



ORGANIC

SUGAR

LCA STUDY



ORGANIC SUGAR LCA STUDY

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1. WHY CARRY OUT A LIFE CYCLE ANALYSIS?

The broad topic of sustainability, which is closely linked to the trends of regionality and organic, has become a focus topic for consumers. These three trends were already strong before COVID-19 and were further strengthened by the pandemic. This is also reflected in the results of the Südzucker Consumer Tracker, which was conducted in March this year.



50%

of consumers say: "For me it is important to consume products that contain sustainably sourced/produced ingredients"



1/3

of consumers indicate to consume at least 50% of their foods & drinks in organic quality



45%

of consumers say it is important for them to consume local products

Q: Please read through the following statements and indicate how much you agree with each.
Online Survey 03/21 | N= 4981 | Filter: None

Q: When thinking of [product category], how much of your consumption of this category do you think is organic? (e.g., has an official organic seal on the packaging like the EU organic seal, Agriculture Biologique, Bioland, etc.)

What do consumers associate with sustainability and what are the reasons why they ask about sustainability in products? In addition to the classic topics such as reducing food waste, less packaging material and high recycling capacity, the following topics are of particular interest to consumers according to the Südzucker Consumer Tracker of 2021:

- **More sustainable agriculture**
- **Promotion of biodiversity**
- **Knowledge about the origin of the product and the ingredients**
- **Reduction of CO₂ emissions**
- **Use of regional products and ingredients**



2. RESULTS OF THE SUSTAINABILITY STUDY ORGANIC SUGAR

Südzucker has been supplying organic beet sugar to the organic food industry for 20 years. With the LCA study on organic sugar, Südzucker wanted to examine, via an external company (EBP Schweiz AG), where its organic beet sugar stands in relation to the main competitor products (organic cane sugar from South America – Brazil and Paraguay), primarily from an ecological point of view, but also from a social point of view, and to identify potential for improvement in the value chain.

WHAT IS A LCA – LIFE CYCLE ASSESSMENT

- Standardised method in the field of sustainability assessment of products and services.
- Aim: to identify and assess all environmental impacts that can be attributed to a product (or service) over its life cycle by quantifying all inputs and outputs of material and energy flows
- Considers different impact categories that are aggregated to an overall result



2.1. Methodology & System Boundaries of the EBP LCA Study

For organic beet sugar, primary data from Südzucker were used for the ecological analysis. For the two South American organic cane sugars, secondary data from the Ecoinvent database v3.6 as well as primary data from earlier projects (2015) by EBP were used. These data were checked for plausibility and adjusted using specialist literature and statistical data, as confirmed by experts familiar with the organic sugar sector in Paraguay. An average value of the years 2015 – 2019 was calculated, to compensate for seasonally fluctuating cultivation conditions regarding the cane cultivation and transport to the factory. For the cane sugar factory and distribution 2019 is the base within the ecological analysis. The social analysis was based entirely on secondary data from the SOCA database for all three sugars. It is related to the period 2015 – 2020 and is based on average values for the three selected countries.



ECOINVENT DATABASE

The ecoinvent database is a Life Cycle Inventory (LCI) database that supports various types of sustainability assessments. As the world's most consistent and transparent life cycle inventory database, it supports environmental assessments of products and processes worldwide.



Source: <https://ecoinvent.org/>
<https://ecoinvent.org/the-ecoinvent-database/>
 secondary data from the SOCA database for all three sugars.



SOCA DATABASE

The SOCA database is based on the UNEP guidelines "Guidelines for social life cycle assessment of products" (Benoit & Mazijn, 2009) and "The Methodological Sheets for Sub-categories in Social Life Cycle Assessment (S-LCA)" (Benoit et al. 2013). The database links the ecoinvent database with the PSILCA I/O database (Ciroth & Eisfeldt 2016). This contains information on the 34 social indicators for each sector and counts social data on 15,000 sectors from over 189 countries. Most of the data was compiled in 2011. Based on the country-specific information in the PSILCA database, the corresponding social indicators for the process inventories from ecoinvent were compiled in the SOCA database, so that the social impacts can be calculated analogously to the LCA based on material and energy flows.

For the environmental and social analysis, the supply chain of 1 tonne of certified organic beet sugar from Südzucker and imported cane sugar from Brazil and Paraguay was analysed from cultivation to delivery to a fictitious customer in Marburg. Marburg was chosen because the city is approximately halfway between Rain am Lech (Südzucker's production site for organic beet sugar) and the port of Hamburg (delivery of imported organic cane sugar). For the impact assessment of the environmental impacts, the overall aggregating assessment method Product Environmental Footprint 2018 (PEF 2018) was applied and checked for plausibility by the ReCiPe 2016 method. The Social Life Cycle Assessment (S-LCA) method was used to calculate

the social footprint. This method is based on a guideline published by the United Nations Environment Programme (UNEP) "Guidelines for Social Life Cycle Assessment of Products". In the production of sugar, other products can also be obtained, such as dried pulp and molasses. In order to be able to allocate the results obtained from the ecological and social analyses to the respective products, the allocation according to the lower heating value was applied.



LOWER HEATING VALUE

The lower heating value is a form of energy content. It describes the maximum usable thermal energy at which condensation of the water vapour contained in the flue gas does not occur.



The results are not shown in absolute figures in this white paper, but in relation to the three sugar products. This is due to the fact that there is a risk that absolute figures may be taken out of context or used for comparisons with other studies without checking whether the basis of the respective figures is comparable. This could lead to unintentional false statements, which Südzucker would like to avoid.

2.2. Results of the Calculation of the Ecological Life Cycle

In calculating the ecological footprint according to the PEF 2018 assessment method, a total of 16 impact categories were considered, which of course vary from country to country. The particularly relevant impact categories per country represent at least about 2/3 of the total allocated environmental impacts. The impact categories climate change, eutrophication and acidification can be found in

the top impact categories in all three countries examined. In addition, there are the impact categories resource use, fossil raw materials for Südzucker's organic beet sugar, ecotoxicity, freshwater in Brazil and land use in Paraguay.

In the following, the particularly relevant impact categories for Südzucker's organic beet sugar are examined in more detail at midpoint level.



Climate Change





Resource Use, fossils



Eutrophication



Acidification

Organic Beet Sugar from Südzucker 	Organic Cane Sugar from Brazil 	Organic Cane Sugar from Paraguay 
Climate change	Eutrophication	Eutrophication
Resource use, fossils	Climate change	Acidification
Eutrophication	Acidification	Climate change
Acidification	Ecotoxicity, freshwater	Land use
Other impact categories	Other impact categories	Other impact categories

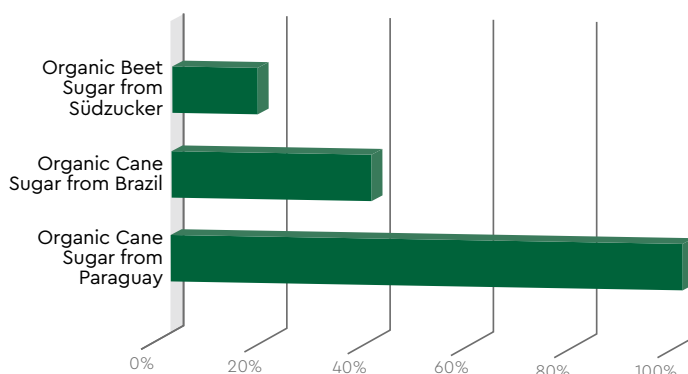
The following graphs in the whitepaper always show the ratio of the three organic sugars to each other. This means that the organic sugar with the absolute highest value in the respective

impact category or social indicator in the S-LCA corresponds to 100 %. The other two organic sugars are then shown in relation to this.

Climate Change



The impact category climate change is the strongest category for Südzucker's organic beet sugar and is also among the top impact categories in the South American countries. The CO₂ footprint of Südzucker's organic beet sugar is significantly lower than that of organic cane sugar from South America, but there is still potential to reduce this value further in the factory and in cultivation. At present, a large part of the CO₂ footprint is influenced by the use of fossil fuels in the production of organic beet sugar. Südzucker will continue to significantly minimise the CO₂ footprint in the coming years by changing the energy source.



Due to the use of bagasse in the production of cane sugar, the CO₂ footprint within the factory in South America is already quite low in comparison. The main factors here are cultivation, distribution to Europe and land use change.

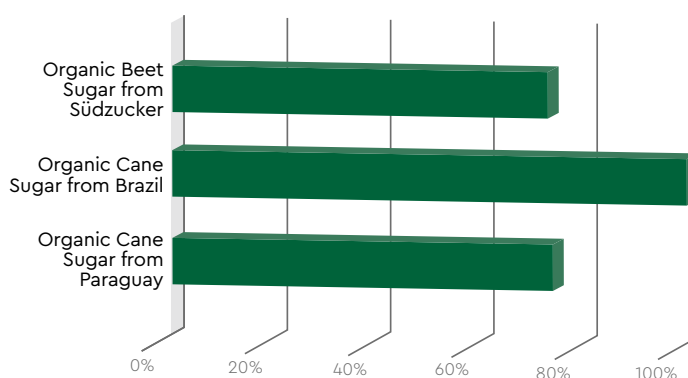


Resource Use, fossils



The second largest impact category for Südzucker's organic beet sugar is the resource use of fossil raw materials. As with the impact category climate change, this is primarily due to production. This will be converted to renewable energy sources in the coming years, as mentioned above, which will also result in a significant reduction in this impact category.

As the bagasse is burned to generate energy for cane sugar production, little to no fossil resources are needed directly in the factory. The main focus within the entire



supply chain for the production of South American organic cane sugar in this impact category is on distribution to Europe and partly on cultivation and delivery from the field to the factory.

Eutrophication

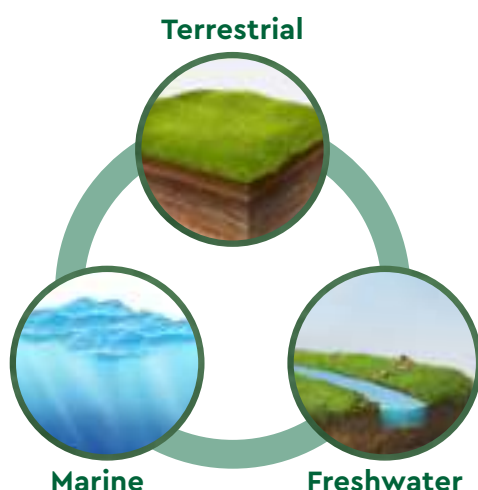


EUTROPHICATION

Eutrophication is the accumulation of nutrients in an ecosystem. It can therefore also be divided into the subcategories marine, freshwater and terrestrial.



The impact category eutrophication (third strongest point for Südzucker's organic beet sugar) is divided into three impact categories in the PEF methodology



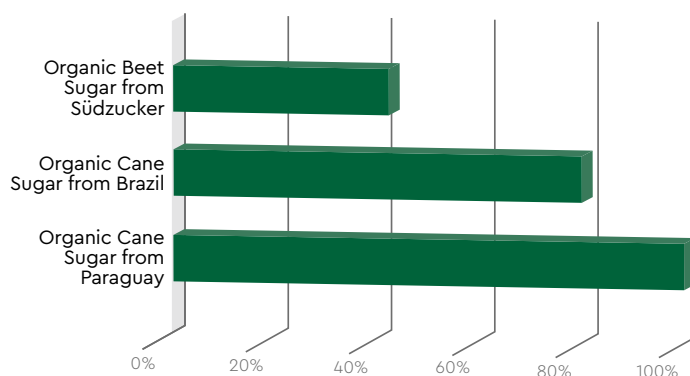
Südzucker's organic beet sugar shows good values in the subcategories marine and terrestrial compared to the South American cane sugars, which are up to 60% worse. In the area of freshwater eutrophication, however, the values are closer together and the Brazilian organic cane sugar performs best, closely followed by the German organic beet sugar from Südzucker according to the analysis of EBP.

For all three impact categories, the main cause is cultivation within the supply chain, although in the case of the two South American organic cane sugars, distribution also contributes significantly to the impact categories.

Acidification

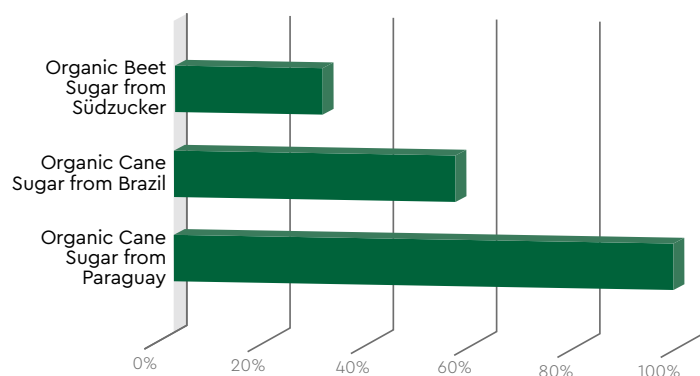


At 10.4 % of the total aggregated PEF result, acidification is as well an important impact category for Südzucker's organic beet sugar. The main focus within the supply chain is also to be found in cultivation. This applies to all three organic sugars analysed.



Total Aggregated Environmental Impact of the LCA Calculation According to PEF 2018

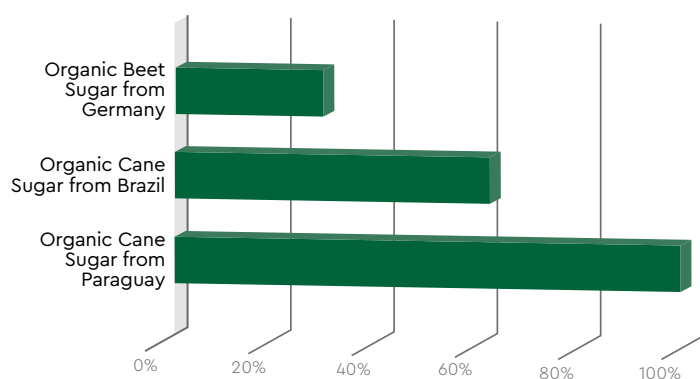
Aggregated result of the LCA calculation in PEF-points for the most important categories



The impact categories described and presented above account for over 70% of the total aggregated environmental impact of the LCA result in PEF points for Südzucker's organic beet sugar.

If we add the other impact categories, which account for just under 30 % of the LCA result for organic beet sugar, the following picture emerges for all three organic sugars analysed:

Overall aggregated result of the LCA calculation in PEF-points



Südzucker's organic beet sugar has an up to 66 % better ecological footprint compared to organic cane sugar from Paraguay and Brazil. On the one hand, this is due to the impact categories described above, in which Südzucker's organic beet sugar has, in some cases significantly, less environmental impact – apart from the category resource use, fossils. Secondly, in the remaining impact categories that are less relevant for the overall result of Südzucker's organic beet sugar,

organic beet sugar has a lower environmental impact in most categories, in some cases significantly, compared to organic cane sugar from Brazil and Paraguay.

When looking at the individual areas (cultivation, delivery to the factory, processing in the factory, distribution to the customer) within the entire supply chain of the three products, the hot spots can be found in the following areas:



Südzuckers Organic Beet Sugar



- Cultivation
- Factory

Organic Cane Sugar from Brazil and Paraguay



- Cultivation
- Land use change
- Distribution to Europe



2.3. Results of the Social Life Cycle Calculation

When calculating the social footprint using the social life cycle assessment (S-LCA) method based on the published UNEP "Guidelines for Social Life Cycle Assessment of Products", a total of 34 indicators for the four relevant stakeholder groups (workers, local community, society and companies) are considered and evaluated.

Table of the 34 social indicators divided by the four different stakeholder groups

WORKERS  <ul style="list-style-type: none"> • Association and bargaining rights • Child labor, total • DALYs (Disability adjusted life year) due to indoor and outdoor air and water pollution • Fair salary • Fatal accidents • Frequency of forced labor • Gender wage gap • Goods produced by forced labor • Non-fatal accidents • Safety measures • Social security expenditures • Trade unionism • Trafficking in persons • Violations of employment laws and regulations • Weekly hours of work per employee • Workers affected by natural disasters 	SOCIETY  <ul style="list-style-type: none"> • Education • Health expenditure • Illiteracy
COMPANIES  <ul style="list-style-type: none"> • Anti-competitive behaviour • Corruption 	LOCAL COMMUNITY  <ul style="list-style-type: none"> • Access to biomass (biomass consumption) • Certified environmental management system • Drinking water coverage • Fossil fuel consumption • Indigenous rights • Industrial water depletion • International migrant stock • International migrant workers (in the sector/ site) • Minerals consumption • Net migration • Pollution • Sanitation coverage • Unemployment

This method is primarily used to distinguish relevant from less relevant social indicators. So far, there is no internationally harmonised assessment scheme for the S-LCA. Furthermore, only negative risks are taken into account. Positive effects, e.g. through the economic promotion of the local population are not taken into account. The data basis is also based on average values for the sector "sugar and sugar products" in the three countries investigated. Therefore, internal standards and mandatory "Codes of Conduct", which exist especially in the German beet sugar sector, are not taken into account.

In this chapter and in the S-LCA analysis, no primary data from Südzucker is used, but only secondary data from the SOCA database relating to the three countries Germany, Brazil and Paraguay and the "sugar and sugar products" sector.

On the following pages, the two most relevant social indicators for German organic beet sugar, which account for almost 1/3 of the total aggregated result of the S-LCA calculation, as well as the strongest social indicator in the calculation for organic cane sugar from Brazil and Paraguay are considered.

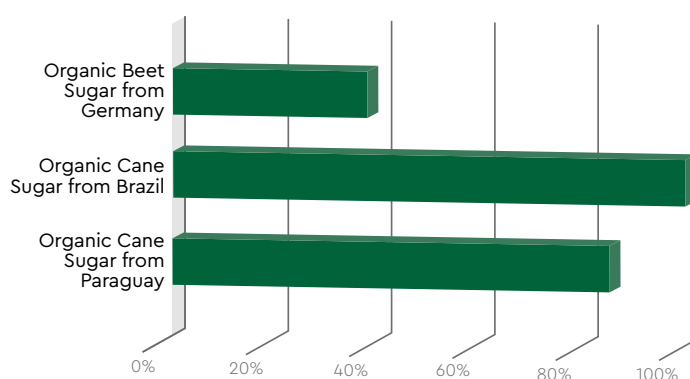
Gender Wage Gap

The indicator gender pay gap is the most relevant indicator for German organic sugar, accounting for 16% of the total aggregated S-LCA result. The strongest share within the supply chain is in production. In Brazil and Paraguay, the gender wage gap is more pronounced compared to Germany, but in Paraguay in particular, with 11.3% of the overall aggregated S-LCA result, it is less relevant for the overall result.



GENDER WAGE GAP

The gender pay gap describes the difference between the median earnings of men and women relative to the median earnings of men when men's wages are higher. Otherwise, it is the difference between the median earnings of men and women relative to the median earnings of women.



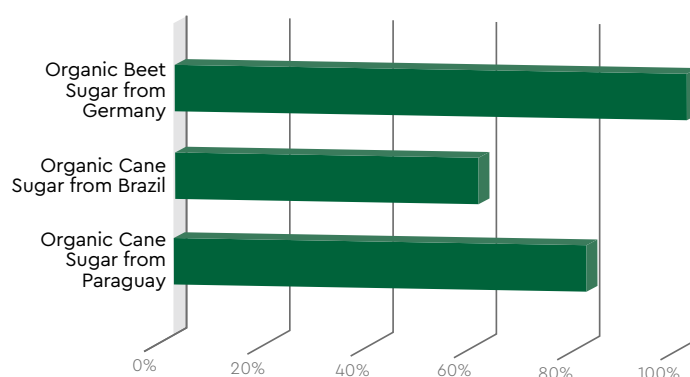
Trade Unionism

For the trade unionism indicator, the SOCA database looks at a total of four elements that make up the value for this indicator:

- Trade union density (proportion of trade union members in the total number of employees, expressed as a percentage of the total number of employees).
- Right to organize
- Right to collective bargaining
- Right to strike



For German organic beet sugar, this is the second strongest social indicator with 12 % of the total aggregated S-LCA score. Germany is not as good as Brazil and Paraguay on this indicator, which is probably due to a lower level of unionisation.



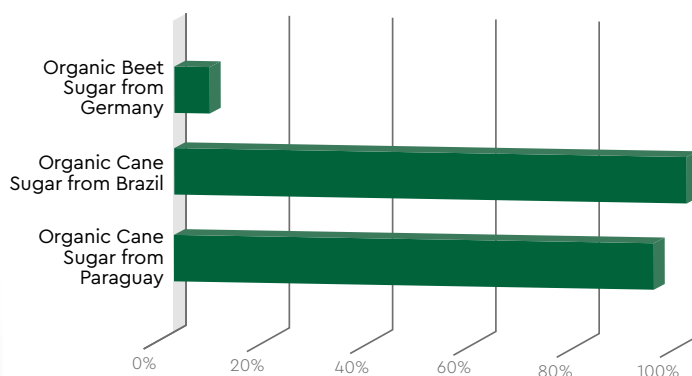
Access to Biomass

Access to biomass is the most relevant indicator for the two organic cane sugars in Brazil (with 37.1% of the total aggregated S-LCA result) and Paraguay (with 28.9% of the total aggregated S-LCA result). For German organic beet sugar, this indicator plays a somewhat subordinate role compared to the two previous indicators with 7.5% of the total aggregated S-LCA result. However, it is the most relevant indicator for cultivation in Germany.



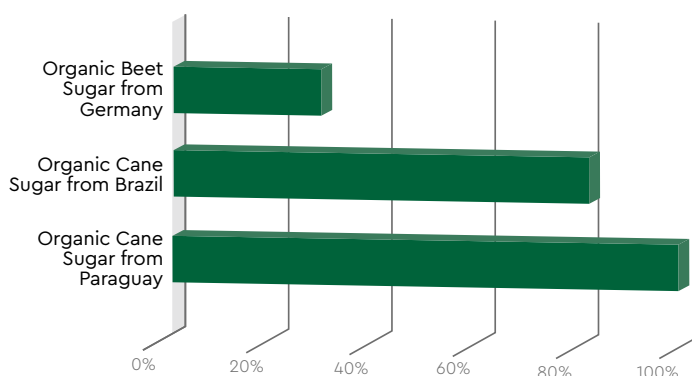
ACCESS TO BIOMASS

The category describes whether the local community's access to biomass such as agricultural land is restricted by commercial or industrial activities. Extensive production activities harbour potential for conflict, especially in emerging countries, when it comes to who owns the rights to exploit natural resources.



Total Aggregated Social Impact of the S-LCA Calculation

The overall aggregation of the 34 social indicators with the S-LCA method shows that organic beet sugar from Germany has significantly lower negative social impacts compared to organic cane sugar from Brazil and Paraguay. This is also reflected in most of the individual social indicators.



3. SUMMARY & CONCLUSION

The "Nachhaltigkeitsstudie Bio-Zucker 2021" by EBP Schweiz AG shows that Südzucker's organic beet sugar has a significantly smaller environmental footprint in the overall supply chain compared to organic cane sugar from Brazil and Paraguay. In the sub-item within the life cycle assessment that

is increasingly relevant for consumers, the CO₂ footprint, Südzucker's organic beet sugar also has a CO₂ footprint that is up to 5.5 times smaller. With regard to the social balance, the results also show a clear picture in favour of organic beet sugar from Germany.

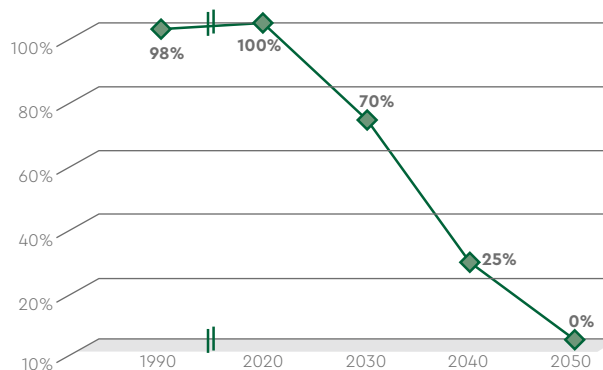
ORGANIC BEET SUGAR FROM SÜDZUCKER



Emissions Reduction Target 2030 of the Südzucker Group

However, the study also showed where there is still potential for improvement within the supply chain for Südzucker's organic beet sugar from an ecological perspective. This is the case, among other things, in the provision of energy within production. This is an area that Südzucker Group is generally working on and which offers great potential for further reducing the environmental impact of Südzucker's organic beet sugar.

Emissions Scope 1 and 2



- ✓ **Scope 1 and 2**
- ✓ **Climate-neutral production in 2050 → net zero emissions**
- ✓ **Reduction of emissions to -30% by 2030 compared to 2018**
- ✓ **Consistent with SBTi -2°C target; Scope 3 targets still to be defined**
- ✓ **Supply chain optimisation**
- ✓ **Provision of climate-neutral, bio-based products for the non-food sector**

To learn more about the sustainability commitments of the Südzucker Group or Südzucker's Division Sugar, please get in contact with us.

*Social indicators analysed German organic beet sugars in total, not specifically Südzucker's organic beet sugar

4. RECOMMENDATIONS & SUPPORT BY SÜDZUCKER

As shown in the previous chapters, Südzucker's organic beet sugar is better from an ecological point of view than organic cane sugar from Brazil and Paraguay. In terms of social aspects, German beet sugar also scores better. But how can this be communicated to consumers concerning your products?

One important point is to make this clear in the list of ingredients and not to speak of "organic sugar" but of "organic beet sugar". This is because consumers see organic beet sugar as healthier and more natural compared to white sugar, beet sugar and cane sugar, among others, as this year's "Südzucker Consumer Study" shows.

It is also important to illustrate that the sugar beet from which organic beet sugar is produced is a regional crop. This supports regional agriculture, as well as the regional economy in general. The production of organic beet sugar in Rain am Lech/Bavaria takes place close to the family-run farms, as approx. 84% of the organic sugar beet processed is also grown in Bavaria. Consumers associate regional sourcing not only with the support of the regional (agricultural) economy, but also directly with the issue of sustainability.

Südzucker is happy to support this with photo material (depending on the purpose) and has also created a mood video on this topic, which can be linked to if required.



Furthermore, all Südzucker organic beet growers meet the stricter regulations of the various organic associations, such as Bioland and Naturland, and are not only certified according to the Bio-EG-Öko-Verordnung.

Südzucker therefore offers organic beet sugar certified by Bioland or Naturland in addition to the standard EU certified organic beet sugar.

Furthermore, Südzucker is currently working on the introduction of CO₂-neutral organic beet sugar in 2022 for the processing industry. The issue of the carbon footprint is increasingly becoming the focus of consumers. With the CO₂-neutral organic beet sugar, we want to support our customers in meeting the growing consumer needs in this direction.

✓ **Label „Organic Beet Sugar“ not only „organic sugar“**

✓ **Show it is a regional crop from home**

✓ **Build confidence about the high farming standards**

✓ **Exploit & communicate about higher grade certificates (Bioland, Naturland)**



5. ABOUT SÜDZUCKER

Südzucker is a market leading company in the food industry with its segments 'Sugar', 'Specialties', 'CropEnergies' and 'Fruit'. In the traditional sugar segment, the group is Europe's largest supplier of sugar products with 23 sugar factories and two refineries – from France in the west to Belgium, Germany, Austria and the countries of Poland, the Czech Republic, Slovakia, Romania, Hungary, Bosnia and Moldova in the east.

Besides Südzucker AG in Germany, Saint Louis Sucre in France, Südzucker Polska (Cukier Krolewski) in Poland and Raffinerie Tirlemontoise are the largest national sugar companies with distribution and local sugar production. The Südzucker Group also includes the segment 'Specialties' with its functional ingredients for food and animal

feed (BENEÖ), frozen/cold products (Freiberger), starch and portion packs (Portion Pack Europe) and is thus active in dynamic growth markets. The CropEnergies segment comprises the ethanol activities in Germany, Belgium, France and the United Kingdom. The group's fruit segment operates worldwide, is the world market leader in fruit preparations and the European leader in fruit juice concentrates.

With about 17.876 employees, the Group generated revenue of € 6.7 billion in 2020/21. The sugar business with sugar commodities and sugar specialties generates € 2.3 billion, or about 1/3 of Group revenue, and the production and marketing of beet sugar is the Group's strategic core business.

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We use the personal data you provide exclusively to send you information about comparable products or services from Südzucker. You can object to this provision of information at any time by sending an e-mail to info@suedzuckergroup.com.

Additionally, our data protection declaration is available at <https://www.suedzucker.com/privacy-policy>. There you can find out to what extent and for what purposes we process personal data and what rights the persons concerned are entitled to.