COLEAD

SECTOR STUDY: CITRUS JUICE

Funded by the European Union

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FIT FOR MARKET+

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Table of contents

1. Citrus juice and its uses

Source www.canva.com

Citrus juice is made by pressing any citrus fruit – orange, tangerine, mandarin, clementine, grapefruit, lemon, lime and pomelo, to be consumed fresh, undiluted, or mixed with other ingredients (see below). Most manufacturers however, either freeze the juice or concentrate it by evaporation to reduce the volume, making it cheaper and easier to transport. Juice is then sold as unconcentrated or concentrated juice that is sometimes called single strength, double strength or triple strength, depending on the degree of concentration.

Freshly squeezed or cold pressed juice – 100% fruit juice, extracted from citrus fruits using a hydraulic or mechanical press without applying heat. Freshly squeezed is generally made to be consumed immediately (such as in a restaurant or at home), while cold-pressed has a slightly longer shelf-life, if bottled. Both have intense flavours that retain the vibrant colour of the fresh fruit.

Not from concentrate juice (NFC) – juice that is 95–100% fruit juice with 5% additives at most. It is extracted directly from fresh fruit, pasteurized and packaged without being concentrated or diluted. NFC juice maintains the natural flavour, aroma and nutritional profile of fresh citrus, but has a shorter shelf life than concentrate juices.

Juice from concentrate – Most citrus juice produced globally is evaporated to remove water so the juice is concentrated, reducing the volume, allowing for more affordable storage and shipping. Later, concentrate is then reconstituted with water before packaging, either as a single flavour or part of a blend.

Nectar – This is made by blending fruit juice with water and sweeteners. The fruit content is typically lower than in NFC or concentrate juices.

Fruit drinks – These are beverages containing less than 10% fruit juice, mixed with water, sugar and sometimes flavourings and other additives. They have a lower fruit juice content than nectar.

Brix values

Citrus juice is typically sold according to the concentration of sugar in the product. This is measured in "degrees Brix" (symbol °Br). One degree Brix (1°Br) is equivalent to 1 g of sucrose in 100 g of solution. In the industry, this is referred to simply as Brix. Orange juice NFC (not from concentrate) is normally around 11°Brix, and concentrate is 65–66°Brix. The Brix level is determined by the amount of water that is evaporated, but also by the type of citrus, and the conditions (soil, sun, rainfall, irrigation, etc.) in which the trees were growing. For example, orange juice will have a higher Brix value than grapefruit juice. But different weather conditions also affect the sugar content of the fruit and hence the Brix content. For example, orange juice from a single origin might have different Brix values from year to year.

Acidity

Orange juice is particularly valued because of the balance of sweet and sour flavours – sweetness from the sugars, and sourness from the acidity. As a result, the industry prefers orange juice that has a good Brix:acid ratio.

Aseptic or frozen

Juice can be packaged and sold either aseptic or frozen. Aseptic is the most common as it is much cheaper to store and transport, and does not require a cold chain infrastructure. Aseptic pulp is sterilised using heat (steam) to kill bacteria and spores and packaged in a sterile bag in a steel drum. It is stable at room temperature and does not need to be stored or transported in refrigerated containers. In contrast, frozen juice is flash heated, but at significantly lower temperatures than the aseptic product, so retaining more aromas and flavours that are typically destroyed by high temperatures. Frozen juice can also be pasteurised at a later point in the production process without altering its colour, whereas undergoing a second pasteurization often results in discoloration that adds a greenish hue. This is important in the dairy industry, such as in the manufacture of orange flavoured yoghurt, or in baby foods.

Citrus juices have many uses in addition to being consumed as a fruit juice.

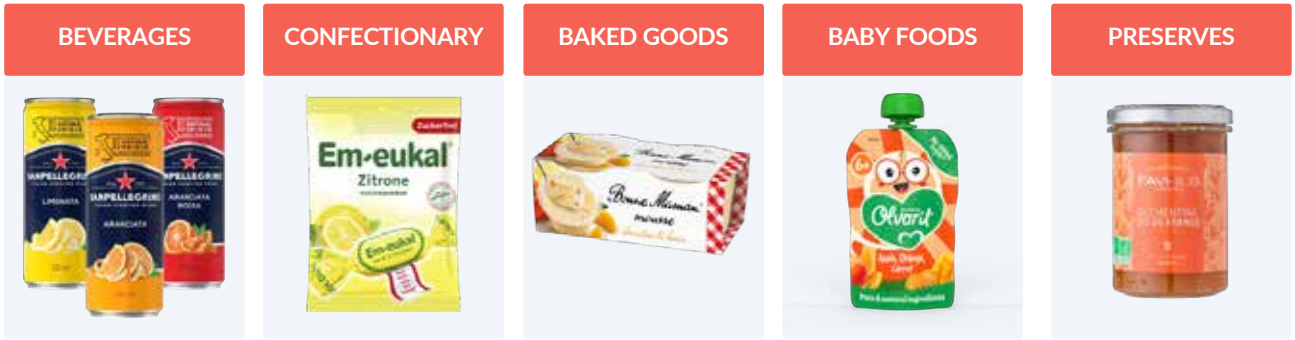

Figure 1: Applications of citrus juice in food manufacturing. Source: Brand websites

Citrus juices are ingredients in other beverages such as flavoured waters and nectars, and can be used to intensify flavours in reconstituted concentrates. Another application is in premium confectionary, that use citrus concentrates to create intense, natural fruit flavours. Lemon juice is sometimes added for its tartness, citrus juice is also used in baked goods, added to cakes, biscuits, desserts or mousses, for added freshness and a fruity flavour. Juices are used in baby foods, to add natural colour, sweetness and flavour. All of these products are also available as organic or conventional products.

2. Demand

2.1. Overview of the citrus juice market

In 2023, there were 5.8 billion litres of citrus juice (orange and lemon juice) traded internationally, valued at US$7.3 billion. A decade earlier, in 2013, volumes and values were marginally higher (5.9 billion litres and US$7.4 billion, respectively). Considering the average inflation over 10 years, this means that while traded volumes remained constant, prices decreased by about 3–5%.

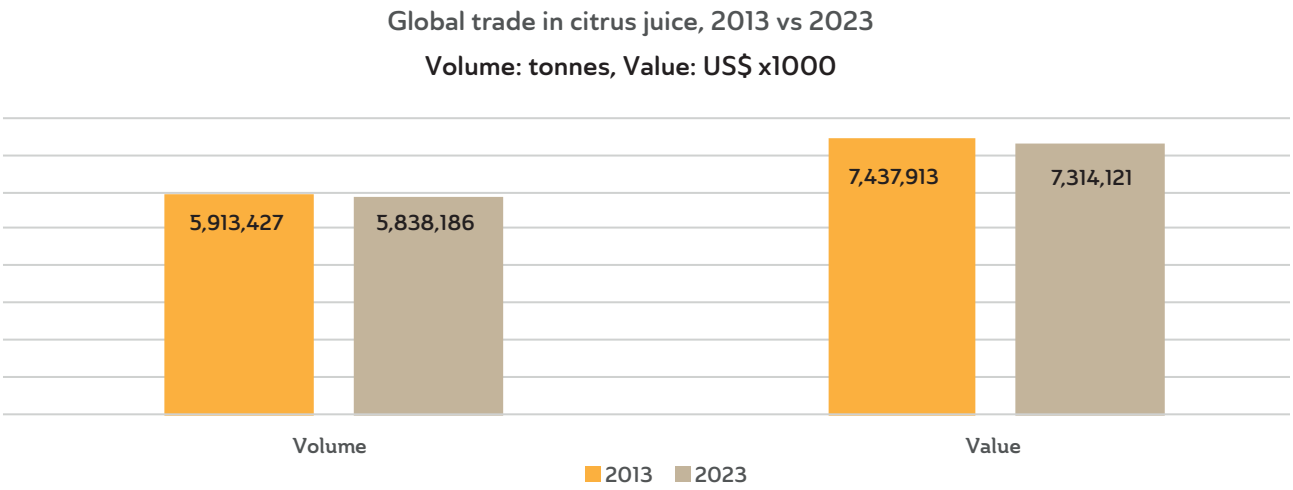

Figure 2: Global trade of orange and lemon juice, 2013 versus 2023 (HS codes 200912, 200919, 200911, 200931, 200939). Source: COLEAD based on CEPII BACI, Eurostat, UK Trade Info and IFPRI.

Orange juice is by far the most popular juice globally, making up 80% of the global market for all types of fruit juices. Lemon juice accounts for 4% of total juice volumes, grapefruit juice makes up 3%, and other citrus juices are less popular.

Of all orange juice imported, 51% is not from concentrate (NFC). This has low sugar/Brix value of 11°Br. Another 26% is imported as concentrated juice (65°Brix), while 3% is imported as frozen orange juice. Grapefruit juice and other citrus juices are primarily imported in concentrated form.

Organic juice

Most studies suggest that 90% of the organic market (all products) is found in the European Union (EU) and the United States of America (USA). Within these markets, up to 25% of the market can be organic products. Organic juices are, however, a smaller share of the overall juice market in these countries. For example, organic juice is only 6% of the French juice market.

Trade in citrus juice by region

Citrus juice is enjoyed around the world. North America and Europe (the EU27 countries + the United Kingdom (UK)) are by far the largest citrus juice importing regions, together making up 84% of global demand. This is followed by Asia, which is the second largest importing region in the world. Orange juice makes up the biggest share of imported juice.

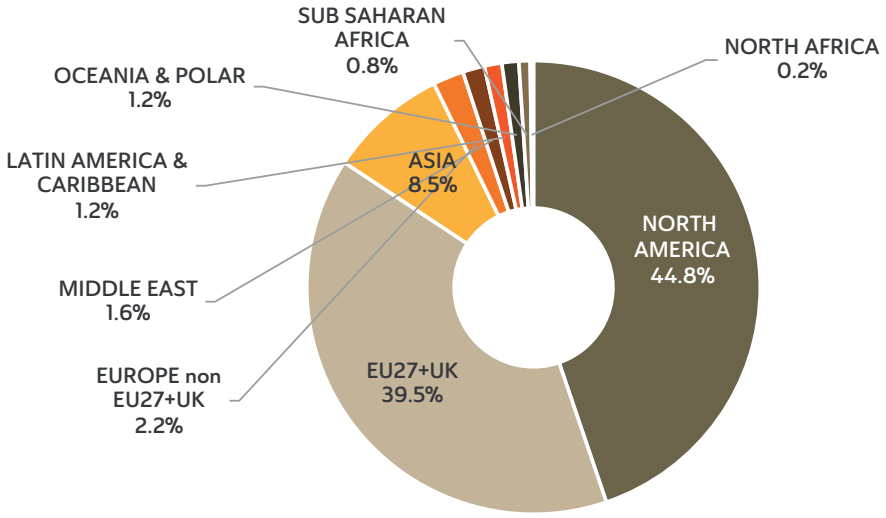

Figure 3: Global citrus juice market share, based on extra-regional imports volumes in 2023. Source: COLEAD based on CEPII BACI, Eurostat, UK Trade Info and IFPRI.

The average citrus juice price in 2023 was US$1.25 (FOB), ranging from US$2.09 per litre in Italy to $0.94 per litre in Brazil, the largest juice exporting country globally. It can be noted from Figure 4 that Argentina's average "citrus-juice" unit-value (US $/t) sat well above that of the other big shippers (Brazil, Mexico, Spain and the United States). The main explanation is that about 75 % of all Argentine citrus juice exports consist of higher value, concentrated, lemon/lime juice for which it has about 34% of the global supply share, while the others mainly ship frozen concentrated orange juice.

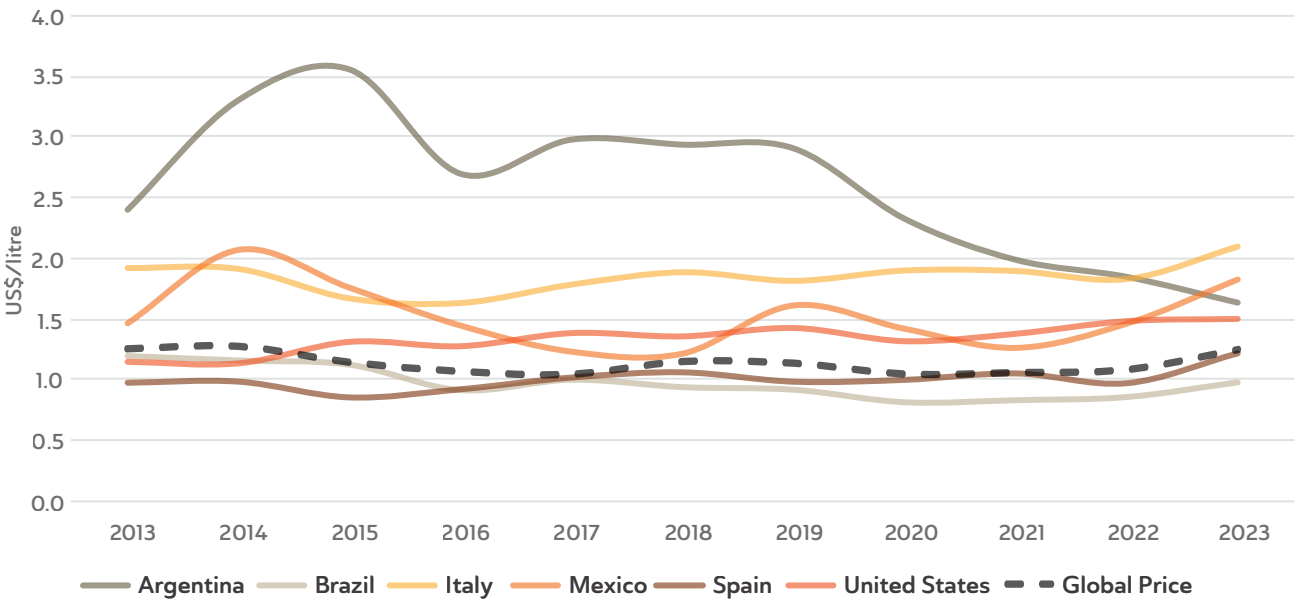

Figure 4: Average export price per litre based on export data. Source: COLEAD based on CEPII BACI, Eurostat, UK Trade Info and IFPRI.

France and the UK are the largest net importers of citrus juice in Europe while Belgium and the Netherlands mainly re-export. As the EU is such a large importer, a decline in individual country imports leads to changes in the global market.

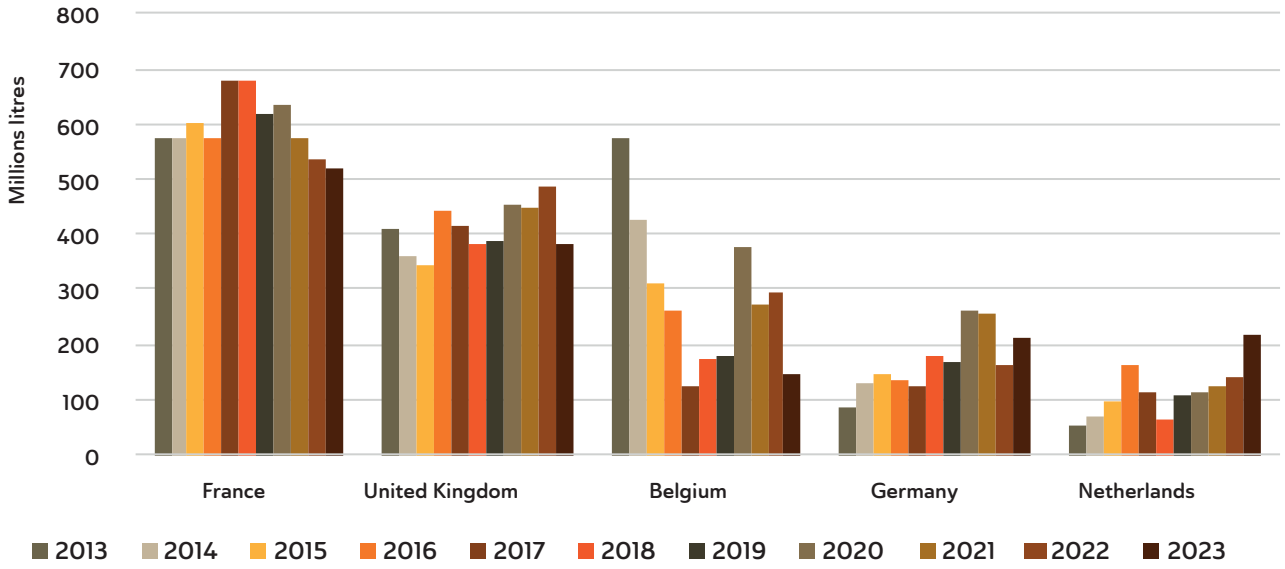

Figure 5: Annual import volumes top EU27+UK countries for oranges and lemon juices (2013–2023). Source: COLEAD based on CEPII BACI, Eurostat, UK Trade Info and IFPRI.

2.2. Market trends

As citrus juice import volumes are declining in the major EU countries, it is important to understand the trends driving declines and those that offer opportunities to differentiate and win market share. Five key trends have become apparent in developed markets and to a lesser extent in developing markets, in Africa, Asia and South America.

Figure 6: Macro trends affecting citrus juice sales.

Indulgence

In recent years, shoppers have become more aware of the sugar content in juice. An increasing number now consider juice to be an indulgence, rather than an everyday source of vitamins and minerals. In the past, more families would regularly start their day with a glass of juice. This is no longer the case, with a glass of juice being more often reserved for special occasions.

To accommodate such new roles of citrus juice, companies have begun to innovate, to emphasise the pleasure potential of juice.

New flavours have been introduced, with traditional juices such as orange juice being blended with more exotic flavours such as mango, pineapple and in some markets, with herbs such as mint. Some companies have also been creating marketing stories around the varieties and origins of juices, or have connected some citrus juice to the "pink" trend seen in cocktails and other beverages. Spanish blood orange, clementine-mandarin juice and pink grapefruit juice are some examples of new products available in France, the Netherlands and the UK, for example.

Source: Brand website

Price sensitivity

Globally, the cost of living crisis has put pressure on the disposable income of many households. Increases in the price of orange and other citrus juice, especially private labels (retailers' own brands), has meant that many more consumers are looking for more affordable alternatives. Flavoured water, energy drinks and sugar-free soft drinks are some more affordable products that people are choosing instead of juice.

Health and wellness

Source: Brand website

The health and wellness trend has provided many opportunities for manufacturers to differentiate their juice offering and capture a premium market. In nearly every market, there is growing awareness of the negative effects of sugar in the diet and that added preservatives, flavours and colours might also be harmful to health.

Source: Brand website

As a result, more shoppers are looking for natural juices. This could mean choosing 100% juice instead of a squash, or juice-based drink. Consumers in both the developed markets and to a lesser extent in developing markets, are increasingly interested in juices that have no added sugar, preservatives or flavours. Reduced sugar products are not widely available, however, outside key markets such as in Europe and North America.

Source: www.ocado.com

Freshly squeezed juices have been available in retail environments for some time. Packaged versions of these juices are also gaining popularity and can now be found in the chilled aisle of most major supermarkets. More restaurants and cafés now offer fresh squeezed juice on site. As freshly squeezing juice also gives the perception that the retailer is able to provide the freshest ingredients, several large retailers in developed markets have opted to offer customers the option to squeeze their own juice in their urban stores.

The growth of online shopping has allowed smaller processors to offer freshly squeezed juices that can be delivered directly to people's homes. These juices typically focus on health, such as vegetable-based juices with added citrus. However, some manufacturers also sell citrus juice. These are sold frozen and bottled in glass, or clear plastic containers.

Source: www.innocent.co.uk

Functional health has also become an area of innovation with manufacturers marketing products that claim have added vitamins, and improve immunity or gut health.

Hydration

Hydration is currently another trending theme. In the USA and Asia this has created great interest in coconut water, which has consequently seen the fastest growth of all segments in the juice category. Water with juice blends have also grown in availability and popularity, with a new push likely to come from added minerals and salts.

Organic

Demand for organic juice has experienced consistent long term growth. Until 2019 the organic juice market was able to grow by 7.8% in each year. This growth rate has slowed somewhat,

but the market is still expected to grow at 4.9% each year. This is positively affected by consumers who are looking for more natural juice, and juices that have a smaller negative impact on the environment.

Environmental sustainability

Consumers are increasingly appreciative of the environmental impact of their shopping habits. With juice, this has translated into shoppers looking for environmentally friendly packaging, lower waste, recycling and carbon footprints, as well as organic production and locally sourced (i.e. reduced airmiles).

Beyond those who have always used recyclable glass bottles, other manufacturers have responded by innovating. Plastic bottle caps have become recyclable for example, bottles are made from recyclable materials, more glass bottles are in the market, with many manufacturers planning to launch additional innovations in packaging that is less harmful for the environment.

The theme of environmental sustainability goes beyond packaging, with increasing interest in carbon neutral products, low waste production, water wise, and even in juice made from fresh fruit waste. The Scandinavian brand Rescued is a good example of a brand that sources waste fruit to make fruit juice from orange, berries, rhubarb, amongst others, and the brand Innocent (part of Coca-Cola) advertise that their products are carbon neutral.

Source:6 www.innocent.co.uk

Source: www.rscued.se

2.3. Market prices

Supply shortages over the past decade have created price volatility in the citrus juice market. For example, longer term data shows a decline in prices. However, in the 2023/2024 season, supply from Brazil was reduced by citrus greening and extreme weather aggravated by El Niño, leading to price increases, and that reached significant highs compared to previous years.

While this allows suppliers to take higher prices, it also means that prices are increasing for retailers, raising questions of whether the resulting juice will remain affordable for most shoppers.

Table 2: Citrus juice price (€ per kg). Source: CFR 2024

	Price (€ per kg)	
	Conventional	**Organic**
Orange NFC (11°Brix):	1.1	1.4
Orange concentrate (65°Brix):	6.5	7.5
Lemon concentrate	1.2	1.6
Lime concentrate	1.5	2.0
Grapefruit concentrate	2.5	3.5
Mandarin concentrate	4.0	4.5

Source: Importer interviews.

2.4. Buyer requirements

Quality requirements

Adulteration of citrus juice has pushed the industry to introduce more stringent quality criteria.

1. **Brix level:** The sugar content of juice is expressed as Brix. This level depends on the variety, type of fruit, harvesting season, ripeness and fruit variety. For example, lime juice has a Brix value around 7°, 10–14° for orange juice, and in NFC orange juice from 9° in early varieties to over 12° in late varieties. Concentrated juice will also have higher Brix values, so where NFC orange juice can have a maximum Brix value of 12°, concentrate can have a Brix of 66°.
2. **Brix:acid ratio:** This ratio measures the balance between sweetness and sourness and is influenced by the sugar and acid content. High acidity results in a low Brix-to-acid ratio (BAR). Lemon and lime juice naturally have low BARs, i.e. having low sugar content and high acidity. For orange juice, however, consumers prefer a ratio of 15. In the USA and EU, an optimal BAR is achieved by blending juice with lower and higher BARs. This is possible by sourcing juice from many locations, or from fruit harvested at different times in the season. As a result, this is an important product specification.
3. **Colour:** Citrus juice should be as similar in colour as possible to the original fruit. For orange this should be a fresh orange colour, grapefruit can be pale, pink, or red; lime can be a very pale green, while lemon juice is preferably yellow.
4. **Flavour profile:** Flavour depends on the fruit variety, growing conditions, ripeness, processing method and freshness. Citrus juice with intense flavour and strong aroma is particularly valued. Bitter notes should be avoided, except in some grapefruit juice.
5. **Turbidity and cloud stability:** For some clients, a cloudy product is preferred over one that is perfectly clear. Lime juice is a good example where to retain the cloudy colour, processors pasteurise the juice, inactivating a key enzyme that allows particles to remain in solution rather than settle.
6. **Vitamin C (ascorbic acid)**: Vitamin C content is an important quality criterion for certain citrus juices, especially for clients wanting to make health and wellness claims. This might be expressed in the product specifications, but is not mandatory for all clients.
7. **Shelf life:** Concentrate has a shelf life of 24 months if the drums are unopened, and 1 month if opened and kept refrigerated at <10°C.

Packaging and transport requirements

Packaged juice is rarely imported into major juice markets, with the blending and bottling typically occurring closer to the points of sale. Most global trade is in bulk shipments. Developments in citrus juice sectors, specifically for orange juice from Brazil, means that a variety of bulk packaging format have developed.

1. **Tanker shipments:** To accommodate the large volumes of orange juice from Brazil, European ports have installed specialised infrastructure that allows for juice to be received in bulk tankers. The juice is then pumped into road tankers. Frozen juice is shipped in tankers at −8°C to −10°C.
2. **Drums:** Pasteurised juice is packed in to double-wall polyethylene bags and then transported in 200 kg steel drums. Aseptic and frozen juice is also transported in a drum. Frozen drums are transported at 18°C to −25°C.
3. **Bag in box**: Juice can also be transported in "bag in box", that can be as large as 1 tonne.
4. **Aseptic:** Aseptically packed juices can be transported at room temperature.
5. **Frozen:** Frozen bag-in-drums can also be used. Frozen juices must be transported at <10°C, while NFC juices are shipped at 0°C when transported in tanks.
6. **Market ready packaging:** Regional buyers are more likely to purchase packaged juice, especially if this is affordable, meets market expectations, or if they do not have access to their own or contract bottling lines. Packaging formats vary greatly. Laminated carton packages, glass bottles, plastic bottles, cans, pouches and bag in box are all formats found in local markets.
7. **Labelling:** Buyers require labelling for product code and name, production and expiry date, brix value and ratio, net and gross weight, country of origin, storage conditions, batch number and drum number. For export to the EU, there is a "Packaging and Packaging Waste Regulation" which controls the use of packaging and disposal of packaging waste by any company that packages goods for sale (to come into effect between 2024 and 2026).

Food safety certification

Food safety certification is not mandatory in many countries. However, most established European importers will not work with suppliers who cannot provide at least one of the Global Food Safety Initiative (GFSI) certificates.

Most buyers of citrus juice will expect a food safety certification. Hazard Analysis and Critical Control Points (HACCP) certification is the minimum standard for the international trade in juice. However, most buyers in the EU prefer more advanced food safety standards. There are four commonly requested food safety certifications for citrus juice.

- **International Featured Standards (IFS):** European-focused certification ensuring food manufacturers meet quality, safety and legality standards required by major retailers and wholesalers.
- **British Retail Consortium Global Standards (BRCGS):** Globally recognized certification that validates food safety, quality and operational criteria to meet retailer requirements and consumer protection standards.
- **Food Safety System Certification (FSSC 22000):** ISO-based certification combining food safety management systems with prerequisite programmes and HACCP principles for comprehensive supply chain safety.

- **SGF Voluntary Control System:** This certification has been created specifically for the fruit juice sector. This is a voluntary system that allows most actors in the juice sector to be certified. These include fruit processing companies, packers, bottlers, traders, brokers, transport companies, tank cleaning companies, cold stores, etc.

It is important to be aware that buyers may require audits to be undertaken at the start of some business relationships. In addition, unannounced spot checks might be undertaken, pesticide residue tests, or similar. This is especially true for buyers supplying products to the health and wellness sector, or baby food manufacturers. Retailers or bottlers might also have a specific code of conduct for their suppliers. Finally, some buyers require certification from specific internationally accredited certification companies, such as SGS, CIS, TÜV and Bureau Veritas (source: www.CBI.com).

3. Supply

3.1. How products reach the market

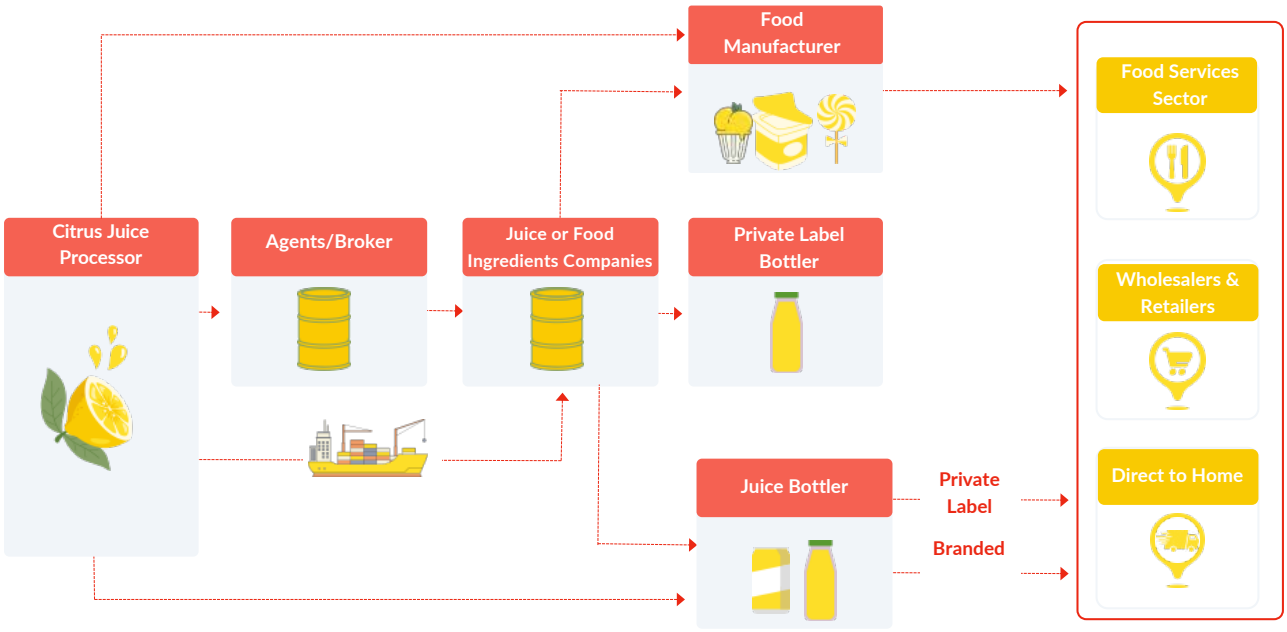

Figure 7: Structure of the citrus juice value chain. Source: Time for Sense.

End-markets

Since the 1990s, the industry has experienced concentration, globalization and vertical integration in the market. Many companies that operate in Europe now also operate in the USA, and markets are becoming more and more global. For example, PepsiCo (Tropicana, Naked fruit) and Coca-Cola (Minute Maid, Innocent) can now be found in every supermarket in Europe and have a growing presence across the world. Refresco acquired and merged with 13 European juice companies between 1999 and 2016 to become the biggest soft drinks and juice bottler in Europe. In 2018 it bought Cott's bottling activities in North America and the UK, and now has a production capacity of 12 billion litres with 59 facilities in 12 countries.

On the other end of the spectrum, smaller niche companies source juice ingredients to create their own specialty blends. These might supply retailers with products, or use direct sales via the internet to market their products. These smaller companies source citrus juice directly from processors, but typically buy from juice or food ingredients companies.

Route to market

There are four avenues for supplying juice to the end markets.

1. Vertically integrated juice companies

The dominance of Brazil has resulted in a few large juice companies investing in vertical integration, such as farming so they now grow the fruit that they process into juice in their own factories, sometimes use their own transport tankers, and then deliver to their own bulk storage facilities in major markets. Louis Dreyfus, CitroSuco, Citrale and Döhler are good examples.

2. Food ingredient companies

These source a wide range of food ingredients and supply to food manufacturers. A large food ingredients company might source food ingredients such as colours, flavours, coatings, sweeteners, juices, purees, powdered fruits and vegetables, for a wide array of customers such as breweries, confectionary companies, bakeries, others producing dairy products, juice, ice cream, the food services sector.

They source citrus juice from processors, then they can do one of three options. The first is that they supply these directly to bottlers, or they could blend these juices to achieve a standard flavour profile required for bottlers and food manufacturing companies. Finally, they could further process ingredients into new products such as fruit powders, flavours, extracts, oils, etc.

These companies have specialised skills that allow food manufacturers to be able to have access to a wide range of ingredients, from many regions and throughout the year, to achieve similar flavour profiles and quality irrespective of seasonal variations around the world, and have to also access to innovative new products. Symrise is an example of one of these food ingredient company.

3. Juice companies

Specialised juice companies source a variety of juice from suppliers around the world. They act in a similar way to food ingredient companies, blending juice from different origins to achieve a consistent blend for bottlers and food manufacturers. They focus specifically on juice, and sometimes on associated products. Some examples of these companies are Agrana, Verbruggen Juice trading, Quriante Fruits and Universal Iberland.

4. Direct to market/food manufacturers/bottlers

Some food manufacturers process their own citrus juice and then bottle this for local and international markets. This occurs very infrequently. Blue Skies (Ghana) is one such example.

Transport and logistics

Transport and logistics for citrus, specifically orange juice, has undergone a significant transformation. Historically, juice was transported in drums or bag in boxes, and this is still the norm for lemon, lime, clementine or grapefruit juice, and even orange juice sourced from outside of Brazil.

But orange juice from Brazil is increasingly imported using specialised tankers. These ships forgo the use of packaging, and pump orange juice directly into tanks inside the ships, either concentrated juice, not from concentrate, chilled and even frozen orange juice can be transported.

Some companies such as Citrosuco own their own sea tankers. Other companies work with contract carriers that ship juice to specialised juice terminals in North America, and Europe (Ghent, Rotterdam and Avonmouth), that have infrastructure to pump orange juice from the cooling tanks on the ship, directly into tanker trucks. This allows juice to be transported to bulk holding facilities and blending units nearby. In some cases, juice is also re-exported. For example, juice leaving mainland Europe for the UK is able to make use of specialist facilities in Ghent and Avonmouth. As infrastructure has improved, juice can be moved smaller tanker boats, and bulk tankers for road transport within the EU.

3.2. Suppliers in the market

Brazil

Brazil grows one third of all oranges in the world, with at least 70% processed into juice. This makes processors in this country. Brazilian companies are thus central to global trade in orange juice, sourcing Valencia, Natal, Hamlin, Pera Rio, Westin, Rubi and Folha Murcha varieties. The dominance of Brazil in orange juice production has resulted in Brazilian Valencia orange juice becoming the benchmark for flavour in the industry.

Mexico

Mexico is a the third largest exporter of citrus juice in the world. To compete, processors have developed a strategy to focus on high value niches within the orange and lime market, . Most exports are organic, frozen orange or lime juice, where Mexico is the global leader. Mexican exporters also focus on specific markets, selling mostly to the USA (86%), the Netherlands (9%) and Japan (3%).

Argentina

Argentina produces some 2.5 m tonnes of citrus fruit, half of which are lemons, 75% of which are converted into juice, from Eureka, Lisboa, Limoneira and Génova varieties. In 2020, Argentina exported over 70,000 tonnes of citrus juice, with concentrated lemon juice making up 90%, followed by oranges (10%) and small quantities of grapefruit. Most were exported to the Netherlands (30%), USA (25%) and Japan (10%).

Spain

In 2022, more than 700,000 tonnes of citrus juices were exported by Spanish processors. Most citrus production is from the regions of Valencia (oranges and mandarins), Andalusia and Murcia (lemons and grapefruits). The Valencia variety is primarily utilized for producing NFC juice.

Others

Many of the largest exporters of citrus juice by value and volume are not citrus producing countries. For example, the Netherlands, Belgium and Germany are in the top eight exporters of citrus juice globally and together contribute about 20% to global citrus juice exports. This reflects the importance of their food ingredients, juice and bottling companies within the EU.

Table 3: Leading citrus juice exporter volumes (2023). Source: COLEAD based on CEPII BACI, Eurostat, UK Trade Info and IFPRI.

Country	Volume of exports in 2023 (tonnes)	Contribution to global citrus juice trade
Brazil	2,760,076	47.3%
Netherlands	537,100	9.2%
Spain	405,690	6.9%
Belgium	374,418	6.4%
Mexico	295,185	5.1%
Germany	196,458	3.4%
United States	137,557	2.4%
Italy	132,500	2.3%

3.3. Seasonality

Processed citrus juice tends to have a long shelf life, especially aseptically packed juice which has a shelf life of 18 months. By introducing early and late season varieties, producers in key growing countries like Brazil have also been successful at lengthening the growing season and can now harvest oranges from June to February.

Nevertheless, most buyers are wary of purchasing products with a significantly reduced shelf life, as this introduces risks from improper storage or provides less flexibility if the product is not quickly sold onwards.

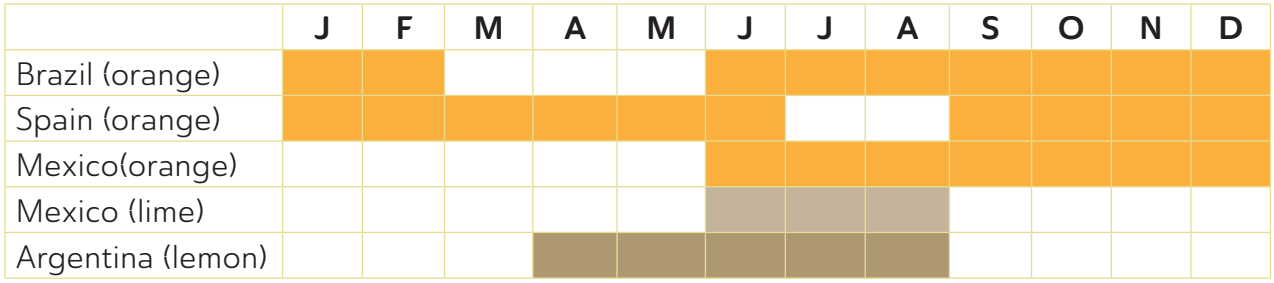

Figure 8:Citrus harvesting periods in key producing countries. Source: Time for Sense

3.4. Changing supply

The changing climate, adverse weather events, and outbreaks of diseases affecting citrus crops, have affected production in major exporting countries, creating large fluctuations in the supply of citrus and hence citrus juice.

- In Brazil, severe drought, heat stress and the spread of citrus greening disease, severely reduced supply in the 2023/2024 season. Many retailers and bottlers were unable to source sufficient juice, while others opted to avoid the far higher prices at that time.
- In Argentina and Mexico, adverse weather conditions destroyed some citrus orchards. Then, as the industry in both countries was beginning to benefit from new areas planted, increasing input prices pushed small scale growers out of business.
- In Florida in 2017 and 2022, hurricanes affected the supply of oranges and hence orange juice.
- In South Africa in 2024, citrus growers were affected by floods.
- In Spain, increasing input costs have slowly been making citrus production an unviable enterprise for smaller growers.

Supply shortages generally result in price increases. Between 2020 and 2024 for example, organic NFC orange juice concentrate (65°Brix) almost tripled in price, from €3 to €8 per kg. However, it is during such periods of shortages that new suppliers have greater opportunities of entering the market.

3.5. Processing

Citrus juice has a six stage production process.

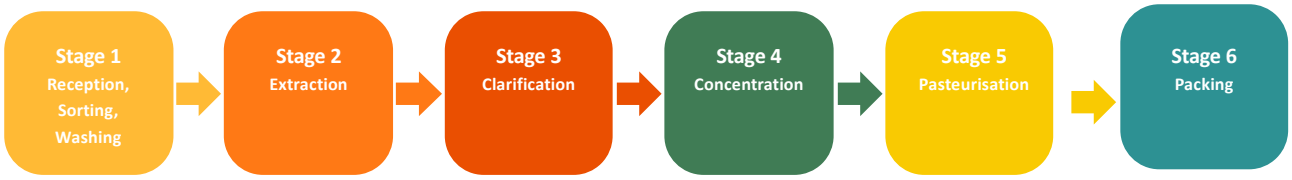

Figure 9: Typical citrus juice processing stages

Figure 10: Example of processing equipment. Source: Tropical Food Machinery

Stage 1: Reception, sorting, washing
At reception there is a visual inspection of the fruit, and any infected, overripe or rotten fruit are removed. The sorted fruit is then washed in a water bath, that can also be dosed with chlorine or other disinfectant products. Then the fruit is cleaned using brushes and water to remove dirt, but this also allows for oils to be collected and recovered later.

Stage 2: Extraction: pre-heating and pressing

Fruit is flash heated to 60°C prior to pressing. This temperature increases the extraction rate of juice from the pulp, but is not so high that it allows retention of flavour and aroma of citrus juice. The juice is then removed from the pulp, entirely for smooth juice, or in part if some pulp is be left to meet "with pulp" specification. Pulp and skins are removed from the process.

Stage 3: Clarification

Juice is passed through a decanter to remove smaller particles in order to achieve a clearer citrus juice. With lemon and lime this is an optional step, depending on the desired end product.

Stage 4: Concentration (optional)

After clarification, citrus juice may undergo an optional concentration process for reducing the volume, making it more cost-effective to transport and store. Concentration also helps to preserve the juice by reducing the water content.

Figure 11: Forced circulation evaporator. Source: Tropical Foods.

Stage 5: Pasteurisation

The juice is sterilised through heating. While high pressure pasteurisation is sometimes done for consumer-ready, packaged juice, industrially produced juice is typically pasteurised using heat exchangers. In this method, juice is passed through pipes that are heated using steam or hot water. Temperatures during pasteurisation are typically 85°C, but this can be higher if the juice is heavily contaminated. This is a rapid process that kills bacteria, viruses and other microorganisms, ensuring that the products are safe to consume. The process enables continuous, high-volume commercial production with consistent results.

Stage 6: Packing

For aseptic filling, juice is commonly filled into aseptic bags that are sealed and put inside in 210 litre or 220 kg drums for transportation. Smaller aseptic bulk bags in boxes are also available if this is specific client demand. This is often the most expensive equipment in the juice value chain. For freezing, juice is filled into double walled foiled bags and frozen at temperatures of −18°C to −25°C. Tankers are sometimes used from select origins such as Brazil. In this system tankers are chilled to −8°C to −10°C.

Figure 12: Aseptic filler. Source: Tropical Food Machinery

Figure 13: Filler for drums, bins and buckets for frozen juice. Source: Supplied by Tropical Foods.

Technologies

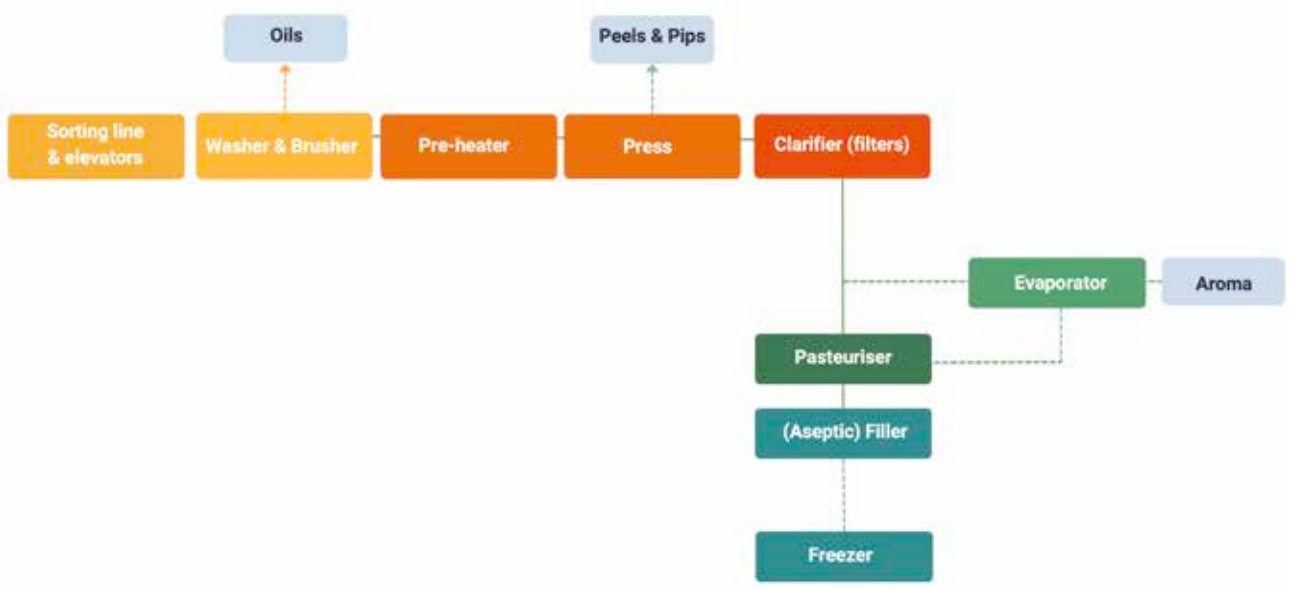

Figure 14: Puree processing process with technology. Source: Time for Sense

- Commercially efficient and competitive lines tend to start with a capacity 4–5 tonnes of fresh citrus per hour. But this depends on the speed at which the line is fed, which in turn depends on loading and the speed of the sorting team behind the sorting belt. The time need for clarification, pasteurisation and evaporation also influences the speed.
- Companies target a 65% conversion ratio from fresh oranges to juice. This is affected by the size of the fruit, variety, quality and losses during the sorting process. For economic calculations, 58% should be taken for new factories and 60% for existing plants with qualified staff and good supply chain management.
- Small, artisanal lines are sometimes manufactured locally. However, when companies scale up to become industrial manufacturers they often source equipment from Asia or the EU. Indian and Chinese produced lines often have quality issues and they manufacture juice inefficiently while increasing waste. Parts are often not available locally, or maintenance of the equipment is challenging. The largest suppliers of industrial juice lines are in Italy (Bertuzzi and Tropical Foods) and the USA. These are more expensive suppliers of production lines, but they offer servicing, post-purchasing support and technical assistance, and the production process is often more efficient.
- To set up a processing facility, one hectare of land is considered as a minimum area required, which would need to be fenced, with buildings to house the production line, an office, small laboratory, ripening rooms and final product storage.
- The production line would need a boiler to produce steam that is fed to the concentration and pasteurising units, and a generator for back-up electricity. These are normally sourced from separate suppliers.
- The approximate costs for setting up a processing line are detailed in the table below.

Table 4: Approximate costs for establishing a production line (US$)

Equipment	Number	Unit price	Unit price	Total cost
Juice processing line for tropical foods	1	2,098,000	2,286,820	2,286,820
Extraction line	1	782,000	852,380	852,380
Control system	1	4,000	4,360	4,360
Spare parts	1	66,000	71,940	71,940
Sterilization and aseptic filling line	1	500,000	545,000	54, 000
Auxiliary services (thermal plant, electric plant, water power plant, chiller, basic laboratory, compressed air generator, connexions to process machine)	1	716,000	780,440	780,440
Packaging	1	30,000	32,700	32,700
Generator	1	28,000	28,000	28,000
Pallet jacks and small equipment	2	28,000	28,000	56,000
Plastic crates (22 kg)	25,000	5.5	6	149,875
Total			**2,342,826**	**2,520,695**
Optional: Concentration unit	1	385,000	419,650	419,650
Optional: Filler for drums for frozen with cooling module	1	102,000	111,180	111,180
Optional: Aroma recovery unit	1	196,000	213,640	213,640

This model is for a basic processing line designed to produce NFC, aseptic juices. It has the versatility to be adapted with a concentration unit to produce concentrates, a filler to produce frozen juice, and an aroma recovery unit (costs above).

When concentrating citrus juice, flavour can diminish due to the loss of volatile oils. The installation of an aroma recovery unit allows collection to sell as a separate product. The evaporated components can be marketed as a citrus extract to be sold as flavours or fragrance to the food or cosmetic industries.

Typically, half of the total investment cost for a citrus plant is allocated to land and building, and half to equipment costs. The overall cost for establishing a citrus plant is approximately US$45 million. Capacity can be doubled or tripled by adding more production lines in parallel. Some manufacturers also modify existing line to increase capacity. Building layout and location of the utilities (e.g. the boiler) should be planned to accommodate the potential addition of extra lines in the future.

4. Challenges and opportunities

Table 5: Challenges and opportunities for citrus juice

Challenges	Opportunities
▪ Declining demand for juice globally. ▪ Highly competitive market. ▪ Rising prices contributing to making juice a luxury. ▪ A few countries dominate supply of specific citrus juices. ▪ Stringent quality requirements to compete. ▪ The HACCP standard is required as a minimum. ▪ Specialist bulk juice tankers give Brazilian suppliers a cost advantage. ▪ Supply constraints cause shortages of raw materials. ▪ Vertical integration of major citrus juice companies gives them a competitive advantage. ▪ High investment costs. ▪ Exceptionally well organised industry in South America, with a clear focus on efficient production and logistics.	▪ Widespread use of citrus juice and by-products across many applications. ▪ Positive trends in health and wellness, environmental sustainability and hydration, all create opportunities for bottlers and suppliers. ▪ Turbulent supply chains create opportunities for new sourcing origins. ▪ Multi-season, multiproduct systems and processors are likely to succeed, alongside tropical fruits such as papaya and pineapples and vegetable juices. ▪ Citrus juice technology requires minor adaptations to process many other fruits and vegetables. ▪ Waste can be valorised, to produce oil, aroma, food additives, compost, animal feed, etc. ▪ Small suppliers have smaller barriers to adapted to and adopting environmentally sustainable production.

5. Ingredients for success

Juice production is a capital-intensive industry. The minimum capacity for a production line is about five tonnes of fresh fruit per hour, and initial investment required to set up such a line is around US$4–5 million. To break even and cover fixed costs, a company needs to produce 10,000 tonnes of juice and concentrate annually. Typically, producers focus on two or three types of juice to keep them in continuous operation for most of the year in order to cover fixed costs. The scale of operations and the highly competitive nature of the market have knock on effects that companies must pay attention to.

5.1. Sourcing excellence

Processing 5 tonnes of fresh fruit per hour requires 40 tonnes per 8-hour shift, and a 3-shift system needs 120 tonnes of fresh fruit every day, throughout the season. Finding this volume of affordable fruit can be challenging, especially when fresh fruit companies compete directly with processors. The harvest season may also be short, compared to Brazil where oranges are harvested for nine months of the year.
Sourcing teams must solve these problems.

- How to find sufficient volumes of affordable fruit.
- What sourcing standard to use, knowing that farmers may not know what variety they grow, and that volumes are in short supply.
- How to arrange reception, sorting and storage of large volumes of fruit in the short season.
- How to cope with the dynamic nature of citrus growing that is highly susceptible to climate events like drought and flooding.

To solve these sizeable challenges from season to season requires focus and investment, and experienced team for extension, sourcing, harvesting and logistics. Juice companies must carefully consider the value proposition they offer to farmers. Without this, farmers are more likely to opt for different buyers or to sell fruit on the fresh market. Juice companies should consider the overall operations of farmers, whether they can play a role in improving cash flow, or providing technical skills and services to improve orchards, yields, farmer revenues and profits.

5.2. Operational excellence

The citrus market has established suppliers in South America that leverage benefits from economies of scale, cost savings from specialised logistics, and from vertical integration. To compete, new juice companies must carefully design and manage operations to ensure they are efficient and cost-competitive.

Competitive production

A key pillar of competitiveness is the ability to expertly manage the extraction rate of juice from the fruit. Brazilian companies aim for 60–65% extraction, thanks to using a certain variety, Valencia, that is high in juice content, and optimising the process by carefully managing the extraction at each stage of production.

Capacity utilisation rate and total productivity management

Maximising the capacity of the juice processing equipment is another important strategy, to maximise returns on investment. In processing, a good capacity utilisation is 85%, so if the equipment can process up to 5 tonnes of fruit per hour, then the plant should process at least 4.25 tonnes of fruit per hour.

To achieve such a utilisation rate, the company should implement a total productivity management programme. A skilled repair and maintenance team is needed so equipment is kept in good working order, unplanned stoppages are minimised, planned maintenance schedules are organized, skilled line operators identify when and where small adjustments are required, and that all maintenance and repairs are properly logged.

Waste minimisation and valorisation

Minimising waste helps companies to preventing leakage of value from production systems. From 1 tonne of fruit, a company should aim to convert 80–88% into end products. Losses due to poor sorting of fruit, spillage during production, and from poor storage, must be minimised. Then as companies become better at preventing waste, they can look for opportunities to convert waste into value. In the case of citrus, this is becoming an important revenue stream.

Companies can recover citrus oils, aromas and sell the skins and peels to companies looking to process these into ingredients for food and industrial chemicals, such as flavourings, fragrances, cleaning agents and animal feed.

- Flavourings: citrus oils and aromas are often used in the food and beverage industry to enhance the taste and smell of products.
- Fragrances: essential oils extracted from citrus peels are used in the cosmetics and perfume industry for their fresh and invigorating scents.
- Cleaning agents: citrus oils, particularly d-limonene, are used in the production of cleaning products due to their natural solvent properties.
- Animal feed: dried peels and pulp are used as a source of fibre and nutrients in animal feed.

These by-products not only reduce waste, but also create additional revenue streams for the citrus processing industry, and processors are relying increasingly on such to improve profitability

Multi-season production

To afford the specialised equipment needed for large-scale production and to invest in skilled staff, companies must operate for most of the year. Achieving this is only possible by offering a range of products with complementary seasons. As such, it is worth including fruits with longer production seasons into the production schedule. Pineapple is a good example, as it can be harvested all year round, and mango puree, papaya and vegetables purees like sweet potato, beetroot or carrot can also be considered.

Access to markets – finding a strategic partner

South America is the known leader in citrus juice production, and juice companies there have an established industry, world class logistics, and fruit from the region is considered the flavour benchmark. This is a strong value proposition, which is difficult to compete with. Some potential strategies include the development of a differentiated value positions, developing strategic partnerships, or working with distributors.

Achieve minimum standards

Before investing in a juice company, consider whether it is worthwhile to achieve the minimum market standard. A company must be able to reliably deliver large enough volumes of stable juice that meets quality standards (Brix, flavour, aroma, certifications), and at a competitive a price.

- Food safe: meeting at least HACCP standards (but preferably higher), aseptically packed or frozen, and with a shelf life of >18 months.
- Controlling pesticide residues and compliant with required certification standards.
- Acceptable quality standards: in terms of Brix, flavour, aroma, certifications.
- Competitive price: based on market price fluctuations for the specific value proposition being offered.
- Good phytosanitary controls support companies to reduce the contamination in incoming fruit which in turn allows factories to pasteurise at lower temperatures. High temperatures often reduce the flavour of the final juice, or introduce off notes in the final product. Damaged or poor quality fruit is cheaper, but it requires heating, which can limit options for clients and makes marketing challenging. On the other hand phytosanitary controls require investment, but can be an asset in marketing and sales. It is important that companies strike a healthy balance and develop a strategy that best fits their context.

Differentiated value proposition

Competing with South American suppliers is extremely challenging. It might be advisable to focus on market segments where good value or a unique proposition can be offered. For example, this could include organic, or NFC for premium markets, or both, such as certified "baby organic" would be an even greater differentiator. In some cases, the environmental or social certifications – such as SEDEX or fair trade – can prove to be beneficial in marketing.

Many African suppliers have an advantage of being able to offer citrus that is high in sugar and volatile oils. This makes for a more aromatic product, which can potentially be valorised either as oils and aromas, or as high-value niche products for the right buyer. This is an opportunity for African suppliers.

When there are gaps in the market, as with insufficient supply from Brazil, it is important to be ready to capitalise on the opportunity. Some buyers may be unusually open to new flavour profiles when there are shortages, rather than when large suppliers are able to meet all orders. When this happens, reliable, professional suppliers will be in demand, who can deliver a predictable flavour, colour, quality and aroma. This entails having clear communications, being able to supply the critical information such as certifications, production volumes and facts and figures regarding quality and sourcing.

Environmental sustainability

Consumers, retailers and bottlers have a growing interest in environmental sustainability. As a result, companies are more open to suppliers that can meet sustainability criteria. Environmentally friendly production, low waste and water wise production are some examples of areas where buyers are looking to innovate. These present opportunities for new suppliers who might be able to pivot to take advantage of these opportunities far faster than traditional, large-scale suppliers such as Brazil.

Strategic partnerships and distributors

A key challenge for new producers is cash flow. A processing plant can produce at least one container of juice worth around US$60,000. However, the cost of production will be US$10,000–40,000. Thus, after a month of processing without making any sales, this could lead to US$300,000 tied up in stock, with dwindling working capital and storage space. Furthermore, even will some sales, payment may take another 30 days to be received, and full payment typically takes at least another 90 days. This could force an operation to halt production until sufficient funds are finally received, resulting in earnings that are insufficient to repay investment loans.

A better approach is to develop strategic partnerships with one or more importers. This allows the building of a business that has guaranteed sales volumes at the beginning of the season. Through such partnerships, a business can also learn more about customer requirements, secure a place in the global sourcing calendar, and receive support for innovation and certification, and ultimately make its product more marketable.

A second option is to find an experienced distributor or agent and establish for a company to establish its own sales organisation in the target markets. This will enhance connectivity with food ingredients companies and reduce barriers to sourcing from the company. In that case, it is crucial to choose agents who fully understand the market, can provide excellent customer service, and are respected by their peers in the juice industry.

5.3. Bottling or juice, but don't mix your drinks

Juice processing requires significant investment in order to be competitive. Entrepreneurs, especially those new to the juice sector, often aim to process, bottle and market bottled fruit juice. However, in most successful models, these are two distinct business.

On the one hand, apart from artisanal or home industry juice companies, juice bottlers almost never handle fresh fruit. The typical model is for them to source juices and concentrates from around the world. then blend and package them on an industrial scale. Their goal is to produce the most appealing juice for consumers at the lowest price by blending around up to five different juices into one flavour. They have the same flavours available year-round. Essentially, they operate as packaging, marketing and distribution companies. Their focus is on business-to-consumer marketing, which includes television, radio, billboard and internet advertisements, product sampling, public relations and retailer incentives. The minimum investment required is around US$5 million, as even one Tetra Pak filling line can cost US$2 million and fill 20 million litres per year, with such a scale necessary to reduce the cost per unit and compete with soft drinks.

Combining these two models presents issues, as investment cost can become high, and relying solely on own production means that the price can vary significantly each year, sales can be limited by the amount of juice available, and spreading attention introduces unnecessary risk to companies.

5.4. Sound financial planning

Before starting a juice company, a comprehensive cost analysis must consider local costs, international processing benchmarks, and global market prices for similar products. Surprisingly, some juice entrepreneurs neglect this step, leading to the construction of factories that cannot compete in the global market, and consequently fail to export their products.

In addition, realistic time and financial planning are vital. Constructing a plant requires at least 12 months, and should be timed to be ready for the next harvest season. It is also important to designate the first season as a trial period, when limited volumes are produced while staff learn how to source large quantities of fruit and process it.

Lastly, it is crucial to develop a sound cash flow plan based on realistic assumptions. Payment terms for clients should be carefully considered, with an extra month allotted for potential delays. Unfortunately, it is common for production plants to face cash shortages, resulting in farmers not being paid, and subsequently discontinuing their supply, and that can ultimately lead to closure of the business.

6. Further reading

Industry Reports & Market Analysis

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SECTOR STUDY: CITRUS JUICE

1. Fresh citrus
2. Citrus juice
3. Citrus oil and peel

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