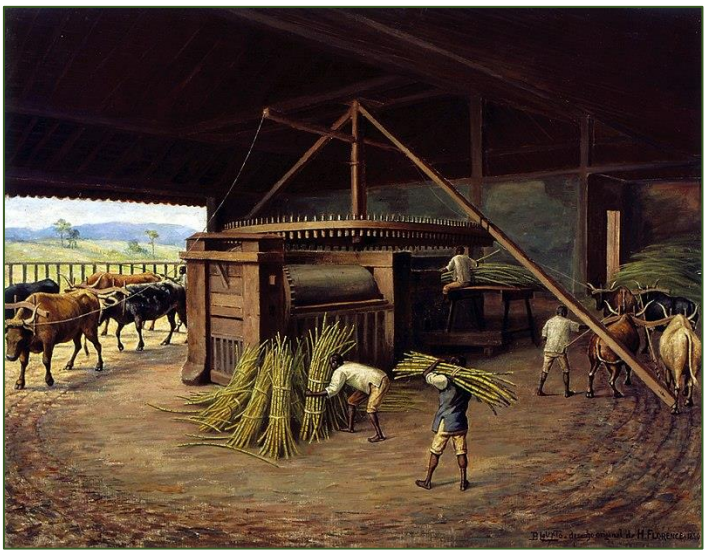
We hope this guide will be a valuable source of reference and practical information, and we welcome your comments and suggestions for corrections and improvements in a future edition.

REPRESENTAÇÕES PROINDE LTDA.
October 2021

1. Brazilian sugarcane industry

1.1. History of sugarcane in Brazil

The sugarcane culture is intrinsically linked with the socioeconomic history and development of Brazil. The sucrose (sugar) consumed in the country is extracted from sugarcane[1], brought by Portuguese settlers in 1532, together with the first African slaves, whose descendants continued to form the predominant workforce in the cane fields and sugar mills until slavery was eventually abolished in 1888.



Picture 1: "*Sugarcane Crushing - Cachoeira Farm - Campinas, 1830*", oil on canvas by Benedito Calixto (1853/1927). Source: Museu Paulista

Around the turn of the 20th Century, the technology used in the sugarcane sector was still rudimentary and labour-intensive. Slowly, sugarcane cultivation was separated from industrial processes, resulting in fewer sugar mills with inputs concentrated in larger central mills. Yet, the production of sugar, alcohol, and other by-products, such as Brazil's national drink "*cachaça*" (sugarcane spirit), did only supply the domestic market, which ended up experiencing overproduction from time to time.

In the 1930s, the federal government imposed tighter controls on sugar and alcohol and devised long-term export policies to encourage farmers to rationalise sugarcane production and boost yielding[2]. In addition, scientific research on ethyl alcohol (ethanol) as a renewable fuel was intensified; however, the quotas on distilleries and suppliers continued to render Brazilian sugarcane products uncompetitive in the international market, and export volumes were modest.

1.2. National biofuels policy

After the 1973 Oil Crisis, the government introduced the "*Programa Nacional do Álcool* - Pró-Álcool" (National Alcohol Program) to finance sugarcane growers and promote ethanol as a cleaner option to lessen dependency on the costly imported petrol[3]. The program became the most successful of its kind globally, resulting in a rapid expansion of sugarcane cultivation and distilleries in Brazil, mainly in the Centre-Southeaster states of São Paulo, Goiás and Minas Gerais and along the Northeastern coast. Other government and industry-supported programs and initiatives also followed.

[1] The sugarcane plant (*Saccharum officinarum*) is a perennial grass of the family *Poeacea*, cultivated for its juice from which sugar, alcohol, "*cachaça*" (cane spirit) and "*rapadura*" (brown sugar) are made. The straws and bagasse are used as second-generation biofuels

[2] The *Instituto do Açúcar e do Álcool* – IAA (Sugar and Alcohol Institute) was an autarchy of the federal administration created in 1933 and headquartered in the then federal capital Rio de Janeiro. Its objectives were to guide, promote, control, and formulate policies on the production and export of Brazilian sugar, alcohol and by-products. IAA was disbanded in 1990 amid cases of corruption. The previously regulated sugar and alcohol export prices were released, and the sector was deregulated

[3] Since the 1990s, light vehicles in Brazil have run on anhydrous ethanol, gasoline with a minimum blend of ethanol (regulated by the government according to the sugarcane harvest and ethanol production), or flexible-fuelled engines, which use either type of fuel

1.3. Market deregulation

The government's initiative to foster the sugarcane industry and promote biofuels was followed by profound deregulation as of 1990, including the end of controlled production and export prices. With growing confidence from producers and traders and an abundance of arable land, sugar, ethanol, and other sugarcane derivatives have reached unprecedented productivity levels. The sector was modernised and attracted major trading companies that invested in logistics infrastructure. In the late 1990s, the first port terminals specialised in sugar storage and export were built in Santos, the country's busiest sugar port since the days of colonial Brazil.

1.4. Sugarcane production

With an average annual sugarcane output of 631 million metric tons (mmt) over the last ten years, Brazil remains the world's largest producer, followed by India, Thailand, and China[4]. Given its geographic position on the globe, Brazil cultivates sugarcane on an economic scale across its vast fertile territory. Due to a large diversity of microclimates in the north-south axis, the country produces sugar and ethanol practically all year round, albeit with varying intensity.

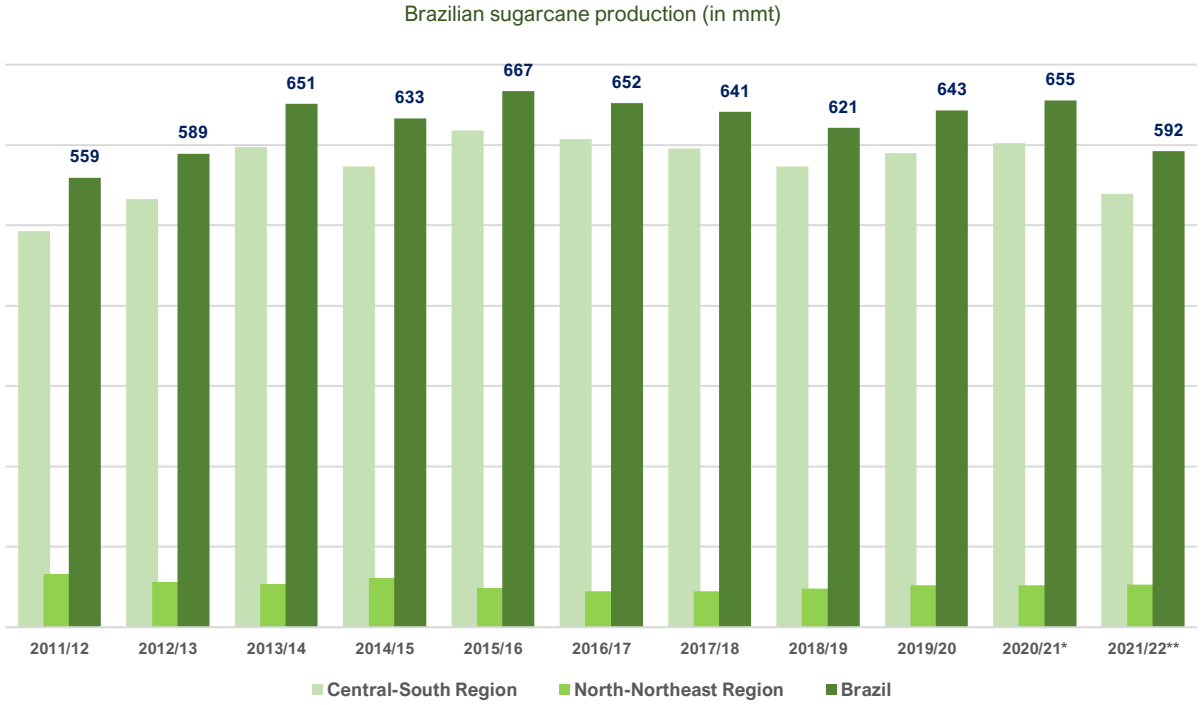
Currently, sugarcane is grown in nineteen of the 26 Brazilian states. The producing areas are grouped into two regions: Centre-South, which covers about 92% of the domestic output, and the North-Northeast, which accounts for the rest of the country[5]. Within the former region, the wealthy state of São Paulo, where the Port of Santos is located, alone supplies about half of the sugarcane harvested in Brazil and half of the national sugar and ethanol production. There is no sugarcane cultivation within the Amazon region, except for subsistence agriculture. **[Section 1.6]**

Picture 2: Cutting machine harvesting sugarcane in the hinterlands of São Paulo, Brazil. Source: Shutterstock

In the last ten years, the area destined for sugarcane cultivation remained at an average of 8.7 million hectares (mha), yielding 631 mmt of sugarcane per year on average. In the same period, agricultural yield rose from 68.6 kg/ha to 78.1 kg/ha in the Centre-South region. In comparison, the less developed North-Northeast sugar region increased its productivity marginally from 57.5 kg/ha to 58 kg/ha.

[4] FAOSTAT Database of the Food and Agriculture Organization of the United States (FAO) [retrieved 16/06/21]
[5] The sugarcane region is determined according to the state where the product has grown or where the last manufacturing process has occurred. The Central-South region includes São Paulo, Rio de Janeiro, Paraná, Rio Grande do Sul, Santa Catarina, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais and Espírito Santo. The North-Northeast region includes Acre, Alagoas, Amazonas, Bahia, Ceará, Maranhão, Pará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Roraima, Sergipe and Tocantins

The National Supply Company (CONAB)[6] estimates the 2020/21 sugarcane crop to close at 655 mmt, 1.8% higher than the previous season, with a planted area of 8.6 million hectares (mha), up 2.1% to the 2019/20 season. The Centre-South Region harvested around 603 mmt (92% of national output). Highlights were São Paulo, the top producer, followed by Goiás, Minas Gerais, and Mato Grosso do Sul[7].



Graph 1: Brazilian sugarcane production 2010/11 to 2021/22, in mmt (* estimated, ** projected). Source: CONAB

For 2021/22, CONAB predicts a planted area of 8.2 million hectares, yielding 61 kg/ha in the North-Northeast and 73 kg/ha in the Centre-South region, 4.3% down from last season. CONAB's latest estimate points to a reduction of sugarcane production to 592 mmt, a staggering 9.5% drop[8]. **[Graph 1]**

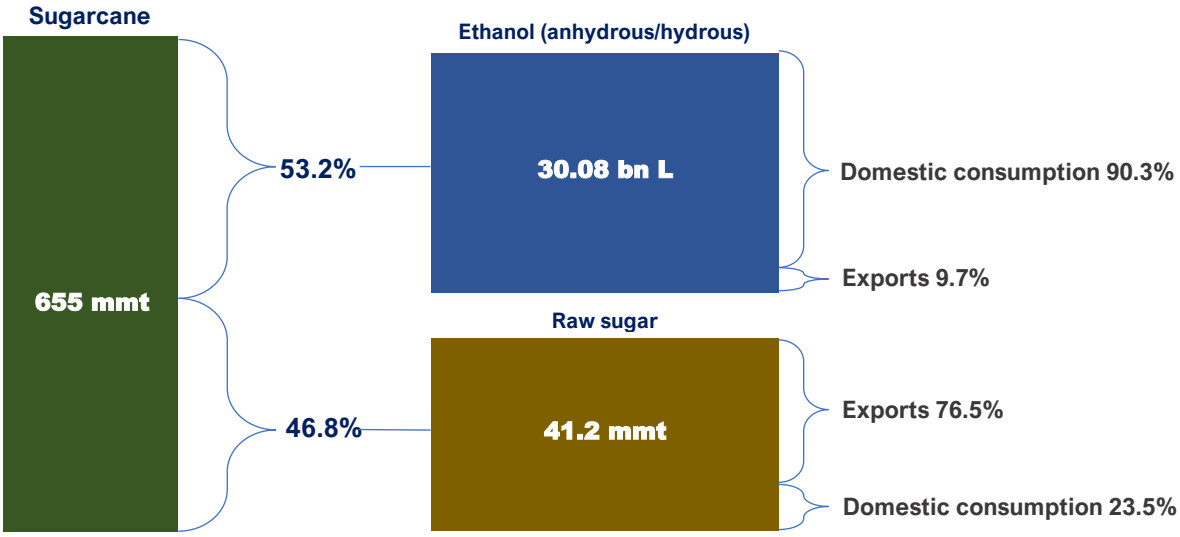
The United States Department of Agriculture (USDA), in turn, forecasts that sugarcane output will close at about 635 mmt, 3% less than it estimated for 2020/21 (657 mmt), but still above average[9]. The decline in production is attributed to a combination of dry weather and fires that damaged cane fields and, to some extent, migration of sugarcane areas to more profitable and price-steady crops, such as soya beans and maize (corn)[10].

1.5. Sugar-ethanol mix

The current regulatory framework allows sugar-ethanol mills to adjust their sugar and ethanol production ratio according to the most attractive market price of the two commodities. During this century, Brazilian sugarcane production has more than doubled, while the sugar-ethanol balance fluctuated in the range 50%-65% for ethanol refining, the remainder diverted to sugar production.

[6] *Companhia Nacional de Abastecimento* – CONAB (National Food Supply Agency) is a public company under the *Ministério da Agricultura, Pecuária e Abastecimento* - MAPA (Ministry of Agriculture, Livestock and Supply) that controls and regulates the stocks of staple food and commodities
[7] "*Acompanhamento da Safra Brasileira de Cana-de-Açúcar, v.7, Safra 2020/21, 4º Levantamento, Maio 2021*" (Monitoring of the Brazilian Sugarcane Harvest, v. 7 - 2020/21 Crop – Fourth Survey, May 2021) by CONAB [retrieved 20/06/21]
[8] "*Acompanhamento da Safra Brasileira de Cana-de-Açúcar, v.8, Safra 2021/22, 2º Levantamento, Agosto 2021*" (Monitoring of the Brazilian Sugarcane Harvest, v. 8 - 2021/22 Crop - Second Survey, August 2021), by CONAB [retrieved 11/09/21]
[9] Imports and exports figures may not balance due to differences in marketing years (MY), shipments in transit and reporting discrepancies. Brazil's marketing year for sugarcane is from April to March
[10] "*Sugar Annual - Brazil BR2021-0015*", April 2021, by the Foreign Agricultural Service of the USDA (FAS-USDA) [retrieved 20/06/21]

CONAB forecasts the sugarcane production mix in 2020/21 to close at 53.2% for ethanol, of which about 2.9 billion litres (9.7% of total output) for exports, mainly to South Korea, the United States, and the Netherlands, and 46.8% for sugar, with about 31.4 mmt (76.5%) destined for exports, chiefly to China, Algeria, and Bangladesh[11]. The mix should remain the same through the 2021/22 cycle, albeit with a significantly lower amount of sugarcane available for crushing. **[Graph 2]**



Graph 2: Brazilian sugarcane production 2020/21 with the sugar-ethanol mix, exports and consumption. Source: CONAB/USDA/UNICA

1.6. Socioenvironmental concerns

Brazil is a member of the 1992 International Sugar Agreement adopted by the International Sugar Organization (ISO)[12], which sets international standards for sugar trade. The sugarcane producers are subject to strict land use and occupation rules imposed by the Brazilian Forest Code[13].

The leading sugar-ethanol producers in the Centre-South region, who cover about 90% of the national production, comprise the membership of the Brazilian Sugarcane Industry Association (UNICA). They pledged to comply with the Green Protocol, a chart of intentions to finance sustainable development through credit lines and programs to promote quality of life and environmental protection.

The sugar-ethanol sector generates more than 2.3 million direct and indirect jobs. Nowadays, the harvesting process is almost fully mechanised. The harmful tradition of burning fields has been eradicated in the Centre-South, and better fertigation procedures adopted across the plantations[14].

Sugarcane as a renewable energy source accounts for 18% of the national matrix or 39% of all the bioenergy generated in Brazil. The industry produces around 40 mmt of sugar per year, more than three-quarters of which are shipped abroad, representing half of the world's sugar exports. Brazil is the second-largest ethanol producer, only behind the United States, with about 30 billion litres refined each year. Besides, the straws and bagasse resulting from the sugarcane crushing generate more than 23 TWh of bioelectricity, primarily supplied to the sugar mills themselves. The surplus of milling residues is used as animal feed or second-hand biofuels.

[11] "*Monitoring of the Brazilian Sugarcane Harvest, v. 7 - 2020/21 Crop – Fourth Survey, May 2021*"; "*Monitoring of the Brazilian Sugarcane Harvest, v. 8 - 2021/22 Crop - Second Survey, August 2021*", by CONAB; "*Sugar Annual - Brazil BR2021-0015*", Apr 2021, by FAS-USDA; *Observatório da Cana*'s Import Export Dashboard [retrieved 20/06/21]
[12] The International Sugar Agreement, 1992, is an international treaty fostered by the UNCTAD through the International Sugar Association to enhance international cooperation to improve world sugar economy and facilitate trade. Brazil signed the Agreement in 1992 and ratified it in 1996
[13] Law 12,651 of 2012, known as *Código Florestal Brasileiro* (Brazilian Forest Code) establishes general rules for the protection of vegetation, Permanent Preservation Areas and Legal Reserve, forest exploitation, supply of forest raw material, control of forest products and control and prevention of forest fires. Landowners cannot use more than 20% of land in the Amazon Forest for agriculture or otherwise. Properties in the Cerrado Biome can use up to 65% of the land area, while elsewhere in Brazil up to 80% of the land may be deforested for growing crops or pastures
[14] UNICA statement on sustainable food and energy in the industry [available on https://unica.com.br/en/sugarcane-sector/ [retrieved 20/06/21]

In 2017, the federal government launched Brazil's National Biofuels Policy, branded "*RenovaBio*" (BioRenew), to reduce greenhouse gas releases and help the country fulfil its commitments under the Paris Climate Agreement[15].

Picture 3: Sugar cane fields in the hinterlands of São Paulo. Source: Shutterstock

Sugarcane ethanol has the smallest carbon footprint among existing biofuels[16]. It is mandatorily added to gasoline or used as neat automotive fuel[17]. Almost the entire Brazilian fleet of light vehicles operates with flex-fuel engines that use either ethanol or gasoline blended with about 25% ethanol interchangeably. New gasoline-fuelled cars sold in the country also run with a much higher proportion of ethanol.

[15] RenovaBio, was established through Law 13,576 of 2017, with the objectives of i) providing an important contribution to the fulfilment of Brazil's commitments under the Paris Agreement; ii) promoting adequate expansion of biofuels in the energy matrix, with emphasis on regularity of fuel supply; and iii) ensuring predictability for the fuel market, inducing gains in energy efficiency and reduction of GHG emissions

[16] "*Sustainable biofuels: prospects and challenges*", Jan 2008, by the Royal Society; *"Brazil's road to energy independence: alternative-fuel strategy, rooted in ethanol from sugar cane, seen as model*", by Monte Reel for the Washington Post, August 2006 [retrieved 17/06/21]

[17] The addition of ethanol is a legal obligation of fuel distributors. Law 8,723 of 1993 stipulated the mixing of anhydrous alcohol (ethanol) in gasoline. Over the years, new decrees and regulations changed the percentage of the mixture. As of March 2015, the mandatory percentage of anhydrous ethanol fuel in regular gasoline is 27%, while the percentage in premium gasoline is 25%

2. Sugar production

2.1. Cane sugar production process

The sugarcane is a heavy, low-value, perishable vegetable that quickly loses sucrose; therefore, it cannot be stored or hauled over long distances. The mechanically harvested cane is transported promptly by lorries (or railcars) to the sugar mills for cane crushing (cutting and grinding) and juice extraction by milling or diffusion. The broth is treated to remove impurities. After that, it undergoes evaporation, crystallisation, centrifugation and is finally dried into raw sugar. **[Figure 1]**

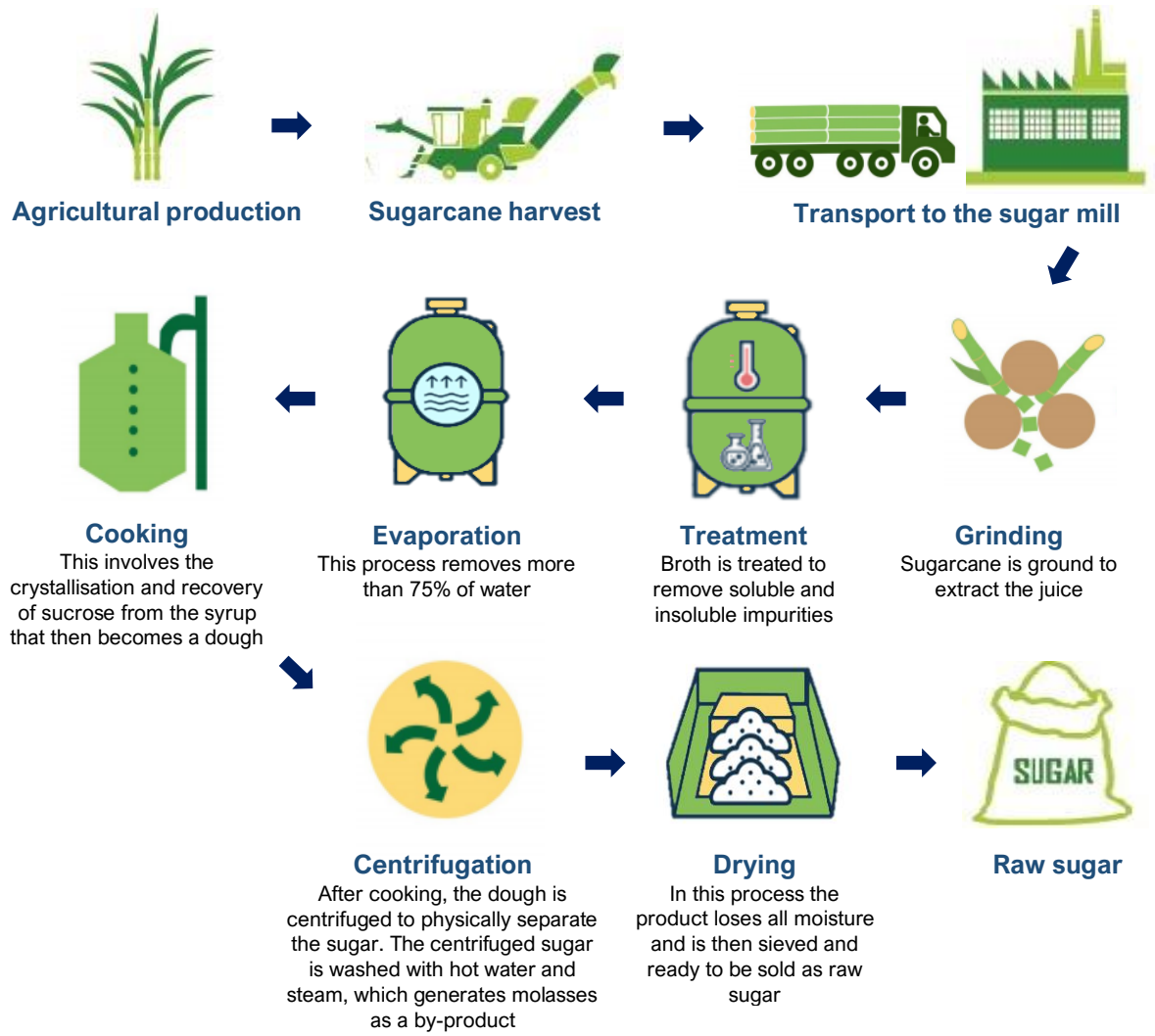


Figure 1: Simplified cane sugar production-process flowchart. Source: UNICA

Most of the raw sugar produced in Brazil is exported. A smaller proportion is sold to food and beverage processors or refined into various types of sugar for human consumption. **[Sections 5.1 & 5.2]**

2.2. Global production and consumption

While the supply and demand for raw sugar are concentrated, with Brazil being both the top producer and exporter of the commodity, the refined sugar market is more diffuse, with Asian countries leading production and exports.

The USDA forecasts that global sugarcane and beet sugar production in the 2020/21 marketing year will be around 180 million metric tons (mmt), with a slight drop in imports and exports worldwide. On the other hand, the US agency projects the world sugar supply to reach 186 mmt in 2021/22, thanks to increased production in the European Union, India, and Thailand, which will more than offset the decline in Brazil's output.

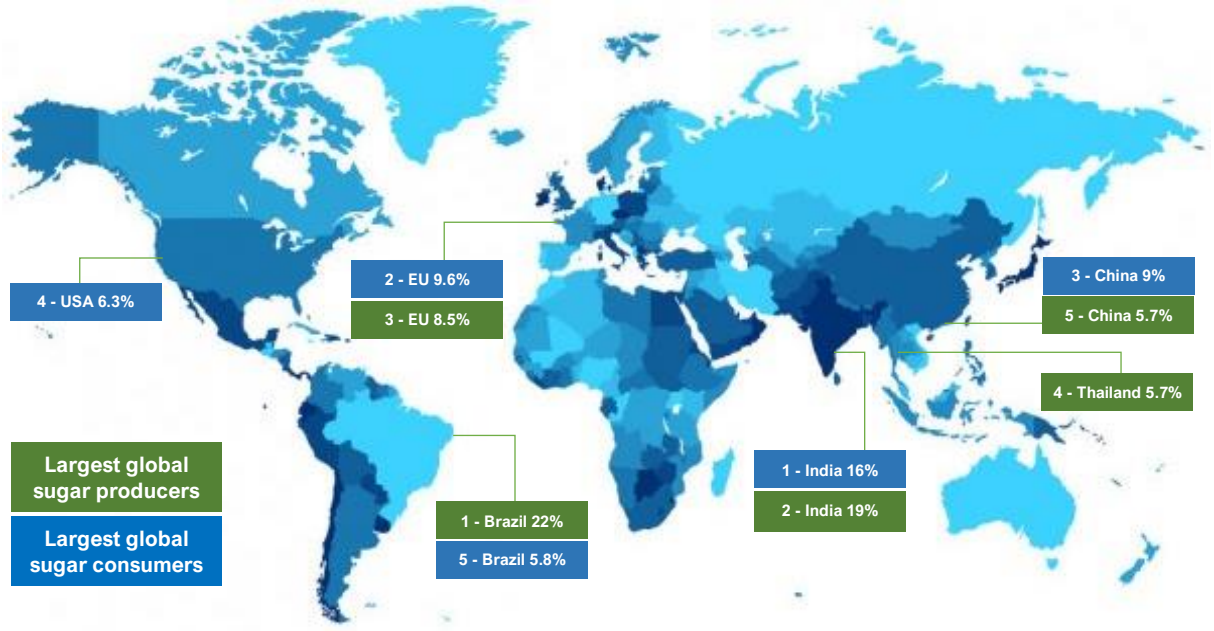
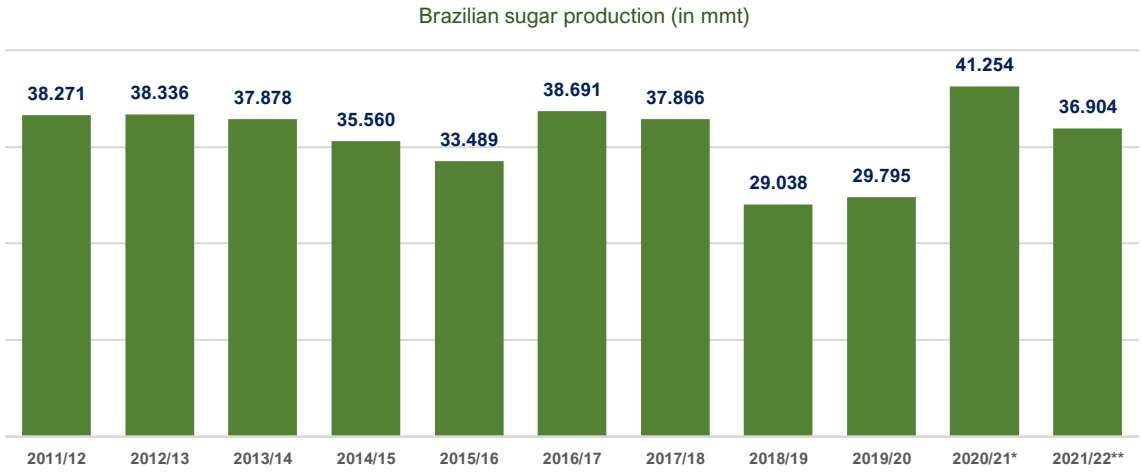


Figure 2: Estimated share of largest sugar producers and consumers in 2021/22. Source: USDA

After a record output of 42 mmt the past season, the US agricultural agency reports that Brazil will experience a drop to a projected 39.9 mmt (-5.1%) due to adverse weather and shift from sugarcane to more lucrative crops. Still, the country should maintain its leadership with about 22% of the world sugar production. Other leading sugar producers in the 2021/22 cycle will be India (34.7 mmt), the EU (15.8 mmt), Thailand (10.6 mmt), China (10.6 mmt) and the United States (8.4 mmt)[18].

World consumption is predicted to rise from 171.8 mmt in 2020/21 to 174.4 mmt this season, with top consumers being India (28.5 mmt), the EU (16.8 mmt), China (15.8 mmt) and the USA (11 mmt), with ending stocks falling from 45.8 mmt to 43.9 mmt in 2021/22. Brazil should keep its domestic consumption around 10.2 mmt, the same level as the last five years. **[Figure 2]**



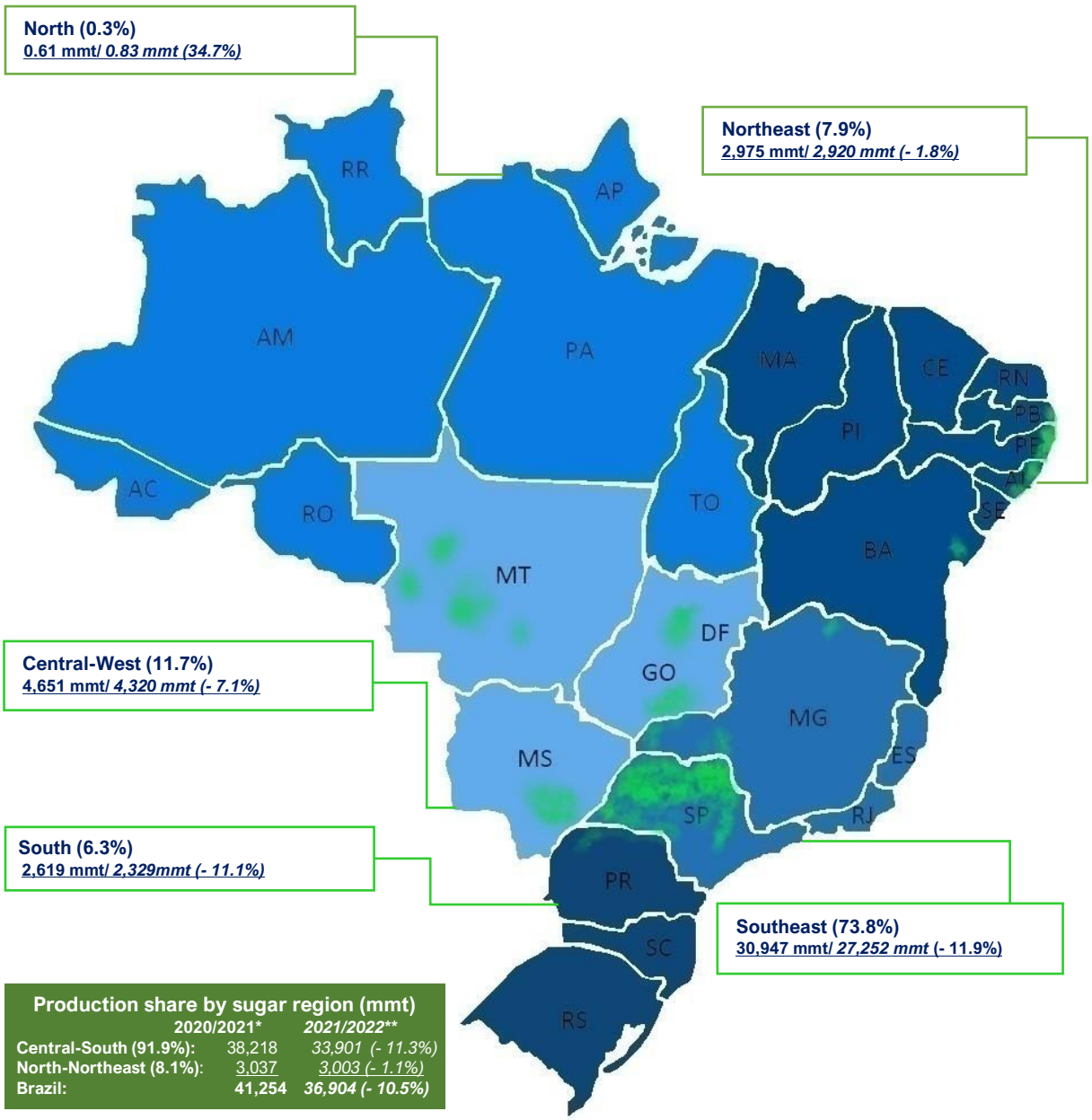
Graph 3: Brazilian sugar production in marketing years 2011/12 to 2021/22, in mmt (*estimated, **projected). Source: CONAB

[18] "*Sugar: World Markets and Trade*", May 2021; "*Sugar Annual - Brazil BR2021-0015*", April 2021, by FAS-USDA [retrieved 20/07/21]

2.3. Brazilian sugar production

Most of the raw sugar produced in Brazil is exported in bulk. A smaller proportion is refined into a variety of white sugars for domestic consumption or exports.

CONAB estimates the 2020/21 season to close with a production of 41.3 mmt of sugar, followed by an estimated 10.5% drop to 37 mmt in 2021/22 due to reduced volume of sugarcane available for crushing, resulting from unfavourable weather, lower ethanol demand amid the COVID-19 pandemic and falling international oil prices. The Centre-South region should cover 92% (33.9 mmt) of the total sugar output in the ongoing season, while the remainder 8% (3.1 mmt) will be produced in the North-Northeast region[19]. **[Graphs 3 & 4]**



Graph 4: Brazilian sugar production, in mmt (* 2020/21 est. ** 2021/22 proj.) with variation in % by geographical region (regional production share 2021/22 in %). Greenish areas denote cane fields. Source: CONAB

[19] "*Série Histórica da Safra de Cana-de-Açúcar – Agrícola e Indústria*" (Historic Sugarcane Crop Series – Agriculture and Industry) May 2021, by CONAB

3. Sugar exports

3.1. Global sugar market

The US Department of Agriculture (USDA) predicts that global sugar exports will reach around 66 million metric tons (mmt) in the 2021/22 marketing year, an increase of 2.7% compared to the 64.2 mmt traded globally in the last season when Brazil reached a record production and shipped half of the world's sugar exports.

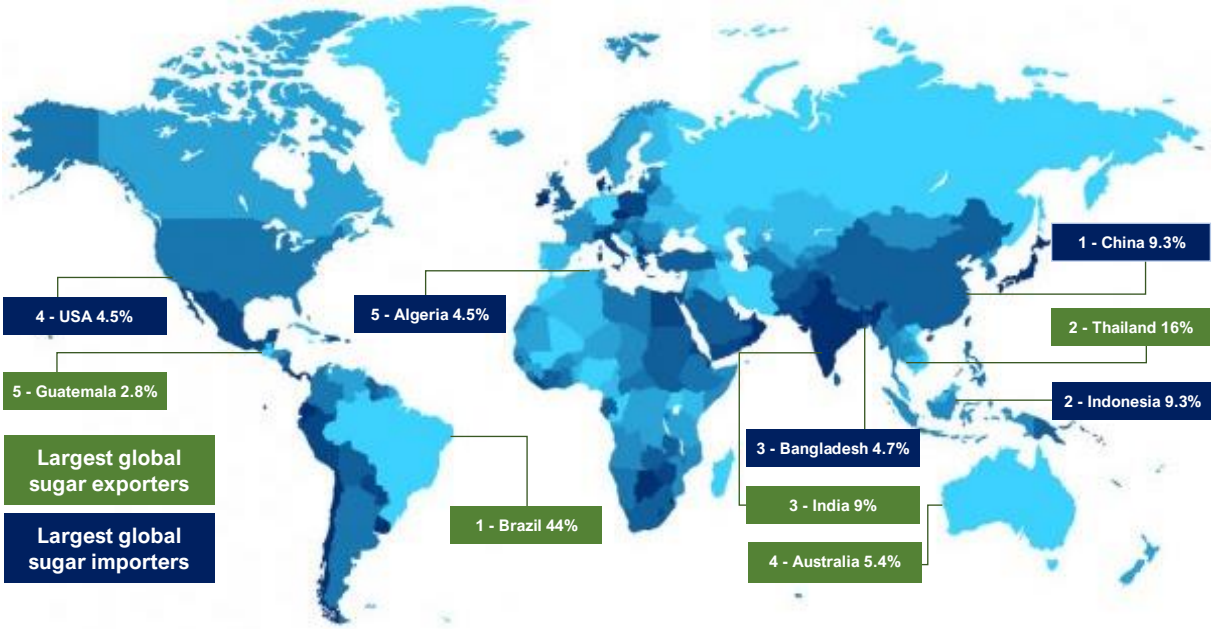


Figure 3: Estimated share of largest sugar exporters and importers in 2021/22. Source: USDA

With an estimated 44% share (29.2 mmt) of 2021/22 sugar shipments, according to the USDA, Brazil will comfortably remain the largest worldwide sugar exporter, followed by Thailand (10.4 mmt), India (6 mmt), Australia (3.5 mmt), and Guatemala (1.8 mmt). Top global sugar importers during this season are expected to be China (5 mmt), Indonesia (4.8 mmt), Bangladesh (2.5 mmt), the USA (2.4 mmt), and Algeria (2.4 mmt) [20]. **[Figure 3]**

3.2. Brazilian sugar exports

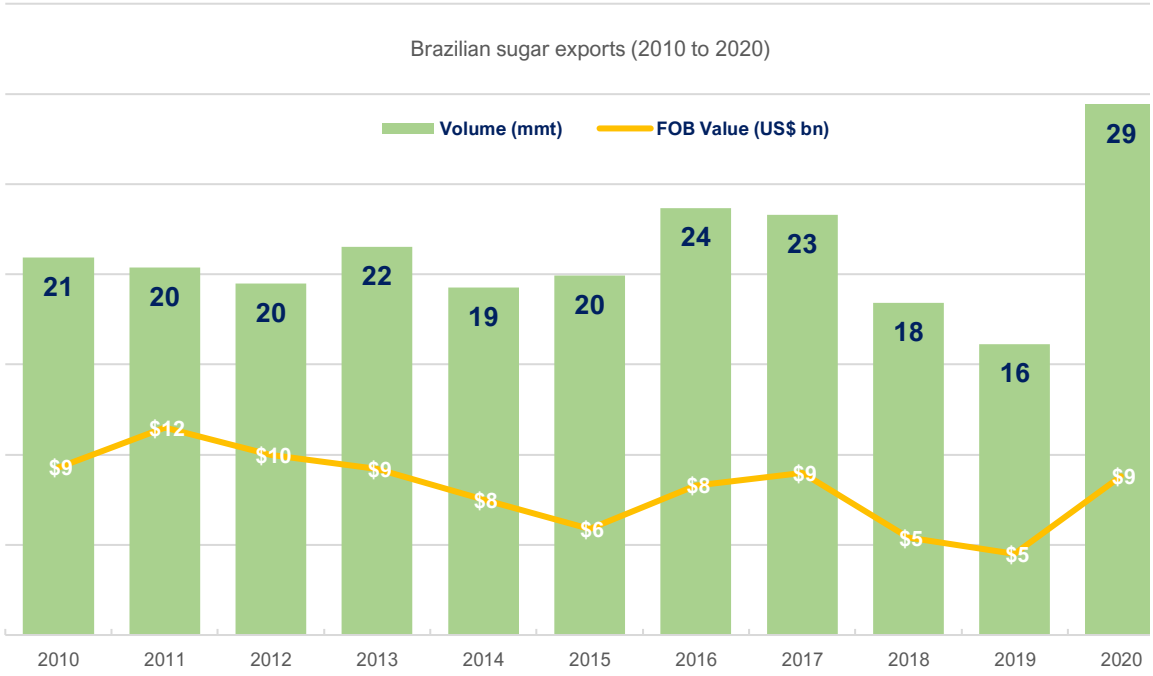
Data from the Ministry of Finance's Foreign Trade Secretariat (SECEX) indicate sugar remains Brazil's leading export commodity in the processing industry in terms of volumes. The product ranked fourth among all Brazilian exports last year, with 30.7 mmt sold (71.1% more than 2019) and revenues of USD 8.8 billion (68.6% up from 2019)[21].

The National Supply Company (CONAB) estimates that in the 2020/21 marketing year, Brazil sold sugar to more than 140 countries, with shipments to Asia and Africa standing out. China was the leading destination, buying around five mmt, 16% of Brazil's sugar exports. The biggest importers in the past season were Algeria (2.6 mmt, 7%), Bangladesh (2.1 mmt, 6.8%), Indonesia (2.1 mmt, 6.7%), and India (1.7 mmt, 5.5%)[22].

[20] "*Sugar: World Markets and Trade*", May 2021; "*Sugar Annual - Brazil BR2021-0015*", April 2021, by FAS-USDA [retrieved 20/06/21]
[21] *ComexStat* is a SECEX system for querying and extracting data from Brazilian foreign trade, supplied through SISCOMEX. Due to difference in marketing year and calendar year statistics, there may be discrepancies when compared with date from CONAB, USDA, ANTAQ and other governmental agencies. Data refers to sugar products grounded under NCM (Mercosur Common Nomenclature 1701.1100, 1701.1300 & 1701.1400
[22] "*Historic Sugarcane Crop Series – Agriculture and Industry) May 2021*"; "*Monitoring of the Brazilian Sugarcane Harvest, v. 8 - 2021/22 Crop - Second Survey, August 2021)*", by CONAB [retrieved 11/09/21]

3.2.1. Market outlook

In the last twelve months, the rise in prices contributed to Brazil reaching a record in the 2020/21 cycle and expanding anticipated sugar sales throughout 2021/22. Although well below the previous output, it will still be Brazil's second-best sugar export season ever. **[Graph 5]**



Graph 5: Brazilian sugar export volumes (mmt) and values (USD bn) from 2010 to 2020. Source: SECEX

CONAB predicts that, for the 2021/22 season, the low rainfall that extended until earlier this year and damage to crops by hoarfrosts in June and July in key producing states, such as São Paulo, Mato Grosso do Sul, and Paraná, will adversely impact productivity in the current season. It estimated sugarcane production to reach 592 mmt, 9.5% below last season's bumper crop. Of this volume, 46.6% should be used for sugar production and the remaining 53.4% for ethanol[23].

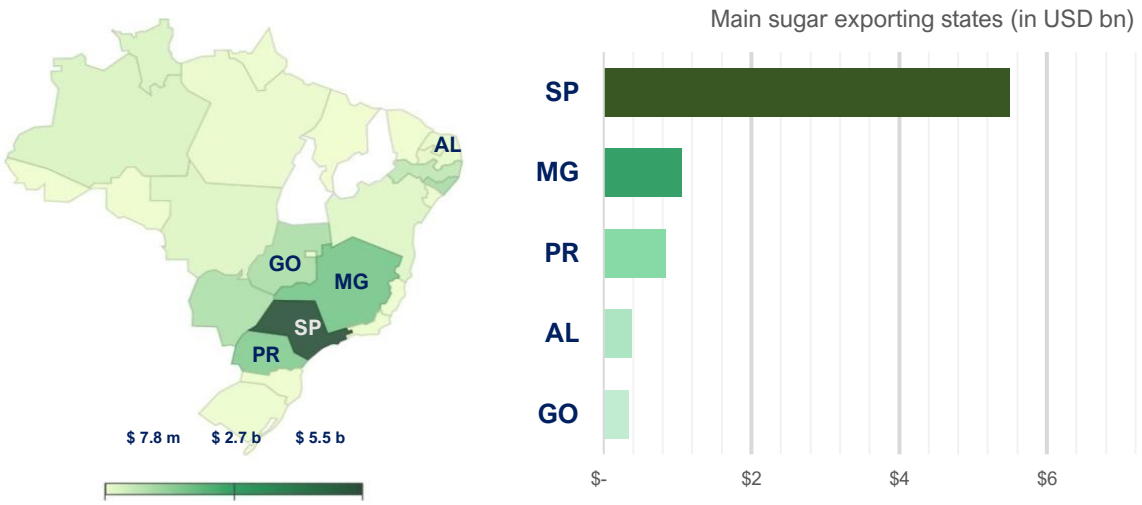
The estimate for sugar production in 2021/22 is about 37 mmt, against 41 mmt in the past season, a 10.5% drop. Nevertheless, the outlook for sugar exports is to remain at high levels, influenced by a somewhat favourable exchange rate and higher prices amid lower production.

3.2.2. Main exporting states

The leading sugar exporting state is São Paulo, which accounted for 63.2% of the 2020 exports, maintaining its traditional leadership with sales grossing USD 5.5 billion. São Paulo was followed by the states of Minas Gerais (12.2%), Paraná (9.7%), Alagoas (4.3%) and Goiás (3.9%). **[Graph 6]**

Until August 2021, around 17.8 mmt of sugar had already been sold, a marginal increase of 1.6% in volumes year on year. According to SECEX, sales in this period amounted to USD 5.8 billion, a FOB growth of 18% compared to the same period last year[24].

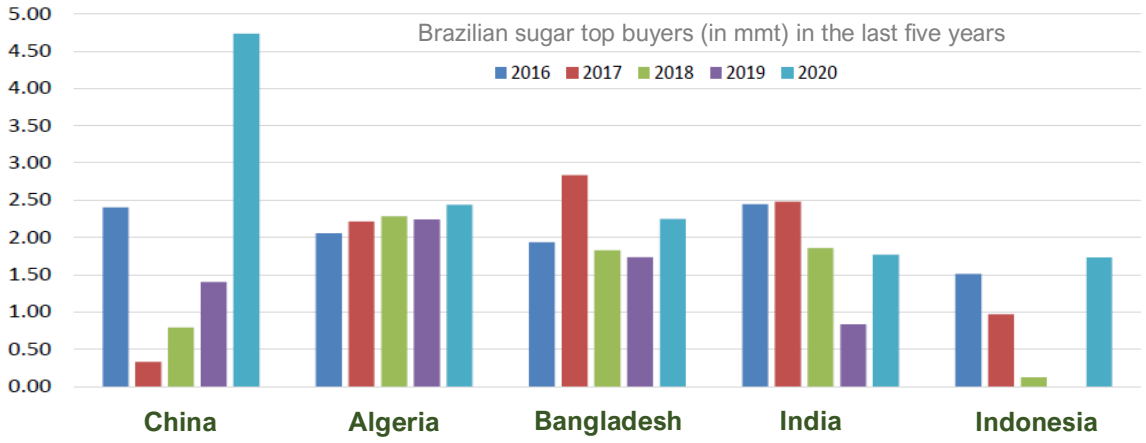
[23] "*Monitoring of the Brazilian Sugarcane Harvest, v. 8 - 2021/22 Crop - Second Survey, August 2021*", by CONAB [retrieved 11/09/21]
[24] SECEX' ComexStat database [retrieved 11/09/21]



Graph 6: 2020 primary sugar exporting states FOB sales, in USD billion. Source: SECEX/ComexStat/ComexVis

3.2.3. Main buying countries

For the last five years, the main destinations of Brazil's raw sugar shipments were China, Algeria, Bangladesh, India and Indonesia, in fluctuating volumes. **[Graph 7]**



Graph 7: Brazilian sugar top buyers 2016-2020, in mmt. Source: USDA

The USDA predicts that Brazilian sugar will remain highly competitive in the global market despite lower production. The US agricultural agency estimates that Brazil's exports in the 2021/22 marketing year will reach about 29.2 mmt, of which some 23.3 mmt comprising raw sugar.

In addition to those top five traditional buyers, it is projected that Nigeria, Malaysia, Morocco, Saudi Arabia, and the United Arab Emirates will also buy significant quantities of Brazil's raw sugar in the ongoing season. The main buyers of Brazil's refined sugar are predicted to be Yemen, Ghana, Benin, Mauritania, and Venezuela[25]. **[Graph 7, Table 1]**

[25] Data for raw sugar includes Mercosur Common Nomenclature (NCM) 1701.11, 1701.13 & 1701.14. For refined sugar, NCM 1701.99.00 (Source: USDA/SECEX

Raw sugar (NCMs 1701.11, 1701.13 & 1701.14)	Marketing Year 2019/20		Marketing Year 2020/21	
	Value (USD)	Quantity (m/t)	Value (USD)	Quantity (m/t)
China	382,169	1,374,762	1,371,266	4,877,769
Algeria	696,325	2,449,270	633,062	2,263,649
Bangladesh	534,770	1,916,017	619,654	2,175,914
Indonesia	42,674	145,905	597,862	2,160,831
India	252,209	899,418	477,709	1,755,821
Nigeria	431,604	1,597,322	451,445	1,624,279
Malaysia	82,221	296,013	423,501	1,551,271
Morocco	239,769	861,352	414,096	1,449,690
Saudi Arabia	460,577	1,669,389	382,268	1,367,825
United Arab Emirates	192,129	703,178	314,713	1,165,991
Others	1,433,293	4,927,120	2,144,383	7,366,661
Total	**4,747,739**	**16,839,746**	**7,829,960**	**27,859,700**
Refined sugar (NCM 1701.99.00)	**Marketing Year 2019/20**		**Marketing Year 2020/21**	
	Value (USD)	Quantity (m/t)	Value (USD)	Quantity (m/t)
Yemen	62,176	199,592	113,016	370,068
Ghana	45,043	140,859	96,863	302,080
Benin	63,209	198,049	95,158	299,509
Mauritania	10,992	32,257	82,336	243,836
Venezuela	71,826	141,650	108,959	242,522
Togo	54,347	173,468	76,250	232,303
Gambia	34,243	109,529	72,756	223,231
United States	67,140	90,812	109,095	216,551
Senegal	31,159	91,041	67,783	213,583
Angola	91,261	285,204	63,586	203,172
Others	229,886	642,330	589,223	1,732,087
Total	**761,283**	**2,104,786**	**1,475,027**	**4,278,942**

Table 1: Brazilian sugar exports MY 2019/20 & 2020/21 by top importers, in m/t (values in USD). Source: USDA

3.2.4. Main export routes

About 95% of all Brazilian sugar exports were shipped through the southern port complexes of Santos and Paranaguá. On average, 40% of the shipments were bound for Asian ports (chiefly in China, Bangladesh, India and Malaysia), usually via the Cape of Good Hope. The sea passages can last anywhere between 35 to 45 days, depending on the ports involved, speed, weather and navigation route chosen. **[Figure 7]**

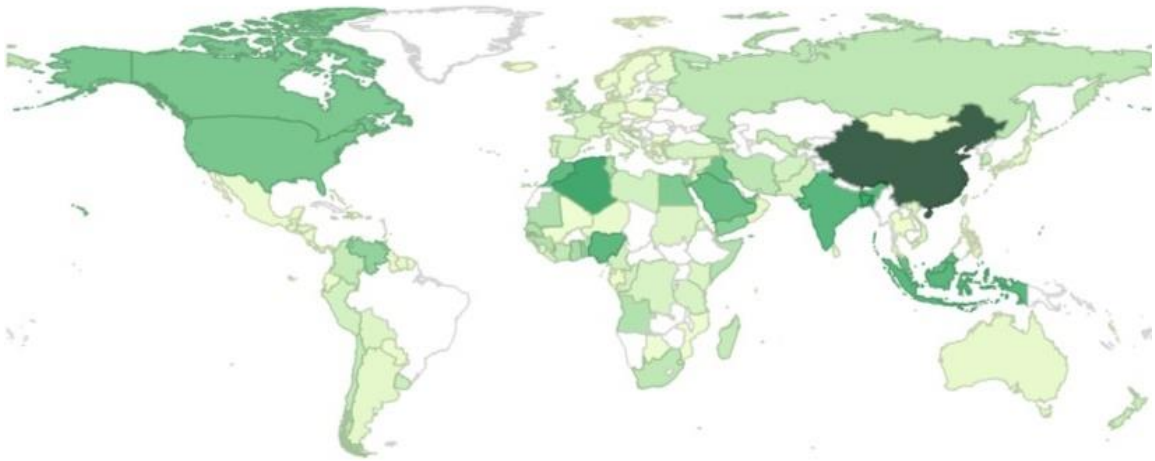


Figure 7: Brazilian sugar exports MY 2019/20 & 2020/21 top destinations (dark green). Source: USDA/CONAB/SECEX

4. Sugar port handling

4.1. Port handling performance

Over the last decade, Brazilian ports handled an average of 22 mmt of sugar per year, the highest volume recorded in 2017, when about 25 mmt of the product were moved. An accumulated 223 mmt were handled between 2010 and 2020, 99% for export, the remainder transported in the inland waterways or cabotage to supply the domestic market. While Brazil's sugar production is set to decline in the 2021/22 marketing year, accumulated stocks, along with last year's bumper crop, indicate that sugar port handling will continue at high levels until at least the following season. **[Graph 8]**

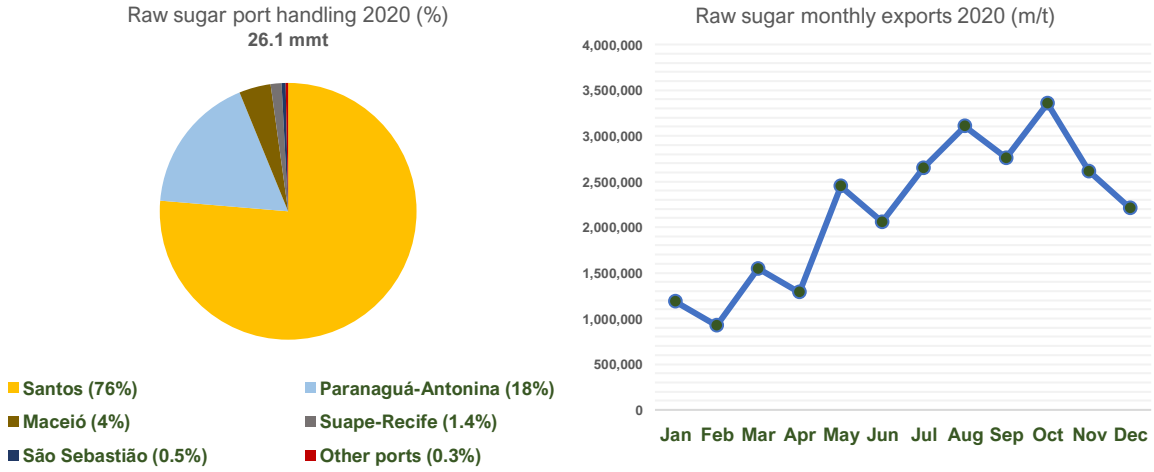
Graph 8: Brazilian sugar port handling volumes 2010-2020. Source: ANTAQ

The National Agency for Waterway Transport (ANTAQ)[26] reports that, in 2020, national ports collectively handled nearly 28 mmt of the commodity, a world record for sugar port handling and exports. Until July 2021, around 14.5 mmt of sugar were loaded at Brazilian ports, an increase of 13.2% year on year, with Santos covering roughly three-fourths of the volumes shipped abroad[27].

4.2. Cargo profile

4.2.1. Raw sugar shipments

In 2020, 95% of the volumes comprised raw sugar loaded in bulk carriers. The port of Santos led the national ranking with 21 mmt shipped or 76% of the record output.



Graph 9: Brazilian raw sugar port handling volumes in 2020 by main ports and monthly exports. Source: ANTAQ

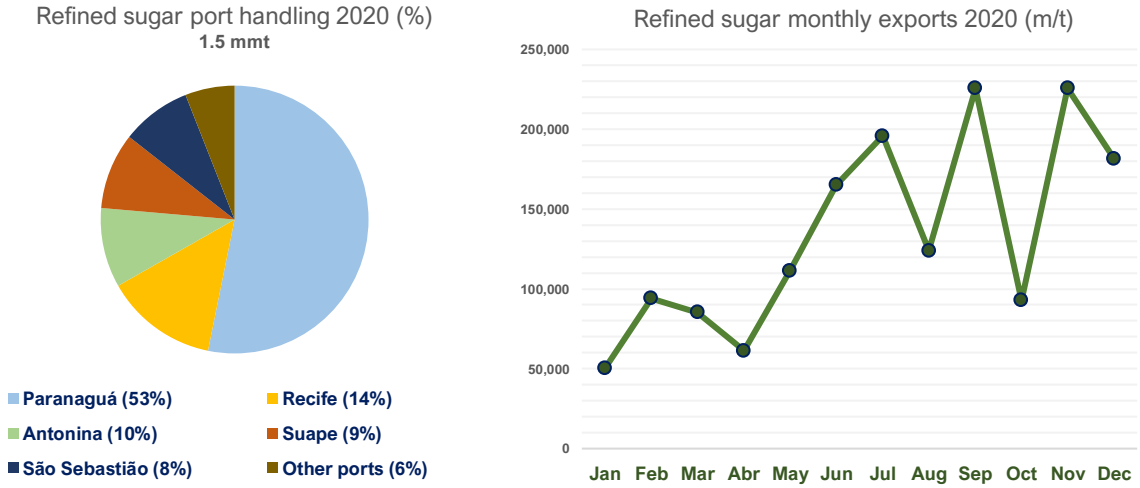
[26] The policies and directives formulated by the *Ministério da Infraestrutura* – MINFRA (Ministry of Infrastructure) to the Brazilian port and waterways systems are implemented by the *Agência Nacional de Transportes Aquaviários* - ANTAQ (National Agency for Waterways Transport), the agency that regulates and oversees the quality of services rendered in the waterborne transport of goods and passengers, ports and port facilities

[27] "*Anuário Estatístico ANTAQ 2020*" (ANTAQ Yearbook 2020), by ANTAQ; ANTAQ online statistics database [Retrieved 11/09/21]

Paranaguá-Antonina came second, moving 18% of the volumes handled, followed by Maceió (4%), Suape-Recife (1.4%) and São Sebastião (0.5%). Minor quantities were recorded in February and the largest in October, with a monthly average of 2.2 mmt of raw sugar moved. **[Graph 9]**

4.2.2. Refined sugar shipments

About 1.4 mmt (5%) of the sugar exported in 2020 was in its refined form, mainly in bags as breakbulk or in containers, loaded at Paranaguá-Antonina (53%), Suape-Recife (23%), São Sebastião (8%) and Imbituba (3%). The lowest volumes handled were registered in January and the highest in September, with an average of 134,414 m/t shipped per month. **[Graph 10]**



Graph 10: Brazilian refined sugar port handling volumes in 2020 by main ports and monthly exports. Source: ANTAQ

4.3. Port complexes performance

On the coast of São Paulo, Santos remains by far Brazil's largest sugar exporting port complex, handling around three-quarters of all the volumes moved last year. Paranaguá and its neighbouring port of Antonina, in Paraná, come in second.

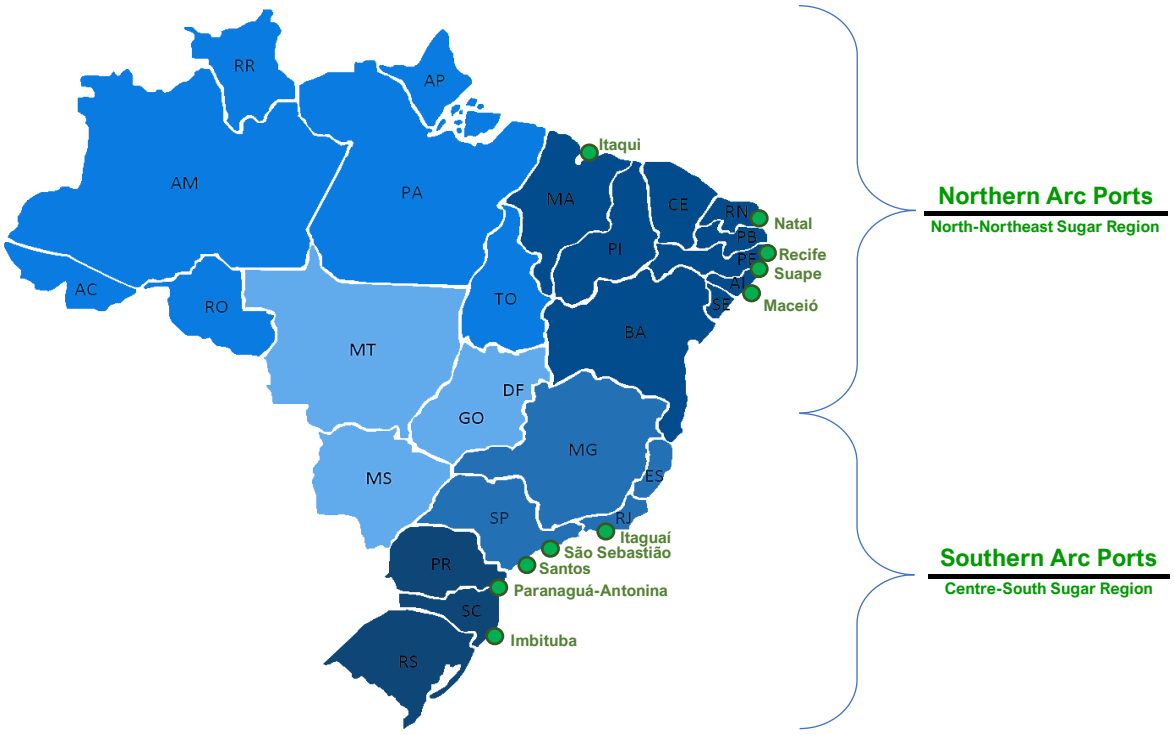


Figure 6: Main Brazilian sugar exporting ports (2016-2021). Source: MAPA/CONAB/ANTAQ

In recent years, occasional minor sugar shipments, primarily in bags, departed from small ports such as Santa Catarina's Imbituba, São Sebastião (near Santos) in São Paulo, and Itaguaí, south of the state of Rio de Janeiro.

Port Complex	State	2016	2017	2018	2019	2020
North-Northeast sugar region		**1.290**	**0.996**	**1.133**	**1.135**	**1.497**
(Northern Arc ports)		**(5.2%)**	**(4.1%)**	**(6.1%)**	**(7%)**	**(5.4%)**
Maceió	AL	0.984	0.996	0.938	0.851	1.098
Recife (including Suape)	PE	0.306	0.374	0.195	0.284	0.378
Natal	RN	-	-	-	-	0.018
Itaqui	MA	-	-	-	-	0.003
Centre-South sugar region		**23.318**	**22.888**	**17.446**	**15.170**	**26.046**
(Southern Arc ports)		**(94.8%)**	**(95.9%)**	**(93.9%)**	**(93%)**	**(94.6%)**
Santos (including S. Sebastião)	SP	18.196	18.042	14.183	12.527	21.163
Paranaguá (including Antonina)	PR	5.122	4.846	3.263	2.643	4.819
Imbituba	SC	-	-	-	-	0.037
Itaguaí	RJ	-	-	-	-	0.027
Total		**24.608**	**24.258**	**18.579**	**16.305**	**27.543**

Table 2: Brazilian sugar exports 2016-2020 by port complex and sugarcane region, in mmt (share in %). Source: ANTAQ

Along the northeastern coast, the ports of Maceió, in Alagoas, and Recife, in Pernambuco, handled around 6% of Brazilian sugar shipments flowing from the so-called Northern Arc ports in recent years[28]. Sporadic shipments of sugar were also sent from Itaqui (São Luis), in the state of Maranhão, and Natal, in Rio Grande do Norte. **[Figure 6, Table 2]**

4.4. Exporting facilities performance

4.4.1. Southeast Region

The largest in Latin America, the port complex of **Santos** features terminals dedicated to the storage and loading of sugar cargoes on bulk carriers departing with drafts of up to 14 metres. Sugar was the third largest cargo handled in 2020, behind containers and soya beans.

Southeast Region

Together, the exporting facilities of Santos moved about 21 mmt of sugar, 76% of last year's sugar exports. **[Graph 11]**

Except for VLI's *Terminal Integrador Portuário Luiz Antonio Mesquita* (Tiplam), a private-use terminal (TUP)[29], and Cargill/Louis Dreyfus Commodities' joint venture *Terminal Exportador de Açúcar do Guarujá* (TEAG), a fully private facility on the left bank, the berths that operate sugar cargoes in Santos are under the control of the state-owned *Santos Port Authority* (SPA). Private companies exploit sectors of the public port under long-term lease agreements and concessions.

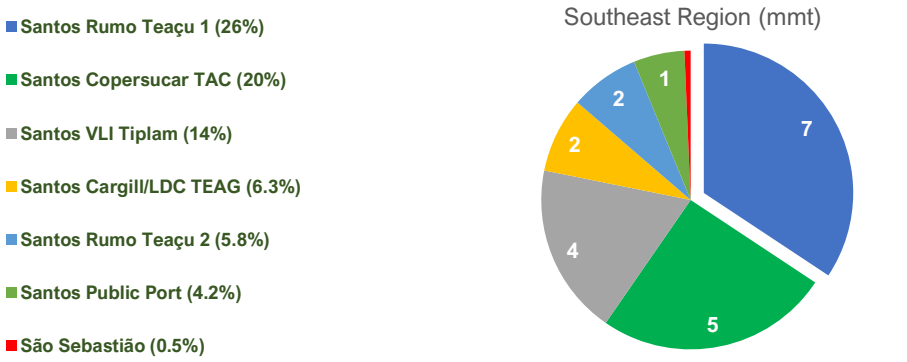
Tiplam handled some 4 mmt, 17% of the sugar exported in 2020, while TEAG reached 1.7 mmt, 6.2%. Nevertheless, the leading sugar export facilities were Rumo's Teaçu 1 and Teaçu 2 terminals in the right bank, which handled 7.3 mmt and 1.6 mmt of the product, respectively, a combined output of 8.9 mmt or 32% of all sugar shipped from Brazil last year.

[28] For more information, consult "Brazil's Northern Arc Ports - Practical Guidance" downloadable on https://proinde.com.br/category/manuals/ brazils-northern-arc-ports-practical-guidance/

[29] A Terminal of Private Use (*Terminal de Uso Privativo* - TUP) is a customs-bonded private port facility outside an Organised Port

Established in 1998 with a modern cargo conveying system and ship loaders, *Terminal Açucareiro Copersucar* (TAC) was the first port facility in Brazil specialised in handling bagged and bulk sugar. Last year, it moved 5.5 mmt of sugar, the second-largest volume in the Brazilian ranking, corresponding to 20% of the sugar shipments.

Other independent port operations occasionally handle sugar cargoes elsewhere in the Public Port of Santos.



Graph 11: 2020 ranking of Southeast sugar exporting port facilities (% of national exports). Source: ANTAQ

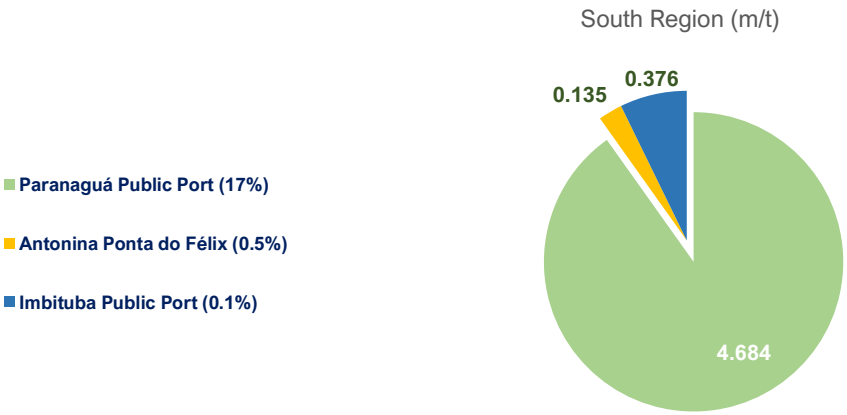
Further north of Santos, the small Public Port of **São Sebastião**, managed by the State of São Paulo through the *Companhia Docas de São Sebastião* (CDSS), only handled minor volumes of bagged sugar as breakbulk in 2020, corresponding to 0.5% of the exports. **[Graph 11]**

4.4.2. South Region

South of Santos, the landlord ports of **Paranaguá** and **Antonina**, administered by the state of Paraná through the *Administração dos Portos de Paranaguá e Antonina* (APPA), together shipped 4.8 mmt of the sugar exported the past year. Most of the sugar handled in Paranaguá was in the Public Port (17%), Brazil's third-busiest sugar exporting unit. **[Graph 12]**


South Region

Upstream Paranaguá Bay, Antonina handled around 0.5% of the volumes, shipping mostly bagged sugar from the *Terminal da Ponta do Félix*.



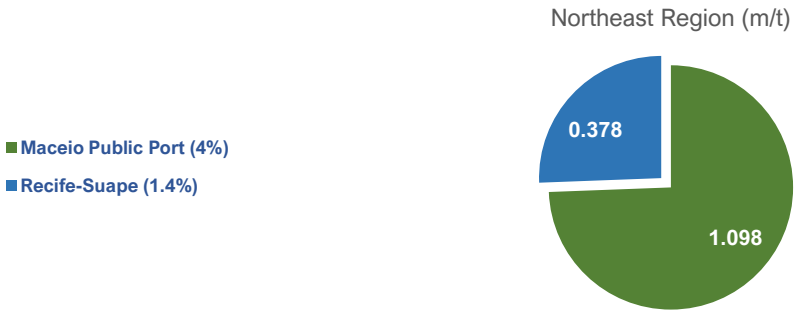
Graph 12: 2020 ranking of South sugar exporting port facilities (% of national exports). Source: ANTAQ

South of Paráná, the Public Port of **Imbituba**, managed by the State of Santa Catarina through *SC Participações e Parceiros S.A.*, handled insignificant sugar volumes in 2020 (0.1%).

4.4.3. Northeast Region

Sugar was the main cargo handled at **Recife**'s small but traditional public port, where arguably the first sugar mills were established in the 16th Century. The State of Pernambuco manages the port through *Porto do Recife S.A*. Along with **Suape** to the south, administered by the *Complexo Industrial Portuário Governador Eraldo Gueiros*, Recife moved less than 2% of the sugar exported last year. Both ports are expected to increase volumes from 2021.


Northeast Region



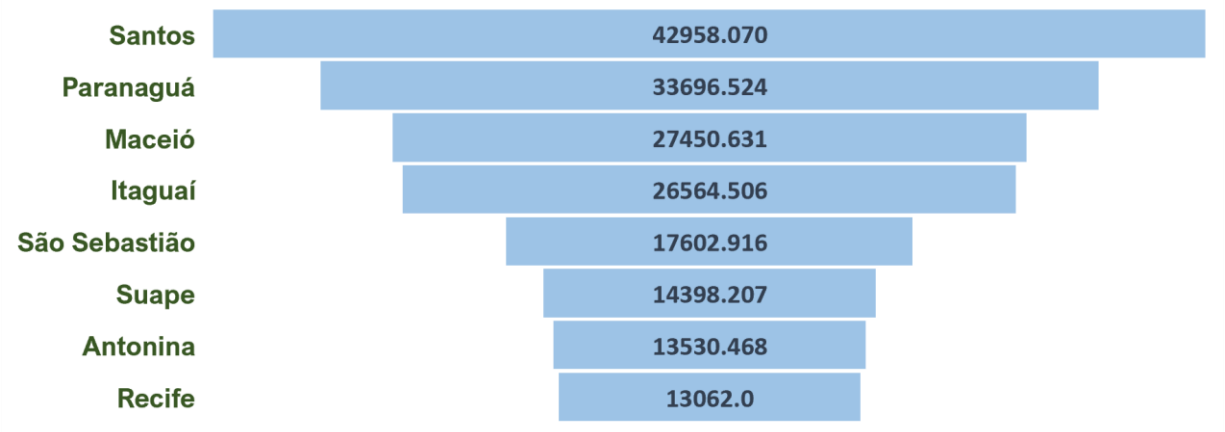
Graph 13: 2020 ranking of Northeast sugar exporting port facilities (% of national exports). Source: ANTAQ

The port of **Maceió**, managed by the state-owned *Porto de Maceió*, handled about one mmt of sugar in 2020, corresponding to 4% of the exports. **[Graph 13]**

4.5. Sugar vessel profile

After the deregulation of the national sugarcane market, the Brazilian sugar was predominantly exported in bags and carried across the Atlantic Ocean in small general cargo vessels. The main workhorses were still the Freedom-type cargo vessels of 15,000 tonnes of deadweight and the 14,000-dwt shelter deck SD-14, some of them built in Brazil. These vessels were loaded to their full capacity, typically carrying 280,000 fifty-kilogram sugar bags, mostly bound for West and North African ports.

By the early 2000s, the tween-deckers were gradually phased out and replaced by Handymax vessels carrying 20,000-40,000 m/t of sugar, mostly in bulk. Nowadays, Supramax bulk carriers leave Brazilian ports with shipments of up to 60,000 m/t, destined for South and Southeast Asia, Africa, and the Middle East. In August 2021, a 120,000-dwt bulk carrier left Santos loaded with nearly 109,000 m/t of bulk sugar for China, setting an all-time national record for this commodity.



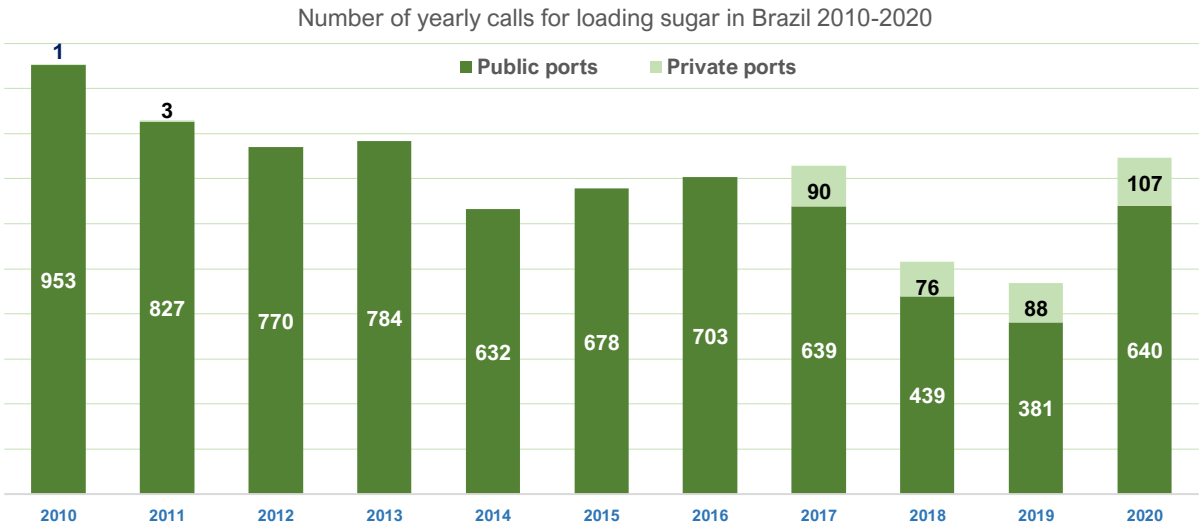
Graph 14: Average Brazilian sugar shipment per oceangoing vessel per port of loading in 2020, in m/t. Source: ANTAQ

Last year, the average quantities of sugar shipments loaded at major ports such as Santos and Paranaguá were 43,000 m/t and 34,000 m/t, respectively, while Maceió and Itaguaí recorded an average of 27,000 m/t apiece. Less than 5% of the sugar exported in 2020 was in bags. Bagged sugar shipments departing from smaller ports such as Recife, Antonina, and São Sebastião, ranged between 13,000 to 18,000 m/t per vessel. **[Graph 14]**

Pictures 4 & 5: refined sugar in bags (left) and raw sugar in bulk (right) lying in storage. Source: Shutterstock/Copersucar

4.6. Port calls and congestions

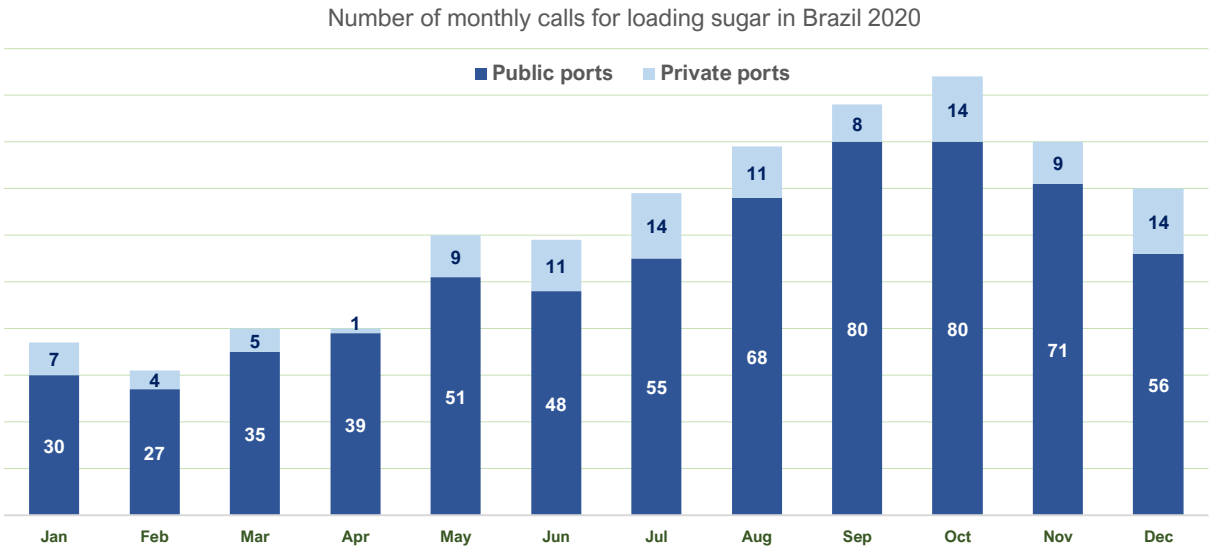
The shift in the fleet engaged in sugar trade has resulted in fewer vessels but with a much greater carrying capacity than the tween deckers of the old days. Between 2010 and 2020, an average of 710 bulk carriers called each year to load sugar. The highest number of vessels was in 2010, which registered 953 port calls; the slowest number was recorded in 2019, which saw 469 bulk carriers arriving to load sugar cargoes[30]. **[Graph 15]**



Graph 15: Number of yearly calls for loading sugar in Brazil 2010-2020. Source: ANTAQ

In 2020, on average, 62 vessels called at Brazilian ports every month to load sugar in bulk, with fewer vessels berthing in February (31) than in October (94). According to ANTAQ statistics, the most congested port complex to load sugar (in bulk or breakbulk) was Paranaguá-Antonina, where the vessels had to wait for a berth for 307 hours on average. The average waiting time at Santos was 124 hours, followed by Maceió (79 h), Imbituba (65 h) and Suape-Recife (19 h). **[Graph 16]**

[30] "*ANTAQ Yearbook 2020*", 2021, by ANTAQ; ANTAQ online statistics database [Retrieved 06/07/21]



Graph 16: Brazilian refined sugar port handling volumes in 2020 by main ports and monthly exports. Source: ANTAQ

4.7. Loading rates

The fastest loading cycles (time from commencement until completion of cargo loading) in 2020 were recorded in Santos, where bulk carriers took, on average, 42 hours to be loaded. Also, Santos recorded the fastest average loading rate, shipping 1,079 tonnes per hour (t/h). The port complex of Paranaguá-Antonina recorded 54 hours and Maceió 95 hours, with a loading rate of 0,757 t/h. The slowest loading cycles were in the ports of Suape-Recife (170 h), Sao Sebastião (134 h), and Imbituba (105 h), the latter two handling chiefly bagged sugar.

Pictures 6 & 7: Loading sugar in bulk with shiploader (left) and bags with vessel's crane (right). Source: Copersucar/Shutterstock

The port facilities of Copersucar's TAC and Rumo's Teaçu 1 and Teaçu 2 recorded the highest average loading cycles in 2020, with 27 h, 35 h, and 40 h of cargo operation, respectively. These three facilities within the public port also had the best average loading rates, with TAC leading with 1,5 t/h, followed by Teaçu 1 (1,1 t/h) and Teaçu 2 (0,948 t/h)[31].

[31] "*ANTAQ Yearbook 2020*", 2021, by ANTAQ; ANTAQ online statistics database [Retrieved 06/07/21]

5. Sugar grading and sampling

5.1. Types of sugar

Sugar generally refers to a broad class of sweet-tasting soluble carbohydrate compounds found in the plant sap. The most common type of sugar is sucrose, extracted in abundance from sugarcane and sugar beet, which share the same molecule and yield the same sugar[32]. There is a wide variety of sugarcane-based sugars available on the Brazilian market to meet every need.

According to the production process involved, Brazilian sugar can be roughly divided into "white sugar" and “raw sugar”. Although both have been processed to extract the sugarcane juice and have gone through the first crystallisation cycle, raw sugar has a much higher concentration of molasses (and contaminants) as it has not yet been refined. Therefore, it is not suitable for *in natura* consumption.

The purest form of crystal sugar is “refined sugar”. It has gone through two stages of crystallisation, in a sugar mill and in a refinery, where natural impurities have been removed (together with the minerals and vitamins, leaving only the sucrose), and it acquires its distinctly whiter and more crystalline appearance. It is the type of sugar commonly seen on tabletops at homes and restaurants.

In terms of the production process, quality and intended application, Brazilian sugar is classified as either "Group I" for human consumption through direct sales to the final consumer, or "Group II" for processing in the food and beverage industry and other applications.

5.1.1. Group I sugar

Group I sugar is divided into two classes, "White Crystal" and "Raw Crystal", each with different types depending on how the product has been processed[33]. **[Table 3]**

Group I – cane sugar intended for human consumption and sold directly to the final consumer

Group I Brazilian sugar types		
Class	**Type**	**Description**
White Crystal	Crystal	Extraction and clarification of the sugarcane juice by physicochemical treatments with bleaching, followed by evaporation, crystallisation, centrifugation, drying, cooling and sieving of the final product, which may be marketed ground or crushed
	Amorphous Refined (Refined)	Dissolution of white or raw sugar, syrup purification, evaporation, syrup concentration, beating, drying, cooling and sieving of the final product
	Granulated Refined	Dissolution of white or raw sugar, syrup purification, evaporation, syrup crystallisation, centrifugation, drying, cooling and sieving of the final product
	Confectionary’s Sugar	Sieving or extracting powder from crystal or amorphous refined sugar. Also known as Icing Sugar or Powdered Sugar
Raw Crystal	Demerara	Raw sugar with polarisation > 96° Z
	VHP	“Very High Polarisation” raw sugar with polarisation > 99° Z
	VVHP	“Very Very High Polarisation” raw sugar with polarisation > 99.49° Z
(*) Up to 400 IU of ICUMSA colour is allowed for an organic product certified in accordance with relevant legislation		

Table 3: Classes and types of Group I cane sugar. Source: MAPA

[32] Sucrose is a disaccharide (double sugar) composed of one molecule of glucose linked to one molecule of fructose. It is found in almost all plants but are present in sufficient concentrations for efficient and profitable extraction in sugarcane (*Saccharum officinarum*) and sugar beets (*Beta vulgaris*). Sucrose from either plant has the same molecule and yield the same sugar. (Source: "Sugar", by Singh, R. Paul and Clarke, Margaret A., *Encyclopaedia Britannica*, May 2021 [retrieved 28/06/21]

[33] Art. 6 & 7 of MAPA IN 47/2018

White Crystal Class: obtained by direct processing through the extraction and clarification of the sugarcane juice with physicochemical treatments, with bleaching, followed by evaporation, crystallisation, centrifugation and drying of the final product. There are four different types of sugar under this class: “Crystal”, “Amorphous Refined” (or “Refined”), “Granulated Refined”, and “Confectionary’s Sugar” (also known as icing sugar or powdered sugar).

Raw Crystal Class: obtained through the extraction and clarification of sugarcane juice with physicochemical treatments, followed by evaporation, crystallisation, centrifugation and drying. Among this class, the types are “Demerara”, “VHP” (Very High Polarisation) and “VVHP” (Very Very High Polarisation). **[Table 3]**

5.1.2. Group II sugar

Group II sugar comprises classes: "White Crystal", "Raw Crystal", and “Liquid”[34].

Group II – cane sugar for processing of food and other uses

Group II Brazilian sugar types		
Class	**Type**	**Description**
White Crystal	Crystal	Extracting and clarifying the sugarcane juice by physicochemical treatments with bleaching, followed by evaporation, crystallization, centrifugation and drying, cooling and sieving of the final product
	Granulated Refined	Dissolution of white or raw sugar, syrup purification, evaporation, syrup crystallisation, centrifugation, drying, cooling and sieving of the final product;
	Amorphous Refined (Refined)	Dissolution of white or raw sugar, syrup purification, evaporation, syrup concentration, beating, drying, cooling and sieving of the final product
	Confectionary’s Sugar	Sieving or extracting powder from crystal or amorphous refined sugar. Also known as Icing Sugar or Powdered Sugar
Raw Crystal	Demerara	Raw sugar with polarisation > 96° Z
	VHP	“Very High Polarisation” raw sugar with polarisation > 99° Z
	VVHP	“Very Very High Polarisation” raw sugar with polarisation > 99.49° Z
Liquid	Liquid	Dissolving crystal or refined sugar and purifying the syrup
	Inverted Liquid	Dissolving crystal or refined sugar, purifying and inverting the syrup

Table 4: Classes and types of Group II cane sugar. Source: MAPA

White Crystal Class: obtained by direct processing through the extraction and clarification of the sugarcane juice by physicochemical treatments with bleaching, evaporation, crystallisation, centrifugation and drying of the final product. Its types are “Crystal”, “Granulated Refined”, “Amorphous Refined” (or “Refined”), and “Confectionary’s Sugar”.

Raw Crystal Class: obtained by direct manufacturing in the mills through extracting and clarification of the sugarcane juice by physicochemical treatments, evaporation, crystallisation, centrifugation and drying of the final product. The types under this class are “Demerara”, “VHP”, and “VVHP”.

Liquid Class: obtained through the dissolution of crystal or refined sugar and purification of the syrup, which may suffer syrup inversion. Its types are “Liquid” and “Inverted Liquid”. **[Table 4]**

[34] Art. 6 & 8 of MAPA IN 47/2018

5.2. Main exporting types

About three-quarters of the sugar exported by Brazil is raw, especially the VHP and VVHP types, with maximum ICUMSA[35] colour ratings of 2,500 and 1,000 IU, respectively, due to their higher sucrose content and fewer impurities compared to regular raw sugar. The sugar is shipped in bulk and generally bought for refining in the importing country or use in food and beverages processing, incorporation into pharmaceutical and beauty products, among other applications. Raw sugar sold to the national food industry is usually packed in 1.2-tonne jumbo bags and carried by land.

White crystal sugar corresponds to about 20% of Brazil's sugar exports, typically ICUMSA 150, which is used where appearance and colour are not essential for the product's function, as in large-scale baking, or refining into purest forms of sugar. This type is packaged in 50-kg bags and shipped as breakbulk, in loose or pre-slung form, or stuffed into 20' containers. **[Section 8.2.4]**

Picture 8: Different types of refined, crystal and raw sugar. Source: Shutterstock

About 5% of the volumes comprise refined sugar, typically packed in 50-kg bags and carried in containers (540 bags per TEU[36]). The sparkling white and extensively refined granulated sugar has extremely low moisture content and the highest polarisation among sugarcane sugars. The best-selling specification in this quality range is the refined ICUMSA 45, the lowest colour rating, meaning the whitest (and most expensive) type of sugar.

5.3. Quality standards framework

Federal laws and regulations govern official standards for the grading of plant-based commodities. Grading is mandatory when the product is intended for direct human consumption, subject to sales contracts with the government or imported[37]. Where international contractual regulations are silent, Brazilian sugar standards apply to exports.

Normative Instruction n° 47 of 2018 (IN 47/2018), as amended, issued by the Ministry of Agriculture, Livestock and Supply (MAPA), lays the groundwork of Brazil's cane sugar standards[38].

[35] ICUMSA (International Commission for Uniform Methods of Sugar Analysis) is a worldwide body which brings together the activities of the National Committees for Sugar Analysis. An ICUMSA rating is an internationally accepted unit for expressing the purity of the sugar in solution and is related to the colour of the sugar. There are different types of ICUMSA. In Brazil, the lower the ICUMSA colour figure the whiter the sugar, but this is not the case in the European Union, for example. According to MAPA in 58/2018, ICUMSA colour is the colour of a sugar solution at defined concentrations and pH, which absorbance is measure at 420 nm, expressed in ICUMSA units (IU)

[36] Twenty-feet equivalent unit container

[37] Arts. 1 to 3 of Federal Law 9,972 of May 2000, which establishes the food grading of vegetable products, subproducts and residues with economical interest as regulated by Decree 6,268/2007

[38] *Instrução Normativa* - IN (Normative Instruction) 47 of Aug 2018 (MAPA IN 47/2018), as amended by MAPA IN 60/2019, came into full force in Brazil in July 2020

Also known as the "Sugar Technical Regulation", IN 47/2018 provides technical definitions and outlines the criteria and parameters for determining the identity and quality of the sugar. It establishes methods of sampling, analysis, marking, and labelling the product. **[Table 5]**

Term	Definition
Sugar	Product obtained from sugarcane belonging to cultivars of the *Saccharum officinarum L.* species through suitable processes; it consists of crystals, except for liquid sugar
Reducing sugars	Sugarcane reducing compounds and products, consisting of glucose and fructose, which have the property of reducing copper in cupric solution (Fehling's liquor), expressed as a percentage
Polarisation	Amount of apparent sucrose measured by polarimetry, under standardised conditions, using the standard weight of 26 g in 100 ml of water at 20° C, in °Z
Moisture	Free water content found in the product, measured by heating to 105° C, expressed in grams per 100 g of the product
ICUMSA colour	Colour of a sugar solution at defined concentrations and pH, which absorbance is measure at 420 nm, expressed in ICUMSA units (IU)
Conductometric ash	Ash content in a sample determined by measuring the electrical conductivity of an aqueous solution of the sample of known concentration, expressed as a percentage
Clarification	A physicochemical operation to eliminate soluble impurities, coarse suspensions and colloids from the sugarcane juice during the sugar manufacturing process
Black dots	Visible particles of colour contrasting with that of sugar crystals, which may come from caramelised sugar, carbonised sugar, soot, sparks from burning cane, cane fibres or residues from incrustation from equipment, expressed in number of black dots per 100 g
Grading document	The certificate, spreadsheet, packing list or another document duly recognised by MAPA, which proves that the plant classification has been carried out
Grading report	The document that contains results referring to the product analysis and which will serve as the basis for issuing the grading document
Risks to human health and foreign matters	Indications of risks to human health and foreign matters indicative of failures of good practices are those detected macroscopically or microscopically, according to specific legislation by the National Agency of Health Surveillance (ANVISA)
Substances harmful to health	Foreign substances or agents of biological, chemical or physical origin, which are harmful to health, such as mycotoxins, residues of plant protection products or other contaminants, provided for in specific legislation, not being so considered those which value is within the maximum limits foreseen in the regulation

Table 5: Brazilian sugar technical definitions, according to MAPA IN 47/2018. Source: MAPA

5.4. Official grading

Sugar quality and purity are dictated by specific grading parameters, particularly those relating to polarisation (amount of apparent sucrose), expressed in Zucker degree (°Z), ICUMSA colour, moisture and ash contents in percentage.

MAPA IN 47/2018 categorises the Brazilian cane sugar according to the production process involved. Following objective qualitative criteria, the regulation stipulates the main specifications for classifying each type of sugar of Group I (for human consumption) and Group II (for industrial use or further refining). **[Table 6]**

Group I – cane sugar intended for human consumption and sold directly to the final consumer

Group I Brazilian sugar		Parameters					
Class	Type	Polarisation (°Z)	Moisture (%)	ICUMSA (max. IU)	Ashes (max. %)	Black spots (max n°/100g)	Magnetisable particles (max. mg/Kg)
White Crystal	Crystal	99.5	0.10	300 (*)	0.10	20	15
	Amorphous Refined (or Refined)	99.0	0.30	100	0.20	5	5
	Granulated Refined	99.8	0.05	60	0.04	5	5
	Confectionary Sugar	99.0	0.30	150	0.20	5	5
Raw Crystal	Demerara	96.0	1.20	5,000	0.50	N/A	N/A
	VHP	99.0	0.25	2,500	0.25	N/A	N/A
	VVHP	99.49	0.15	1,000	0.15	N/A	N/A

Group II – cane sugar intended for the food and beverage industry and other uses

Group II Brazilian Sugar		Parameters						
Class	Type	Polarisation (°Z)	Moisture (%)	ICUMSA (max. IU)	Ashes (max. %)	Black spots (max. n°/100g)	Magnetisable particles (max. mg/Kg)	Reducing sugars (max. % m/m)
White Crystal	Crystal	99.5	0.10	300 (*)	0.10	20	15	N/A
	Amorphous Refined (or Refined)	99.0	0.30	100	0.20	5	5	N/A
	Confectionary Sugar	99.0	0.30	150	0.20	5	5	N/A
	Granulated Refined	99.8	0.05	60	0.04	5	5	N/A
Raw Crystal	Demerara	96.0	1.20	5,000	0.50	N/A	N/A	N/A
	VHP	99.0	0.25	2,500	0.25	N/A	N/A	N/A
	VVHP	99.49	0.15	1,000	0.15	N/A	N/A	N/A
Liquid	Liquid	N/A	N/A	120	0.30	N/A	N/A	0.30
	Inverted	N/A	N/A	120	0.30	N/A	N/A	60 to 90

(*) Up to 400 IU of ICUMSA colour is allowed for an organic product certified in accordance with relevant legislation

Table 6: Annexes I to IV MAPA IN 47/2018 with quality parameters for Groups I & II Brazilian cane sugar. Source: MAPA

5.5. Official sampling

The most common sampling equipment for sugar in bulk is the slotted grain probe, manual or automated, long enough to reach the bottom of the load and draw a top-down representative sample. In modern bulk terminals, automatic flow samplers are installed on the cargo conveying system. Samples from bagged sugar are taken with a bag trier.

MAPA regulates the sampling equipment used by bulk cargo storage facilities. IN 47/2018 specifies the methods for sampling bulk and bagged sugar from conveyances (lorries, railcars, barges and ships) and storage facilities. While the regulation does not stipulate how long the cargo samples must be retained, they should not be discarded until at least the cargo has been delivered to the buyer without protest or remarks concerning quality.

5.5.1. Conveyances

Sampling from conveyances for grading purposes must be carried out at points distributed evenly across the load, reaching the upper third, the middle and the lower third of the cargo compartment. The lot size determines the minimum number of sampling points, varying from 5 to 11 points for cargo lots from 15 to 500 tonnes, with a composite sample made up of at least 2 kilos per sampling. **[Table 7]**

5.5.2. Sheds, silos and vessels

For consignments greater than 500 tonnes, as in the case of sugar stored in sheds and silos (or loaded in cargo holds), sampling must be carried out at the time of loading, unloading or transhipment from the vessel and during dispatch from or receipt in storage, while the product is in motion.

Sampling during cargo transfer must be made with collection in increments of 500 g off the conveyor belt, manually with a scooper or through an automatic sampler, making up at least 10 kg of sugar for each fraction of, at most, 500 t (subsample), at regular intervals of equal times, according to the throughput of the cargo handling facility. The subsamples are homogenised and quartered down to partial samples for analysis for every 5,000 tonnes of the lot. **[Table 7]**

The storage facility accredited with MAPA must accurately describe and document the sampling method adopted for sugar grading carried out by operational flow[39].

If the sampling cannot be made with the cargo in motion, the same conveyance methodology should be adopted with appropriate probing and sampling equipment.

5.5.3. Bags and bales

The sampling of sugar packed in bags (or bales) lying in conventional storage must be carried out at random. The minimum number of packages sampled depends on the size lot[40].

Fractions of a maximum of 10,000 bags must be adequately subdivided into the same number of sub-lots as the minimum number of bags to be sampled, according to the proportions set out in IN 47/2018. The number of bags that make up each sub-lot is obtained by dividing the number of bags in the entire lot by the minimum number of bags to be sampled. **[Table 7]**

The sampling must be made with adequate equipment, and 30g of the product must be drawn from each sampled bag until completing at least 10kg of sugar for each fraction of 10,000 bags. The 10kg subsamples must be homogenised, quartered, and reserved to compose the partial sample to be analysed for every 500 t of the total lot.

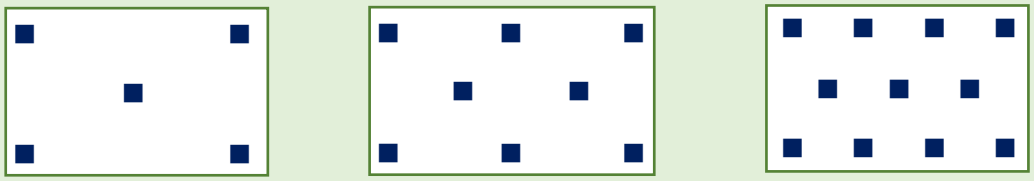
5.5.4. Sample distribution

Regardless of the sampling method, four samples must be made up by homogenisation and quartering method and adequately packed, sealed, identified, and authenticated. One set is sent to the accredited laboratory for analysis; the grader retains one set; one for the interested party; and one set is preserved for counterproof in an arbitration. The partial samples should be homogenised and quartered to form the composite samples representative of the entire consignment[41]. **[Table 7]**

[39] Art. 30 & 32 of MAPA IN 47/2018
[40] Art. 23 of MAPA IN 47/2018
[41] Art. 5 to 22 of MAPA IN 47/2018

Methods of sugar sampling for official grading

Bulk sugar in conveyances (lorries, railcars, barges and ships)



5 sampling points
(Lots of up to 15 t)

8 sampling points
(Lots from 15 to 30 t)

11 sampling points
(Lots from 30 to 500 t)

I. Draw samples from points evenly distributed, between 5 to 11 points depending on the size of the lot, in depths reaching the bottom third, the middle and the upper third of the load
II. Make up composite sample made up of at least 2 kg per sampling

Bulk sugar during loading, discharge and storage transfers

I. Draw samples from the conveyor belt in increments of 500 g, at regular intervals of equal times, according to the throughput of the cargo handling facility, and make up 10 kg of sugar for each fraction of max. 500 t (subsample)
II. Homogenise, quarter and reserve the 10 kg subsamples extracted from each 500 t fraction to compose the partial sample to be analysed for every 5,000 tonnes of the lot
III. Homogenise, quarter and reserve the partial samples

Bagged sugar in conventional storage

I. Subdivide each fraction of max. 10,000 bags into the same number of sub-lots as the minimum number of bags to be sampled, according to the table below
II. Obtain the number of bags to make up each sub-lot, dividing the number of bags of the total lot by the minimum number of bags to be sampled
III. Take 30 g per package until completing at least 10 kg of the product for each fraction of max.10,000 bags (subsamples)
IV. Homogenise, quarter and reserve the 10 kg subsamples extracted from each fraction of max. 10,000 bags to compose the partial sample to be analysed for every 500 t of the total lot
V. Homogenise, quarter and reserve the partial samples

Quantity of bags	Minimum number of bags to be sampled
Up to 10	All
10 to 100	10
100 to 150	13
150 to 200	15
200 to 300	18
300 to 400	20
400 to 500	23
500 to 600	25
600 to 1.000	33
1.000 to 1.500	40
1,500 to 2,000	46
2,000 to 3,000	56
3,000 to 5,000	72
5,000 to 8,000	89
8,000 to 10,000	100

Sample distribution

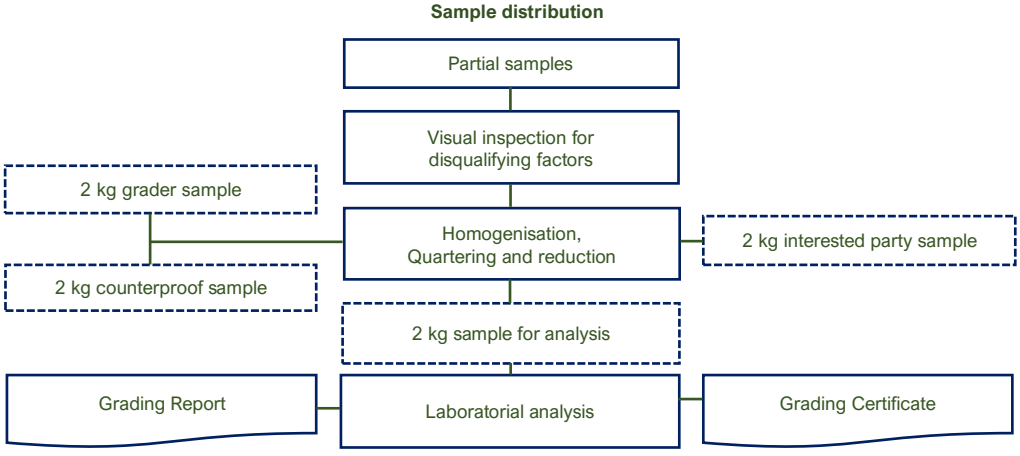


Table 7: MAPA IN 47/2018 sampling parameters for Groups I & II Brazilian cane sugar. Source: MAPA

5.5.5. Unsuitable sugar

Sugar that does not meet the qualitative parameters established in MAPA IN 47/2018 will be typified as "Out of Type"[42].

If it is in a poor state of conservation, the product will be disqualified, rendered unfit for human consumption or commercialisation, and discarded at the expense and risk of the party responsible. It includes generalised deterioration or fermentation, dampness, presence of insects or animal debris above what is allowed in specific legislation, or obnoxious odours inappropriate to the product, to the point of rendering it unfeasible for its intended use[43].

MAPA may discretionarily conduct analyses of a substance suspected of being harmful to health, or containing materials of potential risk, regardless of the grading result. The sugar will also be disqualified when foreign matters exceed the legal limits or when the relevant authority verifies the presence of unauthorised substances[44].

5.6. Comercial grading

The most common standard contractual rules and regulations adopted in the international sugar trade are those drafted by the Sugar Association of London (SAL) and the Refined Sugar Association of London (RSA) for raw sugar and white sugar, respectively.

These contracts and arbitration procedures are subject to English Law. Unless otherwise provided, the analytical methods for testing polarisation and colour grading are those laid down by the ICUMSA or another internationally recognised sugar analytical method.

5.6.1. Raw sugar

Standard SAL raw sugar contracts generally stipulate that the product must be of a fair average quality of a given crop (or, if it is not stated, the current or the immediately preceding crop), shipped in bulk, with an average polarisation of 96°.

The seller is responsible for supervising weighing, taring, sampling, and determining damage and polarisation at loading and the buyer at discharge. Both have the option to appoint their representatives at either end[45].

5.6.2. White sugar

Standard RSA white sugar contracts establish that the product must be within the contractual specifications. Unless otherwise indicated, it must be of the current crop or production, free-flowing, with no impurities other than trace elements inherent to sugar. The product must be fit for human consumption and comply with public health regulations in force in the country of origin.

Cargo supervisory services are usually for the seller's account at loading (or container stuffing) and buyer's at discharge (or container unstuffing). The apportionment of liabilities between buyer and seller varies according to the commercial term agreed between them[46].

[42] Art. 7, § 2 & § 3, art. 8, § 3 & art. 9 of MAPA IN 47/2018
[43] Art. 10 & 11 of MAPA IN 47/2018
[44] Art. 11 to 15 of MAPA IN 47/2018
[45] "*SAL Rules and Regulations*", Effective July 2019, by the Sugar Association of London (SAL) [retrieved 07/07/21]
[46] "*RSA Rules and Regulations*", Effective March 2021, by the Refined Sugar Association of London (RSA) [retrieved 07/07/21]

5.7. Commercial sampling

5.7.1. Raw sugar

Standard SAL rules for raw sugar stipulate that the seller at loading and the buyer at discharge must provide adequate facilities for sampling concurrently with cargo weighing.

Composite samples must be collected at equal time intervals for each lot of 2,000 tonnes of raw sugar (or lots of 500 tonnes in the case of bagged sugar) from each consignment, carefully homogenised and filled in sufficient quantities into at least 4 (four) airtight containers, which must be sealed and identified. One sample is for the seller, and one is for the buyer. The supervisor must hold at least two sets. The samples must be retained for at least two months[47]. **[Table 8]**

Methods of sugar sampling for commercial grading

Raw sugar in bulk and bags (SAL Rules)

I. Draw composite samples for each lot of 2,000 tonnes of sugar (or lots of 500 tonnes in the case of bagged sugar, representing no less than 10% sampled)
II. Homogenise, quarter and makeup four sets of composite samples representative of the entire consignment

White sugar in bulk and bags (RSA Rules)

I. Draw samples from at least 1% of each lot of 1,000 tonnes (or part thereof) of sugar delivered from each supplier
II. Make up representative samples for each lot of 1,000 tonnes of sugar Homogenise, quarter and divide the composite samples into four sets of samples representative of the entire consignment

Sample distribution

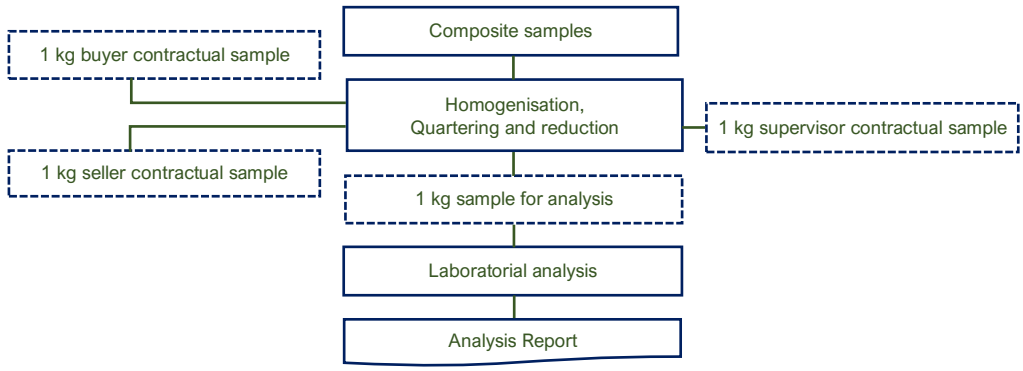


Table 8: commercial sampling method for raw and white sugar. Source: SAL/RSA

5.7.2. White sugar

Under RSA standard rules, unless otherwise agreed, sugar sampling must be carried on at least 1% (one per cent) of each lot of 1,000 tonnes of sugar, or part thereof, delivered from each supplier, from bags selected at random[48]. **[Table 8]**

The sampling is carried out when the sugar bags arrive at the loading port terminal. The composite samples collected from each lot of 1,000 tonnes of sugar are mixed, homogenised, quartered and analysed by a recognised chemist following ICUMSA standard methods[49].

[47] Rule 310 of SAL 2019
[48] In case of a claim as to condition or quality, the buyer must arrange drawing of samples in triplicate from not less than 5% of the consignment. One sample is to be sent to the seller to substantiate the claim and two in the buyer's possession, one for testing and the other withheld for arbitration purposes (Rules Relating to Contracts 4 to 6 of RSA 2021)
[49] RSA rule does not define how long the samples must be retained. However, it provides that, in the event of a claim, the buyer must notify the seller within seven days after completion of discharge at destination. For container shipments, the completion of discharge is the date on which the seal is broken, or at the time of delivery to the final receiver, or 40 days after unloading onto the quay, whichever firstly occurs

6. Cargo quantification

6.1. Official quantification

6.1.1. Sugar in bulk

Brazilian federal laws do not specify how solid bulk cargoes are quantified during loading or unloading from vessels. Nevertheless, for taxation and customs control purposes, the methods for quantifying bulk imports and exports are regulated by the Special Department of the Federal Revenue of Brazil (RFB), the customs authority, through normative instructions.

RFB regulation recognises direct weighing (road or rail weighbridges, intermittent and continuous flow scales), direct measurement (automated devices for measuring cargo flow), and mensuration (draft survey) as acceptable means of quantifying bulk cargoes[50]. The method applied at each customs-bonded port facility is established by the chief inspector of the local Customs House.

Direct and automated measurement by an independent surveying company is the customs authority's preferred method. When a customs-appointed expert carries out the quantification, shore measurements performed by the terminal are excluded unless the chief customs inspector justifiably orders shore figures to prevail[51].

Whereas in some foreign jurisdictions there are recognised customary shortage (or trade) allowances, typically around 0.5% of the manifested quantity, no statutory or agreed tolerances for short-loading (or short-landing) apply in Brazil.

On the other hand, the Customs Regulation[52] provides a 1% (one per cent) 'natural shortage' allowance for cargo in bulk for which the carrier is exempt from tax liability in imports[53]. In the absence of a civil statute on the matter, the civil courts tend to accept, by analogy, the 1% customs allowance to discharge the carrier from liability for short delivery of bulk cargoes. **[Section 9.3]**

6.1.2. Sugar in bags

Breakbulk cargoes, including sugar in bags, are subject to physical inspection and tallying performed by tally clerks employed by customs-bonded terminals or hired from the unions of tally clerks. There is no statutory shortage allowance for bagged cargo[54]. **[Section 9.3]**

In mechanised bulk terminals handling bagged sugar, cargo counting may be performed by electronic sensors installed along the conveyor belt, or any other automated means, as long as the local Customs House approves the equipment.

6.2. Commercial quantification

6.2.1. Sugar in bulk

SAL rules state that, at loading the seller and at discharge the buyer, must provide adequate weighing facilities. Sugar must be weighed regularly on tested scales and weighbridges with a tolerance not exceeding 0.10%, in lots of 1,000 tonnes or as nearly as reasonably possible.

[50] *Instrução Normativa* - IN (Normative Instruction) N° 28 of 1994 (RFB IN 28/1994) regulates the customs clearance for export. IN 1,800 of 2018 (RFB IN 1,800/2018) regulates expert services for the identification and quantification of imports and exports
[51] Arts. 22 to 24 of RFB IN 1,800/2018
[52] Federal Decree 6,759 of 2009, as amended, generally simply referred to as *Regulamento Aduaneiro* (Customs Regulation)
[53] Arts. 72, 238 and 251 of the Customs Regulation
[54] Art. 40 of Law 12,815 of 2013

Raw sugar shipped in bags must be weighted in drafts to 0.5%. When single bag weighing is necessary, the scale should respond to the nearest 0.1 kg. The sugar must be weighed and tallied in lots of 500 tonnes. Where bags are emptied in the vessel, the empty bags must be collected and weighed out directly to determine the taring.

6.2.2. Sugar in bags

RSA contract rules provide that the weight of the sugar in each bag must not be less than the contract weight, and the total net weight of all bags combined must not be less than the minimum weight agreed in the contract. For white sugar delivered in bulk, the weight is determined by the filling weight confirmed by an authorised weighbridge.

Unless contractually agreed, check-weighing must be carried out on at least 1% of every 1,000 tonnes of sugar delivered from each supplier. In case of discrepancy in the weight of the sugar bags loaded as breakbulk, the superintendent must notify the other party's representative before the cargo is stowed on board. For bags in a container, the notification must be made before the container sealing[55].

6.3. Charter Party quantification

Most sugar shipments out of Brazil are governed by the terms of the Sugar Charter Party 1999. Its standard "Tallymen Clause" (Cl. 15) stipulates that the quantity of sugar delivered is conclusive evidence against the vessel as to the number of bags shipped, except for errors and obvious frauds, the vessel remaining responsible for bags short-delivered in relation to the quantity stated in the bill of lading[56]. **[Sections 9.3 & 9.4]**

[55] Rules Relating to Contracts 1 & 3 of RSA 2021

[56] Clause 15 (Tallymen) of the Sugar Charter Party 1999 reads: "*Shore tallymen to be employed by the vessel at the expense of the vessel. Quantity stated on Bills of Lading to be conclusive evidence against the ship as to the number of bags of sugar shipped, errors and obvious frauds excepted. Ship to be responsible for any number of bags short delivered of signed Bill of Lading quantity*."

7. Sugar loading and stowage

7.1. Cargo characteristics

Sugar may be either brown (raw sugars) or white crystalline to bright white (refined sugars) granules of up to 3mm with a moisture content ranging between 1.20% (demerara type) and 0.05% (granulated type), being highly soluble in water. Sugar density varies from 625 to 1,000 kg/m^3, with a stowage factor in the range of 1.00 to 1.60 m^3/t.

Pictures 9 & 10: Raw sugar in storage and during loading on vessels. Source: Shutterstock/Proinde

Although raw sugar is considered a cohesive cargo for which determination of the angle of repose[57] is not required under the IMSBC Code[58], it is common to see shipper's cargo information forms indicating varying angles of repose, with an average angle of 37 degrees[59].

Pictures 11 & 12: Shiploaders pouring raw sugar on vessels' holds. Source: Proinde

7.1.3. Loading equipment

Most Brazilian terminals handling sugar are mechanised. Raw sugar is usually loaded via ship-loaders with moveable spouts that help trim the cargo during the loading process.

Some spouts are not fitted with dust skirts or similar devices to prevent dust emission of particulate matter to the surroundings during loading. Depending on loading speed and wind forces, a large amount of dust can rise around the hold opening and overboard, resulting in cargo wastage. Those exposed to the dusting in such conditions must wear adequate protective equipment and clothing.

[57] Under the definition of the IMSBC Code, the angle of repose means the maximum slope angle of non-cohesive (free flowing) granular material. It is measured as the angle between a horizontal plane and the cone slope of such material. The methods of determining the angle of repose are outlined in Section 6 of the Code

[58] "*The International Maritime Solid Bulk Cargoes Code*" (IMSBC Code), 2008, as amended, 2020, by IMO

[59] Transport Information Service (TIS) from the German Insurance Association (GDV e.V), Berlin [accessed 14/07/21]

A few terminals are equipped with ship-loaders with a spiral chute for loading sugar in bags. However, most bagged sugar is loaded by shore or vessel's crane using the conventional hoisting method with cargo slings.


Pictures 13 & 14: Loose bags being placed on slings (left) and pre-slung bags being loaded. Source: Shutterstock/Proporto

The bags are placed in net slings made up on the quayside as the lorries or trailers arrive. In some shipments, the bags already come in pre-slung form, typically 32 bags of 50 kg in each sling, which speeds up the loading process, facilitates cargo tallying and reduces handling damage.


Pictures 15 & 16: Loose bags being stuffed into a container and pre-slung bags being stowed. Source: Shutterstock/Proporto

7.1.3. Statutory requirements

Chapter VI of the SOLAS Convention[60] regulates cargo carriage by sea in general, while Appendix I of the IMSBC Code includes a schedule for carriage of sugar in bulk. In addition to meeting stability requirements and other stipulations, masters of bulk carriers carrying sold bulk cargoes must also be guided by the safety practices outlined in the BLU Code[61].

All foreign vessels operating in Brazilian waters must comply with the relevant standards issued by the maritime authority, Brazilian Navy's Directorate of Ports and Coasts (DPC)[62]. Otherwise, there is no specific regulation on port handling or sea carriage of sugar that must comply with qualitative and phytosanitary standards of the agricultural authorities of Brazil and the countries of destination[63] and the contractual specifications.

[60] Chapter *VI of the "International Convention on Safety of Life at Sea (SOLAS), 1974", as amended",* by IMO
[61] "*The Code of Practice for the Safe Loading and Unloading of Bulk Carriers*" (BLU Code), 1997, as amended, by IMO
[62] Norms issued by the Brazilian Navy's *Diretoria de Portos e Costas* – DPC (Directorate of Ports and Coasts), particularly NORMAM 04/DPC ("*Brazilian Maritime Authority Standards for the Operation of Foreign Vessels in Brazilian Jurisdictional Waters*") and NORMAM 08/DPC ("*Brazilian Maritime Authority Standards for Traffic and Permanence of Vessels in Brazilian Jurisdictional Waters*")
[63] Ordinance 177 of June 2021 establishes procedures and criteria for phytosanitary certification in the export and import of plant-based products

7.2. Allocation of liabilities

7.2.1. shipper's liability

The shipper is legally responsible for providing the carrier, through the master, with all necessary descriptions of the cargo intended for carriage in advance of loading and ensuring that legal requirements and procedures are fulfilled according to the relevant legislation.

Under the Brazilian Civil Code, the shipper is liable for losses resulting from inaccurate or false information about the cargo shipped, provided that the carrier files the claim within 120 days, under penalty of lapsing of right[64].

7.2.2. carrier's liability

The vessel must satisfy all relevant requirements under SOLAS/VI, IMSBC Code and the BLU Code. Before loading, the master must acquire from the shipper and terminal all cargo information necessary for calculating the vessel's stability for proper stowage and safe transportation[65], as well as agreeing on a documented loading plan with the port operator. **[Sections 7.3.1 & 7.3.2]**

Under the terms of the special law (Law-Decree 116 of 1967)[66], carrier's liability begins when the cargo is received on board and subsists until delivery to the consignee at the port of destination, tackle to tackle, in line with the general provisions of the Civil Code and the Commercial Code[67].

The master has an obligation to refuse cargo that is visibly in poor condition or poses a hazard to human health or vessel's safety. He must also reject any shipment not accompanied by documents required by law or regulation[68]. Otherwise, the master remains liable for the safe cargo loading, stowage, conservation, and delivery to the rightful consignee[69].

7.2.3. Port operator's liability

The port terminal operator or facility (port operator)[70] is legally liable for cargo shortage or damage from when it is taken in storage until loaded on the vessel[71].

Under the Brazilian Law of the Ports, the port operator answers to the cargo owner for loss or damage caused to the cargo during port operation or as a result. It must perform the cargo operation under the instructions of the master or his servants and remains liable to the shipowner for damage caused to the vessel or cargo[72].

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[64] Arts. 743 & 745 of the Civil Code (Law N° 10,406 of 2002)
[65] Regulation 2, Part A & 6, Part C, Chapter VI, of SOLAS; Section 2.2 of the BLU Code
[66] Law-Decree n° 116 of 1967 (as regulated by Decree 64,389 of 1969) regulates the operations related to the transport of goods by waterways in Brazilian ports establishing the responsibilities and dealing with cargo shortage and damage
[67] Art. 3 of Law-Decree 116/1967: "*The responsibility of the vessel or craft commences upon receipt of the goods on board and ceases with the delivery of the goods to the port entity or municipal wharf at the port of destination, alongside the vessel. § 1 the effective delivery on board is considered when the goods are handled by vessel's gear, from the commencement of the operation alongside the vessel*. (…)" (free translation). Art. 750 of the Civil Code: "*The responsibility of the carrier, limited to the value appearing in the bill of lading, commences when it or its servants receive the thing and finishes when it is delivered to the consignee, or deposited in court if the consignee cannot be found*" (free translation). Art. 519 of the Commercial Code (Law N° 556 of 25/06/1850): "*The Captain is the true bailee of the cargo and any other effects that he receives on board and as such he has the duty of their custody, good stowage and conservation and their prompt delivery at sight of the bills of lading (articles 586 and 587). The liability of the captain for the cargo commences from the moment he receives it and continues until he delivers it at the agreed place or the place which is in use at the port of discharge.*" (Free translation)
[68] Art. 746 and 747 of the Civil Code
[69] Art. 519 of the Commercial Code; Section 4.1.1 of the BLU Code; Art. 27 of the Law of the Ports (Law n° 12,815 of 2013)
[70] Under the definition of the Law of the Ports, the port operator is "*the legal person pre-qualified to carry out the activities of handling passengers or handling and storing goods, destinated or coming from waterway transportation, within the area of the organised port*" (free translation). The port operator plays the role of terminal representative as defined in regulation 7, Part B, Chapter VI, of SOLAS
[71] Art. 2 of Law-Decree 116/1967: "*The responsibility of the port entity commences with the entry of the goods in its warehouses, yards or other places designated for storage and only ceases after effective delivery to the vessel or to the consignees. §1 the effective delivery to the vessel is considered from the commencement of loading operation alongside by way of vessel's gear. (…) §3 the goods delivered to the warehouse of the carrier or loaded or discharged to auxiliary ships owned by the carrier or acting on its behalf, are deemed delivered into the custody and responsibility of the carrier*." (Free translation)
[72] Art. 26 of Law of the Ports (Law 12,815/2013)

7.3. Loading operation

7.3.1. Cargo information

Sufficiently in advance of loading, the shipper must provide the master with written information about the intended shipment, including shipper's identity, cargo description (including its BCSN[73]), destination, gross mass, and other relevant properties and characteristics.

FORM FOR CARGO INFORMATION
for Solid Bulk Cargoes

<table>
<tr><td colspan="2">BCSN</td></tr>
<tr><td>Shipper</td><td>Transport document number</td></tr>
<tr><td>Consignee</td><td>Carrier</td></tr>
<tr><td>Name/means of transport
Port/place of departure</td><td rowspan="2">Instructions or other matters</td></tr>
<tr><td>Port/place of destination</td></tr>
<tr><td>General description of the cargo
(Type of material/particle size)</td><td>Gross mass (kg/tonnes)</td></tr>
<tr><td colspan="2">Specifications of bulk cargo, if applicable:
Stowage factor:
Angle of repose, if applicable:
Trimming procedures:
Chemical properties if potential hazard*:
* e.g. class & UN No. and/or MHB hazard(s)</td></tr>
<tr><td>Group of the cargo
☐ Group A and B*
☐ Group A*
☐ Group B
☐ Group C
* For cargoes which may liquefy (group A and group A and B cargoes)</td><td>Transportable moisture limit

Moisture content at shipment</td></tr>
<tr><td>Classification relating to MARPOL Annex V

☐ harmful to the marine environment
☐ not harmful to the marine environment

Relevant special properties of the cargo (e.g. highly soluble in water)</td><td>Additional certificate(s)*
☐ Certificate of moisture content and transportable moisture limit
☐ Weathering certificate
☐ Exemption certificate
☐ Other (specify)
*If required</td></tr>
<tr><td>DECLARATION
I hereby declare that the consignment is fully and accurately described and that the given test results and other specifications are correct to the best of my knowledge and belief and can be considered as representative for the cargo to be loaded.</td><td>Name/status, company/organization of signatory

Place and date

Signature on behalf of shipper</td></tr>
</table>

Figure 7: IMSBC form for cargo information for solid bulk cargoes. Source: IMSBC Code

[73] Under Section 4 of the IMSBC Code, each solid bulk cargo included in the Code must be identified in the transport documentation by its Bulk Cargo Shipping Name (BCSN) as assigned by the Code

Cargo information must meet the requirements of SOLAS/VI and be issued in the form mandated by the IMSBC Code[74]. **[Figure 7]**

Mate's receipts and bills of lading usually only describe the generic or trade name of the cargo and its gross weight. Sometimes, specifications such as crop year, polarisation and ICUMSA colour rating are also included in the cargo description. Nevertheless, the shipper's cargo declaration is ultimately a mere statement of the contractual specifications agreed upon, many of which are not verifiable at the time of loading or during the voyage.

The master must therefore ensure that the cargo is in apparent good order and condition at the time of shipment to the best of his knowledge. If there are apparent errors or omissions, the master must refuse to load until a correct declaration is presented.

7.3.2. Loading and stowage plan

The BLU Code establishes procedures for information exchange between the vessel and the terminal (port operator) to begin before the vessel's arrival. The loading programme must be planned in a timely and safe manner, and the stowage plan formally agreed upon between the master and the port operator. The plan must include the loading rate, cargo holds sequence, deballasting rate, and procedures for cargo trimming and levelling[75].

7.3.3. Loading supervision

Both the port operator and the master are responsible for ensuring that the loading operation is carried out per the agreed stowage plan, including any mutually accepted variations.

The port operator is responsible for performing cargo operations through its own stevedores or casual port workers hired from the unions. At the same time, the master remains ultimately accountable for the cargo safe loading and stowage.

The master or his duty officer must suspend the loading operation if the permissible forces and moments on the vessel are exceeded or if stability may be compromised, in which case the vessel and port operator must agree on the corrective measures to be taken. Likewise, the operation must be halted if the apparent cargo condition deviates from sound or visibly differs from the cargo information provided by the shipper[76].

7.3.4. Cargo trimming

All cargo holds must be as full as practicable and trimmed reasonably level, following IMSBC Code provisions, to reduce the risk of cargo shifting and minimise air entering the void spaces under the decks.

The master has the right to require that the cargo loaded be trimmed when there is any concern regarding stability based on the information available, vessel's characteristics, and intended voyage[77].

[74] Arts. 743 to 745 of the Civil Code; Regulation 2, Part A, Chapter VI, of SOLAS; Section IV of the IMSBC Code
[75] Sections 3 & 4, and Appendices 3 & 4 of the BLU Code
[76] Regulation 7, Part B, Chapter VI, of SOLAS; Section 5 of the BLU Code
[77] Section 5 of the IMSBC Code

8. Cargo risks

8.1. Inherent vice

According to the IMSBC Code, sugar is a "Group C" bulk cargo, which is neither liable to liquefy nor presents chemical hazards. Nonetheless, as it is a highly soluble substance, large-scale water ingress into cargo spaces can potentially lead to a risk of vessel's instability due to the formation of a wet base and dissolution of the sugar, which may shift with the vessel's motion similarly to liquefiable cargoes.

Sugar must be kept as dry as possible, and under no circumstances should it be handled during any form of precipitation. Non-working cargo hatches must always remain closed. The vessel's crew and terminal foreperson must keep a sharp weather lookout to ensure the cargo loading equipment is removed from the hatchways and the hold promptly closed in the imminence of rain. **[Section 9.1]**

8.2. Cargo damage

The incidence of severe damage during loading of sugar in bulk, to the point of requiring the removal of large amounts of cargo, is relatively low compared to the number of shipments of this commodity. However, most bulk terminals are designed for cargo loading and are rarely equipped with offloading facilities. Unloading substantial volumes of damaged sugar from cargo holds can often be a costly exercise that outweighs the value of the cargo.

8.2.1. Wetting

The most common cause of damage to sugar cargoes during loading is probably rainwater wetting. It often occurs through sudden torrential rains that catch vessels off guard with hatches wide open and reach the cargo stowed to depths proportional to exposure time and rainfall intensity. Rainwater – or washwater resulting from cleaning cargo handling equipment – that remains trapped in the conveyor belts and shiploaders is another common source of wet damage. It usually happens upon commencement of loading or after rain breaks.

Pictures 17 & 18: Raw sugar exposed to rainwater (right part of the pictures). Source: Proinde

Wetness causes the sugar to dissolve, and if humidity reaches critical levels, fermentation and mould can quickly develop during the voyage. Although raw sugar is usually processed before end-use, wet damage results in sucrose loss and consequent commercial depreciation, apart from incurring extra costs in removing liquified or compacted sugar from cargo holds.

8.2.2. Caking and stickiness

Sugar agglomeration (caking) and adhesiveness (stickiness) do not typically result from a failure in the vessel's duty of care. These are commonly associated with a pre-shipment condition beyond detection and control of the master or crew. Nonetheless, caking claims are often filed against shipowners and charterers who are left with the burden of proving a vice of origin (inherent vice).

When the sugar lying in storage (or stowage) is not dry enough to reach equilibrium with the relative humidity of the atmosphere, it loses moisture and tends to cake. Conversely, if the sugar is too dry, it absorbs moisture from the surrounding atmosphere until it reaches equilibrium and, if atmospheric conditions change, it dries out again, and (caking) can then occur.

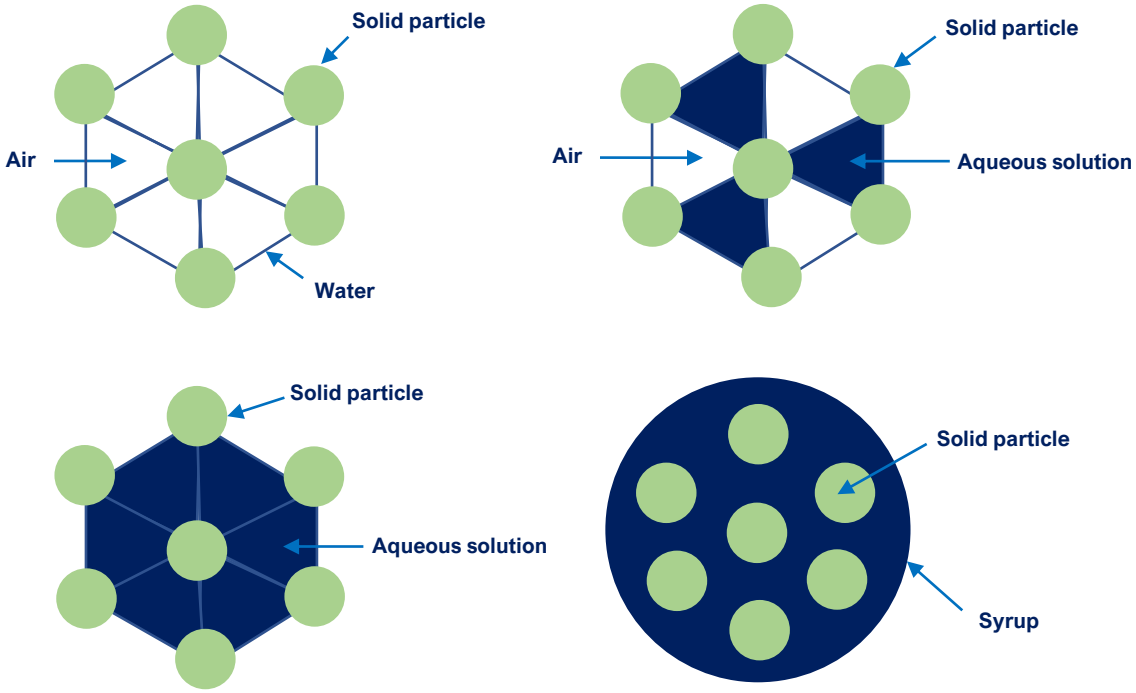

Figure 8: Simplified schematic representation of caking stages. Source: ResearchGate

Raw sugar is a moist and coarse commodity with high turnover and relatively short storage times in port areas. As it is chiefly moved on automated conveyor belt systems that keep it flowing freely, significant caking rarely occurs. However, raw sugar left in storage at high temperature and atmospheric humidity for a long time can become sweaty and lumpy as the molasses remaining on the surface of the sugar crystals adheres to their neighbours, forming a syrup pellicle. Caked and sticky sugar delays cargo discharge and requires additional labour, thereby increasing costs. **[Figure 8]**

8.2.3. Contamination

Common sources of contamination include residues from other bulk products previously moved through cargo conveying systems whose structure and belts were not adequately cleaned and dried before rolling out the sugar cargo. Some terminals load grain cargoes between sugar shipments, and every so often, maize (corn) kernels and soya beans are loaded along with the sugar cargo. This condition is generally not considered damage if the amount of such residues does not exceed contractual tolerances. The difficulty is that the crew has no reasonable means of determining whether the presence of foreign matters in the cargo is within acceptable limits or not.

Occasionally, extraneous objects, such as plastic linings, pieces of rubber and other debris, even rodents and pigeons, are loaded together with the cargo or fall into the hold. These obviously need to be removed as far as possible and documented in notes of protest.

Unless raw sugar is contaminated by chemicals or substances harmful to human health, most types of contaminants and impurities can be removed during the refining process.

8.2.4. Bagged sugar

Packing

Refined Sugar Association (RSA) standard rules require that free-running sugar be packed in new sound bags suitable for international shipping[78]. Most bagged shipments from Brazil comprise white crystal sugar. Occasionally, VHP and VVHP raw sugar is also shipped in bags. The typical packaging for sugar is polythene-lined brown (or white) woven polypropylene bag filled with 50 kg of sugar and double machine-stitched at the ends. Bagged sugar is shipped as breakbulk, either in loose or pre-slung form or stuffed into 20' containers, with up to 540 bags per TEU.

Risks

Sugar in bags is susceptible to caking and stickiness, typically associated with high temperature and moisture content at bagging. Static pressure exerted by excessive stacking weight can also cause the sugar to harden (pressure compaction), but this condition is customarily corrected when the bags are handled for transport[79].

Caking or stickiness can hardly be detected by the crew when the bags come out of automated shiploaders or pass over the vessel's rail in slings. Unless the crewmembers examine the bags as they are stowed inside the cargo hold, these conditions can often go unnoticed until the vessel reaches her destination.

Due to its free-flowing nature, torn bags can result in substantial spillage, causing partial loss of sugar and exposing the remaining product to atmospheric humidity. Therefore, torn bags must be promptly stitched and unloaded for replacement with sound bags to warrant issuance of "clean on board" mate's receipts and bills of lading.

Sugar bags can be very slippery, and care must be taken when stacking them aboard the vessel (or stuffing a container) to avoid collapse of stow and bodily injuries.

8.3. Cargo shortage

From the moment the cargo is loaded on board, the master becomes its legal custodian. Therefore, he must take all necessary precautions and exercise due diligence to deliver the shipment to the consignee in the same condition as received, within a reasonable time or as contractually stipulated[80].

In short loading cases, the master must file a note of protest and request the shipper to load additional cargo to offset the shortfall. Where disputes arise, joint soundings and measurements tend to result in the shipper (or port operator) agreeing to bridge the gap. When no agreement is reached, the owner should involve the charterers in the discussions with the shipper. The master should consider inserting a remark in the mate's receipt and bill of lading whenever he reasonably doubts shore figures. **[Section 9.4]**

[78] Chapter 2 of Rules Relating to Contracts, by the RSA
[79] "*Carefully to Carry, Issue 5: The Carriage of Refined (Crystal) Sugar*", 1997, by the UK P&I Club; "*Lloyds Survey Handbook, 7th Edition*", 1999, by Informa Publishing Group Ltd.; "*Thomas' Stowage - The Properties and Stowage of Cargoes, 8th Edition*", 2018, by Brown Son & Ferguson
[80] Arts. 749 & 750 of the Civil Code; art. 519 of the Commercial Code

9. Loss prevention issues

9.1. Cargo weather protection

The vessel holds and hatch covers must be suitable for the carriage of sugar in bulk or bags. Given its high solubility and hygroscopicity[81], there is no tolerance for sugar exposure to water from any source. The hatches must therefore be weathertight[82].

When preparing the vessel for the carriage of sugar, the chief officer must determine how long it takes to close each cargo hold. When discussing the loading plan, the officer should query the port terminal about the time required to clear the shoreside loading equipment off the hatchways for timely closing the hatch covers in the event of impending rain. This information must be passed on to the deck crew before the commencement of cargo operations so that the time required for closing the hatches will be considered during the weather lookout.

The crew should record the prevailing weather conditions (relative humidity, dry and wet bulb temperature, and dew point) and cargo temperature at loading. This information helps plan the ventilation strategy to be adopted during the passage. **[Section 9.5]**

9.1.1. Cargo holds

No specific cargo holds preparedness or cleanliness standards apply for loading sugar under the IMSBC or the BLU Codes. This commodity's commonly accepted industry standard is the "grain clean", the second-highest level of hold cleanliness only after “hospital clean”[83].

Grain clean (or “stringent cleanliness”) standard requires cargo compartments to be empty, clean, dry, and free from:

- Previous cargo residues and transferable, rub off stains
- Loose rust scales, paint flakes and blisters
- Any contaminants or sources of infestation or wetness
- Obnoxious odours (including that of uncured fresh paint)
- Moisture formation or leakage
- All holds' bilges must be empty, unobstructed, clean and dry

Pictures 19 & 20: Cargo holds during visual inspection. Source: Proinde

[81] Hygroscopicity is the tendency of a solid substance to attract, hold and absorb moisture from the surrounding atmosphere. Because it is attracted to and dissolves in water, sugar is also considered a hydrophilic substance

[82] Under the definition of the IMO International Convention on Load Lines, 1966, as amended, “‘weathertight’ means that in any sea conditions water will not penetrate into the ship”

[83] “*Carefully to Carry - Consolidated Edition*”, 2018, by the UK P&I Club; “*Loss Prevention Bulletin - Cargo Hold Cleaning*”, 2017, by the West of England P&I; “*Thomas’ Stowage - The Properties and Stowage of Cargoes, 8th Edition*”, 2018, by Brown Son & Ferguson

The standard Sugar Charter Party 1999 requires that cargo holds be free from odours and insects, properly swept, cleaned and dried to the satisfaction of the shippers or charterers. Cargo holds must be washed down if a cargo harmful to sugar has been carried previously. If they are washed, the holds must be dry before the tendering of the notice of readiness.

Under the Sugar C/P, the vessel must provide and lay kraft paper on the cargo holds to protect the bagged sugar from direct contact with the bare steelworks and protruding structures. There may be specific requirements by the voyage charterer or shipper, which need to be clarified upon fixture to give the crew (or shore contractors) sufficient time to clean and prepare the holds accordingly. Due to the local monopoly, these services are usually performed by shore workers.

After carrying sugar cargoes, the vessel's holds must be thoroughly cleaned as sugar residues may contaminate some bulk commodities, such as cement[84].

9.1.2. Hatch covers

The hatch covers and closing appliances must be weathertight. The integrity of the rubber packing and compression bars should be carefully checked. The weathertightness should be verified, ideally by an ultrasonic leak test according to the equipment manufacturer's instructions or following the International Association of Classification Societies (IACS) procedures[85]. If this non-invasive method is unavailable, the weathertightness should be assessed through a hose test, with the cargo holds empty.

Pictures 21 to 24: Hatch covers ultrasonic test (above) and hose test (below). Source: Proinde

[84] "*Standard Cargo: Bulk Cargoes - Hold Preparation and Cleaning*", 2011, by the Standard Club
[85] "*IACS Rec 14 Hatch Cover Securing and Tightness, Rev.2 Corr.1*", Oct 2005; "*IACS UR S14 Testing Procedures of Watertight Compartments - Rev.6*", Sep 2016, by the IACS

Under the Sugar C/P, charterers are entitled to arrange a condition survey or hose test, at their expense, before commencing loading[86].

In busy ports such as Santos and Paranaguá, the hose test is usually carried out at anchorage shortly after the vessel arrives. The benefit of this arrangement is that there will be enough time to correct any deficiencies before the vessel proceeds to the loading berth. In these cases, a final, 'official' inspection may still be conducted when the vessel comes alongside, at the discretion of the charterers or shippers.

Once the vessel is berthed, surveyors appointed by the cargo interests will come on board, usually accompanied by the charterer's surveyor. They will ask for the vessel's particulars and details of the last three cargoes carried – the dirtier (or dustier) the previous cargo, the more stringent the vetting tends to be.

Cargo surveyors will physically inspect the holds for "grain clean" or “normal clean” as appropriate. If not already done at anchorage, they may check the hatches for tightness through a hose test, following a mutually agreed test criterion.

The rigour of the holds inspections depends on subjective factors, including the grade of the sugar to be loaded, specific requirements of the importing country, and the strictness of charterers’ and cargo interests’ surveyors. Unfortunately, in some instances, the severity of the hold inspection is dictated by underlying commercial interests, such as cargo unavailability, terminal unreadiness and the line-up of vessels to occupy the berth of a terminal facility where the shippers may have a direct economic interest. Thus, the crew should prepare the holds to meet the stringent industry standards.

9.1.3. Containers

The standard Refined Sugar Association (RSA) rules require 20’ standard ISO containers to be suitable for the carriage of sugar, heavy-duty, clean, dry, odourless, free from nails or holes, and not showing any significant rustiness on its walls and panels[87]. The container’s inner walls are usually lined with kraft paper at the shipper’s expense.

9.2. Cargo condition

9.2.1. Cargo monitoring

The crew should visually inspect the cargo during loading to ensure that the sugar is dry and free-flowing. Crewmembers should be vigilant for any uncharacteristic, aggressive odours and look for caking or stickiness, the presence of foreign objects, contaminants, insects, birds, and rodents.

Meaningful, good-quality pictures illustrating the various stages of the loading operation should also be taken and identified correctly for later reference, if necessary.

9.2.2. Cargo sampling

Collecting representative samples during loading operation can be helpful evidence to support pre-shipment or inherent vice defences against cargo claims. The ideal sampling point is directly from the holds as the carrier's liability legally begins when the cargo is loaded on board.

[86] Clause 17 (Preparation for Loading and Discharging) of the Sugar Charter Party 1999
[87] Chapters 2 & 5 of Rules Relating to Contracts, by the RSA

When the sampling from cargo holds is unsafe or is not allowed by the port operator or the local port authority, the product should be sampled off a safe point along the conveyor belt or on the delivery vehicle at a point as close as possible to the vessel.

The widely adopted sampling standards for sugar export are those established by SAL for raw sugar and RSA for white sugar. **[Section 5.7]**

An alternative, practical method for shipboard sampling is to collect samples uniformly and systematically throughout the loading operation, composing subsamples according to loading rate. The subsamples should be homogenised and reduced to at least two sealed sets of representative samples made up of at least one kilo each per loaded hold.

Pictures 25 to 28: Collection of samples of sugar from cargo holds. Source: Proinde

A sampling certificate must be issued to indicate the source and seal number of each sample. The surveyor should retain one set, and the other should be kept with the master until cargo delivery without claim notices or protests. If there is a need to retain the samples for a more extended period, the carrier must notify the attending surveyor at the earliest opportunity.

9.3. Cargo quantity

Regardless of the weighing method adopted at each port of loading, the master has the right, under Brazilian Law, to resort to any alternative means to ensure the accuracy of shoreside measurements. He is entitled to challenge the shore figures whenever he detects substantial discrepancies. **[Section 9.4]**

There are instances where, for commercial reasons, or fear of delays and ensuing expenses, which can easily overcome the amount of the cargo in dispute, the master eventually agrees to issue clean documents in exchange for a letter of indemnity (LOI) given by the shipper or charterers on the charter chain. However, this commercial arrangement affords no legal protection to the carrier and may prejudice the vessel's P&I cover for cargo shortage liabilities.

The crew must be alert to cargo spillage from the cargo conveying system or trucks and railcars alongside the vessel after weighing the cargo (flow scales or weighbridges).

Significant short shipments must be documented with a note of protest to the shipper and port operator, supported with photographs and videos, if possible, evidencing the cargo wastage during loading.

Preventive measures such as draft surveys and sealing of holds may not, by themselves, preclude shortage claims under a “clean on board” bill of lading. Yet, they can help demonstrate the master's genuine efforts to ascertain, as accurately as possible under the circumstances, the amount of cargo delivered to his custody and that whatever it is, it will remain unscathed inside the sealed holds and will be discharged at the destination down to the last granule of sugar.

9.3.1. Draft displacement survey

The chief officer – or, preferably, an independent local surveyor – should conduct light and loaded draft surveys, ideally in the presence of cargo interests and customs' surveyor, if any in attendance. When loading parcels of sugar on more than one berth, an intermediate draft survey should be conducted before the vessel leaves each berth.


Pictures 29 & 30: Cargo quantification by draft survey. Source: Proinde

The result of the draft survey should be inserted in the statement of facts along with the shore and customs' surveyor figures. In the event of significant discrepancies, the master must lodge a formal protest and consider clausing the mate's receipts and bills of lading should the shipper (or port operator) fails to compensate for the shortfall. The shipowners and charterers must be promptly informed about eventual discrepancies. **[Section 9.4]**

Whether the master can rely on the draft survey result to question the correctness of shore figures will depend on the accuracy of the measurements and calculations performed by his chief officer or by an independent draft surveyor. It should be borne in mind that, however carefully carried out, a draft survey is not an exact method and depends on ideal weather and sea conditions, with a degree of inaccuracy of around 0.5% being reasonably expected[88].

[88] “*Insight 172: Draft surveys*”, 2003, by Gard P&I. “*Ship v. Shore Figures*”, 2006, by the Steamship Mutual. “*Draught Surveys: A Guide to Good*

9.3.2. Tallying survey

There are no shortage allowances for breakbulk cargoes. The official tally for bagged sugar is based on the number of bags, physically counted by customs-accredited tally clerks employed by the port operators or by automatic counters installed on conveyor belts or shiploaders. No other tally is customarily recognised for customs purposes. This position does not help the shipowner and the master who must accept shore tally according to the standard Sugar C/P 1999.

While no parallel tally is recognised, the appointment of local surveyors might assist. Surveyors can oversee the loading operation around the clock – and exercise the master's right to reject unsound bags. They can also help in tracking and comparing vessel's figures and shore tally. The crew are entitled – and must – carry out their tally in the vessel's holds or from the deck to comply with the master's duty to verify the actual quantity and condition of cargo delivered to the vessel's custody.

Tally sheets should be compared at least once a day. Should there be any discrepancies, shippers and charterers must be alerted immediately. Whatever the shortfall compared to the shore figures, a note of protest must be issued.

There is no obligation on the shipper to alter the shore tally – and no legal way of forcing it to do so. Nonetheless, protest and an efficient cross-tally can help persuade the shipper and port operator of the vessel's good faith and have them provide additional bags to bridge the gap between the crew and shore tallying.

Even though the cargo quantity is postulated in terms of the number of bags shipped, the results of independent draft surveys can also be included in any discussion with the shippers to demonstrate both the accuracy of the vessel's figure and the master's genuine efforts to determine the quantity of bags delivered to his care accurately. If the shipper fails to offset the short loading, the master will be entitled to clause the mate's receipts and bills of lading to record the discrepancy. **[Section 9.4]**

9.3.3. Sealing of cargo holds

In addition to a draft survey (or a tallying survey, when feasible), an independent surveyor should seal the hatch covers and associated manholes on completion of loading. Prior to discharge at the destination, a surveyor should also be instructed to certify the integrity of the seals on arrival and break them in the presence of the duty officer and the surveyors acting for the cargo receiver and port operator.

Pictures 31 & 32: Sealing of hatch covers and manholes on completion of loading. Source: Proinde

Practice, 2nd Edition", 2009, by Jim Dibble, Peter Mitchell and the North P&I. "*Loss Prevention Bulletin: Inaccuracies in Draught Surveys*", 2018, by the West of England P&I [retrieved 15/07/21]

Surveyors acting for the shipper or receiver should be invited to accompany the sealing or unsealing of the holds and, if possible, countersign the relevant certificate as witnesses. It is advisable to enter the sealing (or unsealing) times in the statement of facts of the loading (or discharge) and attach copies of the respective certificates to it.

9.4. Clausing of mate's receipts/bills of lading

Disagreements over whether the mate's receipts and bills of lading should be claused to reflect cargo quantity and condition discrepancies are common in the bulk trade. The conflict arises when, on the one hand, the shipper needs clean documents to satisfy the letter of credit requirements and be paid for the goods already shipped, and, on the other hand, the master must exercise his duty to safeguard the interests of the shipowner and charterer and, ultimately, of the consignee.

9.4.1. Brazilian law

Even though standard documentary requirements call for a "clean on board" bill of lading, the sales contract is not automatically binding on the sea carrier. There is no provision anywhere in the Brazilian legislation compelling the master to issue a clean receipt when he reasonably believes that the goods delivered to him are not, to the best of his experience and knowledge, in an apparent good order and condition or as described by the shipper.

Under Brazilian Law, once the loading is complete, the master (or someone under his authority) has 24 hours to sign and surrender the corresponding bill of lading in exchange for the mate's receipt[89]. If these are not qualified, there will be a legal presumption that the cargo was delivered to the vessel in the same quantity, quality and condition described by the shipper[90]. Therefore, whenever the master is in doubt or does not have reasonable means of verifying the accuracy of the shore figures, he must clause the mate's receipts and bills of lading.

The Commercial Code provides that if the shipper disagrees with the remarks in the cargo documents, the cargo must be recounted, with the wrong party bearing the costs and expenses arising from the recounting[91]. Nowadays, the simple solution offered by the ancient – but still in force – commercial law is difficult to implement in practice, especially in port terminals that do not have unloading equipment.

9.4.2. Sugar Charter Party

The standard "Tallymen Clause" (Clause 15) of the Sugar Charter Party 1999 provides that "*Shore tallymen to be employed by the vessel at the expense of the vessel. Quantity stated on Bills of Lading to be conclusive evidence against the ship as to the number of bags of sugar shipped, errors and obvious frauds excepted. Ship to be responsible for any number of bags short delivered of signed Bill of Lading quantity".* This provision runs contrary to the pre-printed reservation "*weight, measure, quality, condition and contents value unknown*" and its variants found in bill of lading forms. Furthermore, in Brazil, the shipowner cannot hire tally clerks directly; the shore workers must be engaged and directed through an authorised port operator.

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[89] Art. 578 of the Commercial Code: "*The bill of lading will be signed and delivered within 24 (twenty-four) hours, after the completion of cargo loading, in exchange of the mate's receipts, the master or the shipper who have been remiss in the delivery of the bill of lading being liable for all damages resulting from delay in the voyage.*"; art. 744 of the Civil Code: "*On receiving the thing, the carrier must issue a bill of lading setting out the information that identifies the thing, in accordance with provision of the relevant special legislation. (…)*" (free translation)

[90] Art. 4 of Law-Decree 116/1967: "*The goods will be delivered to the vessel or carrying ship against receipt issued by the carrier or its agent. § 1. Receipts must be passed in one of the non-negotiable copies of the bill of lading, which must contain space for notes on partial shipments and remarks concerning short-delivery and damage to cargo and its packaging. § 2. The delivery entity shall be responsible for shortage or damage verified at the time of shipment. § 3 - The damaged goods will be returned to the deliverer and will be subject to immediate inspection in the presence of the interested parties. It will only be re-loaded after the delimitation of the damage and clausing of the original bill of lading (…).*" (free translation)

[91] Art. 582 of the Commercial Code: "*If the goods have not been delivered by number, weight or measure, or if there is doubt in the count, the master may declare in the bill of lading that the same number, weight or measure is unknown to him; but if the shipper does not agree with this statement, a new counting should be done, at the expense of whoever caused it*." (free translation)

Clause 16 of the standard Sugar C/P, in turn, states that "*Clean Mate's Receipts to be signed for each parcel of sugar when on board, and the Master to sign Bills of Lading in accordance therewith as presented by Charterers or Shippers. Master to reject any cargo that would involve the clausing of Mate's Receipts and/or Bills of Lading…*".

Nevertheless, if the master has well-founded reason to doubt the figures provided by the shippers concerning the quantity of sugar shipped, or if he cannot reasonably verify these figures, he will be legally entitled, under Brazilian Law, to remark the mate's receipts and bills of lading for the short-shipment or to state that the weight is unknown to him[92].

Likewise, the master is entitled to clause the document when he cannot exercise his right under the Sugar C/P to reject cargo not eligible for clean mate's receipts. Of course, the clausing of the delivery documents is challengeable by shippers and charterers through due process of law.

9.5. Cargo ventilation

Under the IMSBC Code, there are no special requirements for stowage and ventilation of sugar cargoes other than weather precautions. National regulations regarding the storage of plant-based products do not require aeration or thermometric controls during storage or transport of sugar cargoes[93]. Likewise, the rules issued by the Sugar Association of London (SAL) and the Refined Sugar Association of London (RSA) are silent on the matter.

Given its water-repellent packaging and very low moisture content (0.05% - 0.30%), refined sugar in bags has low permeability and does not require ventilation under any circumstance. On the other hand, raw sugar in bulk has a higher moisture content (0.15% - 1.2%) and hygroscopicity. In some cases, where it has been loaded at a warm climate and is to be discharged at a cold climate, surface ventilation of the cargo headspace may be necessary to avoid forming vessel's sweat[94]. Sugar shipments from Brazil often involve loading at a tropical port for discharge at a temperate port. However, most of these vessels leave the country laden to their full capacity, with little or no headspace left to be ventilated[95].

When ventilation is necessary (or contractually required), P&I clubs generally advise shipmasters to follow the "three-degree rule", whereby a cargo should be ventilated when the ambient temperature is at least three degrees Celsius below the cargo temperature recorded at loading[96].

Whatever is the ventilation strategy, the vessel must keep a clear and detailed record about the weather (relative humidity, dry and wet bulb temperatures, dew point for outside air, cargo temperature and dew point at loading and during the sea passage, probed at least twice a day). The ventilation log must include information on whether ventilation is needed, time for starting or suspending ventilation in each hold. Impeding events, such as bad weather or sea conditions and the formation of condensation should be noted down.

[92] Art. 582 of the Commercial Code; Art. 4 of Law-Decree 116/1967
[93] MAPA IN 11/2011
[94] "*Loss Prevention Bulletin - Cargo Ventilation and Precautions to Minimise Sweat*", 2012, by the West of England P&I; "*Cargo and Cargo Hold Ventilation*", 2021, by DNV-GL
[95] "*Bulk matters: a focus on some of the issues surrounding the carriage of bulk cargo in the P&I world*", 2003, by the UK P&I Club
[96] "*Gard Insight 173, 2004: Don't work up a sweat*", 2004; "*P&I Loss Prevention Bulletin - Ventilation, Vol. 41*", 2017, by the Japan P&I Club

10. Conclusion

Sugar is historically integrated into Brazil's socioeconomic and political history. Its production is a fine example of a circular economy: from crushing, bagasse feeds the production of bioelectricity, which supplies and makes some plants self-sufficient in energy, and it is also used as an organic fertiliser in the plantations, thereby reducing the use of chemicals in the crop.

Over the last decades, the country has consistently increased its sugar production to become the world leader, covering one-quarter of the global output and nearly half of exports. Despite the estimated downturn in Brazilian sugar production in the 2021/22 season, the outlook is for exports to remain at high levels, very close to the historic record reached in the last marketing year. That means a need for hundreds of bulk carriers every year to cope with the demand.

While the vast majority of sugar shipments in bulk or bags arrive at their destination without problems, the sea carriers should not let their guard down when it comes to preventing losses. As explained in the previous chapter of this manual, shipowners and charterers can take many practical, cost-effective preventative measures to avert – or at least minimise – claims for cargo damage. They will not go wrong appointing experienced local surveyors to check the cargo during loading and draw representative samples. Arranging draft surveys and sealing holds by independent surveyors will also help reduce the risk of shortage claims.

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