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## **The avocado market with focus on Colombian production and its potential export to Italy**



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## **ABSTRACT**

The global avocado market has experienced a considerable increase not only in demand but also in the production due to the rising popularity of healthy eating habits and the adoption of avocados into the several cuisines around the world. Mexico has been the most important producer and exporter throughout the decades due to the essential fact that it is where avocados were born, being United States not only its most important importer but also the worldwide largest consumer. However, Colombia has been emerging as one of the most important avocado producers in the recent years thanks to its unique geographical and climatic conditions and the effort of the government, investors, and producers, becoming a crucial part of the avocado market currently whilst in Italy is taking place a huge consumption boom in the last years, experiencing the highest percentage increase in avocado consumption in the European context despite Italians are recognized for eating traditional fruits and vegetables as before. Likewise, it is expected that the avocado market rises in the following years in terms of exportations, importations, production, and consumption due to its emerging popularity, nutritional facts, and the efforts of each stakeholder, implying that the cultivation of avocado trees passes from a simplified agriculture to a monoculture, affecting the environmental conditions. Therefore, it is important to analyze the avocado market as an overview in order to identify key improvements points and potential trends focused on Colombia/Italy context which could be exploited based on the preservation of the sustainability.

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# 1. The Avocado

## 1.1. Definition and Etymology

The historic and geographic origins of the plant and its name are highly specific to one area. The name of this well-recognized fruit expanded worldwide comes from the Nahuatl language spoken by the indigenous race Aztecs and the majority of inhabitant who lived in the central part of Mexico at the arrival time of the Europe conquerors. The Nahuatl word for avocado was āhuacatl which comes from the proto-Aztec Pawa [1]. The way the fruit looks like and its shape led to being named “āhuacatl” whose meaning in Nahuatl is testicles. Then a Spanish conqueror called Pedro Cieza de León was the first person who translated the Nahuatl word into the Spanish languages as Aguacate describing its properties and characteristics in print in 1550. Then it was adapted to the English languages as Avocado coming from misspelling the Spanish word “abogado” which could be more familiar in this century [1]. In contrast, due to its vast extension through the American continent its name can change considerably to Palta derived from the Quechua language whose meaning is “a thing that serves to lift” referring to the erectile virtues of the fruit [2].

## 1.2. History and Origin

The origin the Avocado could take place in the highlands of the central and eastern Mexico and highlands of Guatemala that is known as Mesoamerica currently. Likewise, this land was used for the first cultivations of this fruits as well as for corn, squash, calabaza, cassava, cotton, sweet potato, and agave in the classical period because of the rest of plants that could be analyzed from an archeological context. This worldwide fruit has been largely used throughout the ages for the human race due to the oldest evidence of avocado consumption was found in a cave from Coxclatan, Puebla, Mexico which can be dated from 8000 to 7000 B.C. Moreover, the ancient cultures have demonstrated a high knowledge about the Avocado evidenced in the Florentino code in which they categorized this fruit according to its type. The first one “aoacatl” can be considered as the American Persea, “tlacacolaocatl” as the American Persea var. *americana* and “quillaoacatl” as the American Persea var. *guatemalensis*. When it comes to the artistic expressions regarding this fruit from the Hispanic cultures, it can be found some hieroglyphs which describe the town of *Ahuacatlan* (which means land where avocado abounds) by a tree with teeth on the stem (“ahuacacahuitl”) and a “calli” which means town or place. [3]



Fig. 1 Hieroglyph of the Ahuacatlan town and the avocado tree [3]

There are several historians who have described the different types of avocados they had found during their journeys through the Latin American territories. Benavente in his “Historia de los indios en la Nueva España” stated three kinds of avocado; the first one as “early figs”, the second ones are as big as a pear and the third ones are as big as small pumpkins. On the other hand, there is Sagahun who described the ahucatl (also known as an ahucacahuitl) as dark green in color on the outside and white and green on the inside; the tlacazolahuacatl (similar to the first but larger); and the quilahuacatl which is green on the outside and excellent to eat. Likewise, there are historians who highlight the differences among avocados from a geographical focus such as José Acosta, who in 1590, identified the Peruvian avocado as big fruits with a hard shell that peels easily and the Mexican one which is smaller and with a thick shell or Friar Bernabé (1653) who said that there are three types of avocado; the first one which has a thin and flexible skin with a large seed whose flavor is similar to bitter almonds. The second one is a large and rounded one which is produced in the region of Guatemala and it does not have as smooth skin as the first one does and the third one that can be found in Mexico which is similar to a breva fig in shape, size, and color and in fact, these descriptions also resembles those ones made by Bergh and Ellstrand in 1986 [4].

Moreover, the avocado crops expanded worldwide after the discovery from the Spanish conquerors who traded this fruit to their territory immediately. In contrast the European conquerors established early crops in Cuba and Jamaica, then in some parts of Africa as Ghana and in south America as Brazil. The expansion to the southeastern Asia came from Mexico and India and the rest of Europe could have this new fruit by the trade throughout the Atlantic Ocean with the colonies [3].



Fig. 2 Distribution of the avocado after the conquest in the world before 1915 [3].

This worldwide spread has caused a large variability of the avocado fruit which could be due to the different environmental conditions present throughout the world and the mechanisms that maximize crossing among different types of avocados, increasing the genetic modification and therefore extending the adaptation to a greater number of environments [3].

The plants were not given much horticultural attention until around 1900, when researchers discovered that cultivating grafted trees was easy, both allowed for the perpetuation of superior seedlings as well as for the creation of orchards [5]. The chart displayed below from Google Ngram let know the frequency of the word “Avocado” in sources printed out from 1700 to 2000 and it can be seen that the avocado trend started to increase after 1900 much likely for its introduction to the American country. In fact, it can be said that the boom of the manufacturing and distribution of the avocado has their origins more accurate in California when Judge R.B. Ord imported three avocado trees as seedlings and planted them in Santa Barbara in 1871 (Ryerson 575). Later on, the avocado was sometimes called "alligator pear" because of its exterior, which is shaped like a pear, and its tough, dark brown skin, which resembled alligator scales causing low sales to the Californian Avocado growers as the name “alligator pears” was misleading and meaningless and consistently was giving the false picture of the fruit to those who are unfamiliar with it changing it to “Avocado” as consequence. Moreover, in the chart is also displayed that the name “Alligator pear” had a little peak from 1900 to 1940 The effectiveness of this psychological strategy is undeniable, and following the renaming, several Americans became open to trying this fruit [6].

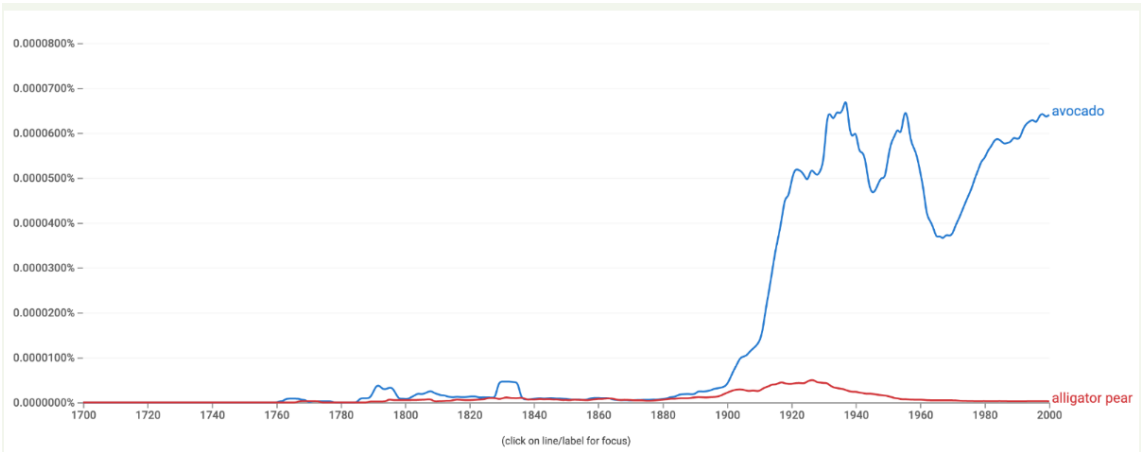


Fig. 3 Historical count of the word “Avocado” on printed papers from 1700 to 1900 [6]

Then, in the 1980s, the U.S. dietary recommendations suggest Americans to adopt a low-fat diet trend having the fruit as a mean character which was accompanied by the industry's best efforts to finance research and produce TV advertisements in order to promote the fruit's health advantages, however it had not achieved the best sales as expected [7]. It was not until the appearance of the well-known PR company, Hill & Knowlton which created a mascot to the avocado “Mr Ripe” emphasized on a fun and healthy life which attracted the attention of the Americans after all. Much more other events have risen up the popularity of the avocado such as the Superbowl. Typically, the final Sunday in January or the first Sunday in February are when the annual American Football Championship is played. Super Bowl has hundreds of millions of devoted admirers, and for many years, this TV program has been at the top of the TV ratings in the United States. As a result, the day of the Super Bowl has even been designated an unofficial national holiday. Today, people almost instinctively think of avocados when they think of the Super Bowl, and guacamole is a need. Super Bowl significantly boosts avocado sales and around 49million pounds of this fruit are consumed during the event. The avocado has finally established itself as a common fruit in America [6].

Nowadays, according to the last years Avocado Forecast by the World Avocado Organization (WAO), Europe and the U.K. are predicted to experience sustained and significant growth during that year, largely influenced by multiple food trends. The report revealed that the region had already consumed more than 650 million kilos of avocados, establishing Europe as one of the rapidly expanding markets

on a global scale. The WAO further emphasized that with an anticipated growth rate of at least 15 percent per year over the next five years, the popularity of avocados, often referred to as the "Fruit of Life," shows no signs of waning [8]

Furthermore, there are current trends that enforce the growing up behavior of the avocado consumption

- 1) Veganism: As more people become aware of the environmental and health advantages of a plant-based diet, veganism continues to grow constantly. Reaching up a figure of 300.000 people joining monthly according to well-recognized organizations such as Forbes and The Economist. Demand for vegan foods is increasing as more people choose a vegan diet, and the avocado continues to be a top choice because of its wealth of vitamins, minerals, and healthy fats [8]
- 2) Health is wealth: Because of the high potassium content of avocados, they make a fantastic post-workout recovery snack when it comes to fitness. Healthy people are looking forward to the greatest foods to support their gym routines. They seek for nutrient-dense foods that offer a powerful punch of health advantages when it comes to our wellbeing [8]
- 3) Photogenic Food: According to studies, 69% of millennials photograph their food before consuming it, and with hashtags like #foodporn and #foodie amassing millions of followers, the habit isn't going anywhere. We're a nation of avocado-snappers, so it goes without saying that avocados are one of the most Instagrammable meals out there, from burrito bowls to smoothies to the perennially popular avocado toast! Want to strengthen your grid? For more genuinely wonderful avocado Instagram inspiration, go to Colette Dike's Food Deco [8]

### ***1.3.Plant description and types of avocado***

Avocado trees can be short or tall, and its elliptic to egg-shaped leaves range in size from 10 to 30 cm (4 to 12 inches). This tree is native to Mexico, Central America and South America and it can be tall up to 60'but its varieties normally grow even shorter.



*Fig. 4 Avocado Tree [9]*

The flowers of avocados exhibit a single ovary and are characterized by nine stamens arranged in three groups. An intriguing aspect is that different avocado cultivars can produce two

different types of blooms, known as A and B. The male and female components of these flowers develop independently, and each bloom undergoes two opening stages. Type A flowers open as functionally male in the afternoon of the following day after closing and as functionally female in the morning, midday, and evening. On the other hand, type B flowers open the next morning as functionally male after being functionally female in the afternoon and closing in the evening. This sequential timing overlap of the mature male and female parts facilitates cross-pollination, leading to increased fruit production when both types of flowers are cultivated together



*Fig. 5 Type of flowers of the Avocado tree[10]*

In certain Mexican avocado varieties, the fruit can be as small as an egg, while in others, it can occasionally reach a substantial size of 1-2 kg (2-4 pounds). The shape of the fruit can vary, appearing either spherical or pear-shaped with a long, slim neck, and its color spans from green to dark purple. From a botanical perspective, the fruit is classified as a berry and is characterized by a single, significantly round seed with two cotyledons. The thickness of the fruit's outer peel can vary, ranging from being only slightly thicker than that of an apple to having a tough and woody texture [5].

There are more than 500 distinct varieties of avocados, but they can generally be classified into three main types: Mexican, Guatemalan, and West Indian. Additionally, avocados are categorized into types A and B using a unique classification system. This categorization is based on the observation that avocado flowers possess both male and female reproductive parts, which can function interchangeably, as opposed to having separate male and female blooms [5].

### **1.3.1. Type A**

#### Hass Avocado (Guatemalan)

The Haas avocado, which is likely the most commonly found avocado in the market, is recognizable by its medium to large-sized fruits. It has a textured outer skin that can be rough or occasionally pebbly, and as it reaches full maturity, the color transitions from green to black. The Haas variety is known for its creamy flesh, which is rich in healthy fats. While some



describe its flavor as nutty, it generally has a mild taste. Hass avocados were developed for the first time in southern California in the 1930s and then introduced to a wider market in the 1970s. Because they may be grown both indoors and outside, they are a popular among home gardeners [11].



*Fig. 6 Avocado Hass[12]*

#### Reed Avocado (Guatemalan)

The Reed avocado is characterized by its exceptionally smooth and creamy texture, along with a remarkable buttery flavor. It is a sizable, round avocado with a thick, green skin. The Reed variety exhibits early and frequent fruit-bearing tendencies. Once mature, the avocados can remain on the tree for an extended period. This type of avocado is resistant to salt damage and is considered one of the most susceptible avocados to cold temperatures [13]

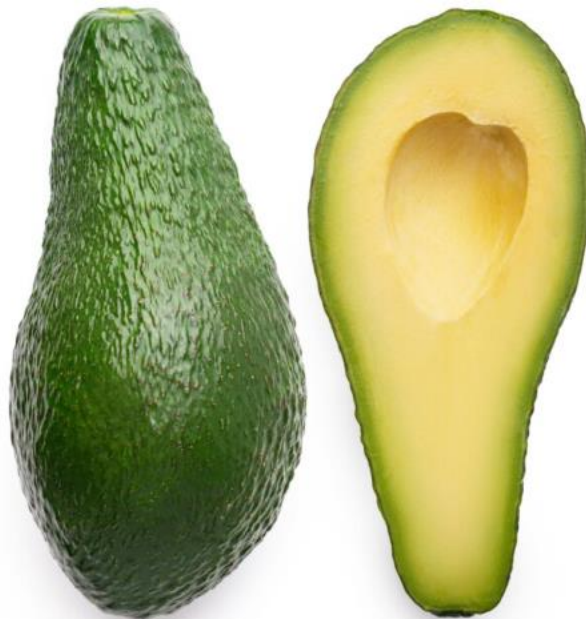


*Fig. 7 Reed Avocado [14]*

#### Pinkerton Avocado (Mostly Guatemalan)

Pinkerton avocados are highly favored due to their consistent yield, excellent quality, and manageable tree size. This variety produces a substantial amount of green fruit with a pebbly

skin. The small-sized avocados are easy to peel and offer a delightful taste, accompanied by a high oil content. [13]



*Fig. 8 Pinkerton Avocado[13]*

#### Mexicola Grande (Mexican)

Of all avocado kinds, the Mexicola Grande is the one that can withstand frost the best. This premium avocado with black skin is up to 25% bigger than its parent, Mexicola. The trees grow tall and spread out in an upright manner. This cultivar thrives both inland and on the seaside [13].



*Fig. 9 Mexicola Grande Avocado[15].*

### Stewart Avocado (Mexican)

The Stewart avocado is a resilient and more compact version of the Mexicola variety. Its fruits feature a thin and shiny black skin. The flesh of the Stewart avocado is of exceptional quality, with a firm texture that melts in the mouth. It has a transparent and brilliant light-yellow color that darkens to green as it gets closer to the skin. The Stewart avocado tree is strong and sturdy, and it produces high-quality yields. Despite being classified as an A-Type avocado, it possesses traits typically associated with B-Type avocados. This makes it well-suited for cooler climates [13].



*Fig. 10 Stewart Avocado [16]*

### Gwen Avocado (Hybrid)

The Gwen avocado, a descendent of the Hass type, is rounder in shape and slightly bigger in size, weighing between six and fifteen ounces. It also has thick, pebbly skin like the Hass avocado. In addition, it keeps its green hue when ripe, unlike the Hass avocado, which becomes nearly black. The Gwen avocado is close to, if not better than, the Hass avocado in terms of flavor and buttery texture. It also features a small, tight seed in its creamy gold-green flesh [16].



*Fig. 11 Gwen Avocado [16]*



### 1.3.2. Type B

#### Bacon Avocado (Mexican)

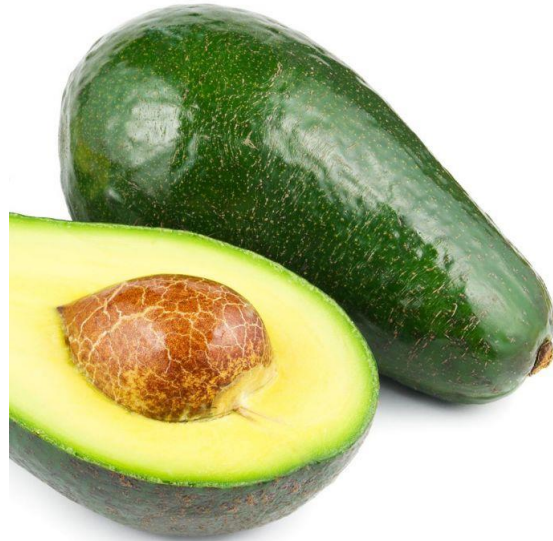
Avocados of the bacon variety display a sleek, thin skin with a deep green color adorned by light speckles throughout. While their flesh is not as oily as Hass avocados, it remains highly enjoyable, boasting a rich taste, a buttery consistency, and a creamy texture. The flesh of bacon avocados showcases a light cornflower yellow hue. These avocados possess a large central pit, which occupies a substantial portion of the fruit's flesh. As the fruit matures, the sizable pit can contribute to the development of mold in the seed cavity, rendering it highly perishable [16].



*Fig. 12 Bacon Avocado [16]*

#### Fuerte Avocado (Hybrid)

Following the Hass avocado, the Fuerte variety is widely recognized as a popular commercial cultivar. It has been favored among California growers for an extended period due to its ability to ripen during the winter season and its B-Type bloom type. Many producers choose to plant Fuerte avocados alongside Hass avocados to ensure a more dependable and consistent production cycle. It is worth noting that the Fuerte avocado often exhibits a pattern of yielding a significant harvest every other year [13]



*Fig. 13 Fuerte Avocado[17]*

### Sir Prize Avocado (Mexican)

The Sir Prize avocado, which bears a resemblance to the Hass variety, stands out for its exceptional quality. In comparison to Hass, it blooms and matures approximately 6 to 8 weeks earlier. As the fruit reaches ripeness, a distinctive ridge along one side becomes less prominent. While the texture of the skin is not exactly pebbled like Hass, there are small patches with varying shades of yellow, giving the appearance of "Hass-like" stones. The flesh of Sir Prize avocados boasts a nutty and sweet flavor, accompanied by a buttery texture rich in oils. The tree exhibits an upright growth pattern. As a commercial cultivar, this variety of avocado is increasingly gaining popularity.



*Fig. 14 Sir prize Avocado [18]*

### Nabal Avocado (Guatemalan)

The Nabal avocado is a spherical fruit that originated in Guatemala. Large, rounded fruits of high quality are produced by it. Creamy and greenish-yellow in its colors. It is one of the avocado kinds that is more susceptible to frost, and it produces a lot of alternative fruit [13]



*Fig. 15 Nabal Avocado[13]*

### Zutano Avocado (Mexican)

The thin, glossy green exterior of the Zutano avocado, which has a pear-like form and stays green even when mature, resembles that of the fuerte avocado, but its flesh is not as creamy or flavorful. Its pale green flesh has a fibrous texture and a low oil content, giving it a taste that is slightly watery. In comparison to other avocado kinds, it is less appealing due to its weak flavor and difficult peeling. [19]



*Fig. 16 Zutano Avocado[19]*

## ***1.4. Manufacturing process of avocado***

Avocados grow up in a better way taking considerable distance from the coastal zones but are not suited to the interior of the desert. West Indian varieties freeze at or just around 0° C and flourish in humid, tropical climates. The Guatemalan varieties are hardy from -1.1 to 4.5°C but are natives in high-altitude tropics area. In contrast, Mexican kinds flourish in a Mediterranean environment and are indigenous to arid subtropical zones. Likewise, any avocado type requires some protection from high strong winds which could damage the branches [20].

### **Soil**

Avocado trees are adapted to either decomposed granite or sandy loam and they would not live longer in zones with no good-drainaging structures but they may grow in either acidic or alkaline soil. The choice of an appropriate location is crucial. The *Phytophthora cinnamomi* fungus, which causes root rot in avocados, is very contagious. No rootstock for avocados is totally immune to this disease. Excellent surface and subsurface drainage is required. If clay bands or hard pans obstruct the free passage of water through the soil, sloping terrain with a porous top soil structure might not be acceptable. It is necessary to check the profile with soil pits dug to a depth of around 2 m. Harvesting and other management activities are challenging because of steep grades, particularly where trees are placed in banana plantations. These locations are prone to erosion. The most suitable orientation is a north-to-east one in contrast to a north-to-south one that maximizes sunlight inception [20].

### **Planting**

Mounding along the row is used where soil depth is marginal (less than one meter) to expand the effective root zone and enhance drainage. It is advised that any tree stumps or huge roots be removed before planting a new orchard to reduce the possibility of root rot forming and spreading to young trees. The pH level has to be controlled and put it at 5.5 with lime or dolomite if necessary. If it is the case, the liming components has to be applied before the cultivating process in order to ensure its proper incorporation to the soil. Likewise, deep ripping method can be used to enhance the sub-surface drainage and the most suitable material to use as common trace element deficient is the zinc [20]

Establishing an avocado orchard may be expensive, and if a well-structured planning and management practices are not used, this investment could be risky. The first step is to collect a sample of soil for chemical analysis, afterwards the required nutrients are applied if needed. A corrections in soil nutrients may require more time to address than a year. Moreover, it is crucial to be protected from high winds. Even three to four years prior to planting the orchard, permanent windbreaks should be installed along crests and along borders. The orchard is divided into protected coves by internal windbreaks. When the trees are roughly 4 years old, these windbreaks are often taken apart. There are two main elements to take into account [20].

1. A well draining system: This is crucial in locations with excessive rainfall because after a downpour, water will pool in little depressions affecting nearby trees.
2. High levels of organic matter: in spite of being a costly procedure, mounding can make the difference between the survivance of the tree or its death.

## Irrigation requirement

During the winter rainy season, avocado trees may not need watering, but during prolonged dry spells in the midst of winter, irrigation is crucial. Avocados are especially sensitive to moisture stress, particularly during flowering, fruit set, and fruit growth. The avocado tree, which is a product of the rain forest, requires regular watering in order to produce healthy fruit. For water monitoring, tensiometers or more sophisticated electronic monitoring equipment that provide a continuous view of the water condition of the root zone are utilized. The soil metric parameters are between -40 and -10kpa at a depth of 300 mm measured by a tensiometer. Water stress during the first eight weeks of fruit growth may slow down cell division, resulting in smaller fruits. In addition, the water stress can produce fruit losses at harvesting and thus, reducing the overall yield performance. In contrast, implementing evapotranspiration once a week can be also an useful method. However, one of the most common problems is the root to caused by the over irrigation. In order to analyze if irrigation is needed, digging a 9 inches holes and squeezing the soils is the procedure to follow-up. If the soil is moist, irrigation would not be necessary; but if it pours on the hand, it can be watered. Moreover, it is recommended not to begin the winter season with moisted soil [20].

## Fertilization

In general, soil fertility, tree age, growth, and yield are taken into account while determining the application dose and percentage of manures and fertilizers. The growth, nutrient uptake, and output of avocado trees are significantly influenced by several micronutrients (Fe, Zn, and B). Use of organic manure is advised for avocado plants in addition to integrated nutrition management and inorganic fertilizer. The full-bearing trees receive a yearly spraying of two kilograms of complete fertilizer. Compost and animal dung from pigs and chickens are two other organic fertilizers employed. Fertilizer is administered at the start and at the end of the rainy season. It is usually dispersed in a ring around the tree's trunk or into tiny holes drilled below the tree's canopy [20]. Although grafted avocado trees may start bearing fruit in their second year, the farmers will not be able to start harvesting until the third year. Finally a table of the yearly average Yield (measurement of output from a crop grown, which in this case would be kg of avocado) can be seen and it is possible to affirm that after the sixth year the output of avocado achieves its top and oscillates between its two maximum values.

*Table 1 Average Achievable Yields [21]*

<b>Year</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
Yield per tree	12kg	26kg	38kg	45kg	51kg	45kg	51kg	45kg
Yield per Hectare	4t	8t	12t	14t	16t	14t	16t	14t

## Harvesting

A tree's avocados do not mature. As a result, they are still hard since they are taken before they are fully mature. Harvesters either use clippers or a picking pole to collect the fruit, depending on where it is located on the tree. During harvest, fruit that is ready to be picked could still be

on the tree. Since avocados that are growing for the future season are growing on the tree at the same time as the avocados that are ready for harvest, the farmers should control each fruit and select those ones ready for harvest [22].

The avocado industry has a large number of small growers that ship their goods to larger packaging facilities. Avocados are washed, kept, gassed with ethylene to ripen, and subjected to various processes at packinghouses before being shipped to grocery stores. The enormous packinghouses' orchards do not have enough fruit to satisfy demand by themselves [22].

### **Hydrocooling**

Once the avocado lots arrive to the collection center they are placed into a hydrocooling process where they are cold watered in order to get rid of any harvest waste and then are placed into a cooler [22].

### **Weighing and Washing**

After being into the cooler, avocados are weighed individually and placed into the washing line in which they are passed through a succession of colored brushes, each of which has a different purpose: the red brushes remove water, the black brushes polish, and the green brushes agitate. This process involves a single pass to sanitize the avocados [22].

### **Sorting and labelling**

This is a manual process, in which the workers take apart those avocados that do not meet with the specific quality requirements to be packed. Afterwards, each avocado is labelled according to its specific production line [22].

### **Packaging**

The avocados can be tray packaged, bulk packed, or bagged depending on the consumer. Avocados that have been tray- and bulk-packed are placed in boxes. This facility has a separate box formation room where the boxes are assembled before being flown overhead to the packing area, where a worker feeds the assembled boxes to the packing line. For the tray line, workers fill the tray with a certain amount of avocado and then pack them into boxes. In contrast, for the bag packing the avocados are packed by weight and by color; which a green color means organic avocados and the purple color, conventional avocados [22]. Likewise, avocados are classified as Premium, Class 1 and Class 2 according to a quality rate and it is performed by the worker who should have a previous training in terms of specifications. Moreover, it is also crucial that the packaging materials have a proper ventilation system in order to keep the fruit cool as much as possible.

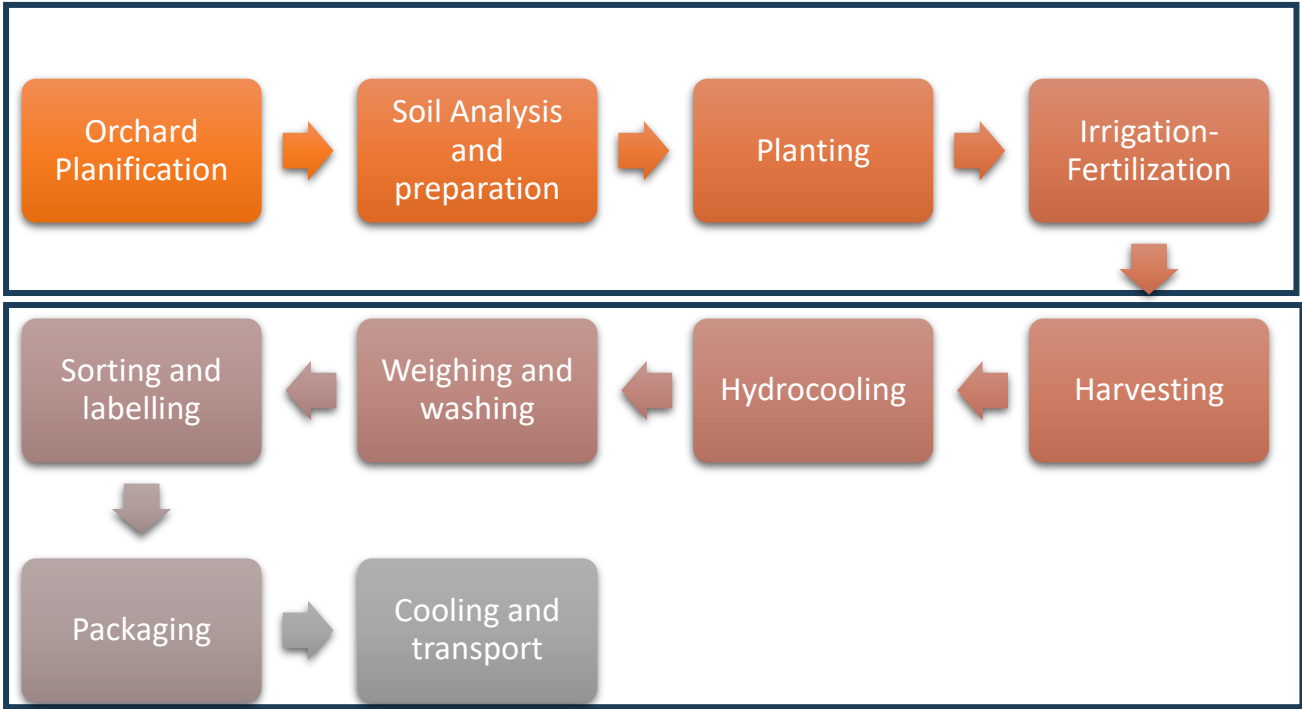
### **Cooling and transport**

The cooler is subsequently used to store the packed avocado pallets until further transportation and commercialization with its respective quality analysis according to the governmental norms of each country [22].

**Considerations to be taken into account throughout the manufacturing process**

- 1. **Sanitation of the harvesting tools:** it is recommended to keep them cleaned and sterilized, including providing a clean location during worker breaks [22].
- 2. **Analysis and controlling of the washing water system:** The avocados are constantly under the touch with water throughout the hydrocooling and packing procedures. Therefore, the water must be frequently inspected and changed based on the quality parameters [22].
- 3. **Postharvest controls:** The workforce has to pay attention to the storage temperature and the ethylene treatment in order to ensure an optimal conservation of the fruit. In regards to the storage temperature, the range varies according to the type of avocado to be on stock, therefore it is important to handle in the best way in order to avoid quick ripening from warm conditions nor hardness from hotter temperatures [22].

**Crops Processing**



**Within the Collection Center**

*Fig. 17 Avocado manufacturing*

**1.5. Nutritional Properties**

Because of their nutritional nature, they are a mainstay in many nutritious meal programs. Avocados are well-liked on lower-carbohydrate diets, such as those for diabetes as they are a rich source of fiber and have more healthy fat than bad fat. Their no blood raising fats make it



proper to low cholesterol diets. Avocado belongs commonly to vegan and vegetarian diets. Moreover, salads, bakery products, dips are made of it as its loose flavor which can be adapted to many recipes [23].

*Table II Components of the Avocado [23]*

Fat (Mostly monounsaturated)	240 Calories
Fiber (Mostly insoluble)	13 grams carbohydrate
Vitamin B	3 gram protein
Vitamin C	
Vitamin E	10 gram fiber
Vitamin K	
Folate	11 miligrams sodium
Potassium	
Magnesium	22 gram fat
Caretenoids	

Avocados contain various beneficial nutrients like carotenoids, monounsaturated fats, potassium, and fiber. These nutrients have been associated with a reduced likelihood of developing chronic diseases, especially when incorporated into a balanced and healthy diet. Avocado's nutritional profile aligns with dietary patterns that prioritize well-being, such as the Mediterranean and DASH diets [23].

**2. INTERNATIONAL AVOCADO MARKET**

The purpose of this chapter is to explain how the economical behavior of the avocado is throughout the global market in terms of production, exports and imports, demand and prices and the factors that have contributed to this dynamic.

***2.1. AVOCADO SUPPLY CHAIN***

As it happens in many industries, the avocado supply chain is composed by many actors and their relationships among each other in order to reach the end consumer. However, it is possible to trace an overall scheme of the supply chain of the avocado that can likely vary according to each country.

The main or first link players who cultivate and provide avocado to the market are the producers. Then, the local farmers offer their avocados to local collectors, who can be also farmers or even traders who collect this fruit from the villages and have the intention to sell it directly to wholesalers or even the end consumer by an informal market. Likewise, the farmer/collector can also have the option to sell through national fresh market, exporting with international agreements or the processing market at a fixed low price, then the main processing companies which can use the avocado as a raw material to produce other goods such as oils or



guacamole, acquire this fruit from either the national fresh market or the collector to sell them to the wholesalers which are renowned for making large-scale purchases with stronger financial and informational resources while they purchase a lot of avocados and ship them to terminal markets and the local market; such as the company called Battaglio from Italy which is in charge of importing and distributing avocado from the south hemisphere the whole year or **Westfalia fruit** . Afterwards, the retailers purchase and sell the produce in smaller quantities to more specific customers, which are at the very bottom of the value chain for fruit; they are persons or households who buy a variety of fruits for their personal use from local collectors, dealers, and producers. As the chain's last players, they can buy the fruits from various other chain participants. That either comes from the producers directly or via additional channel players like local shops and collectors [24].

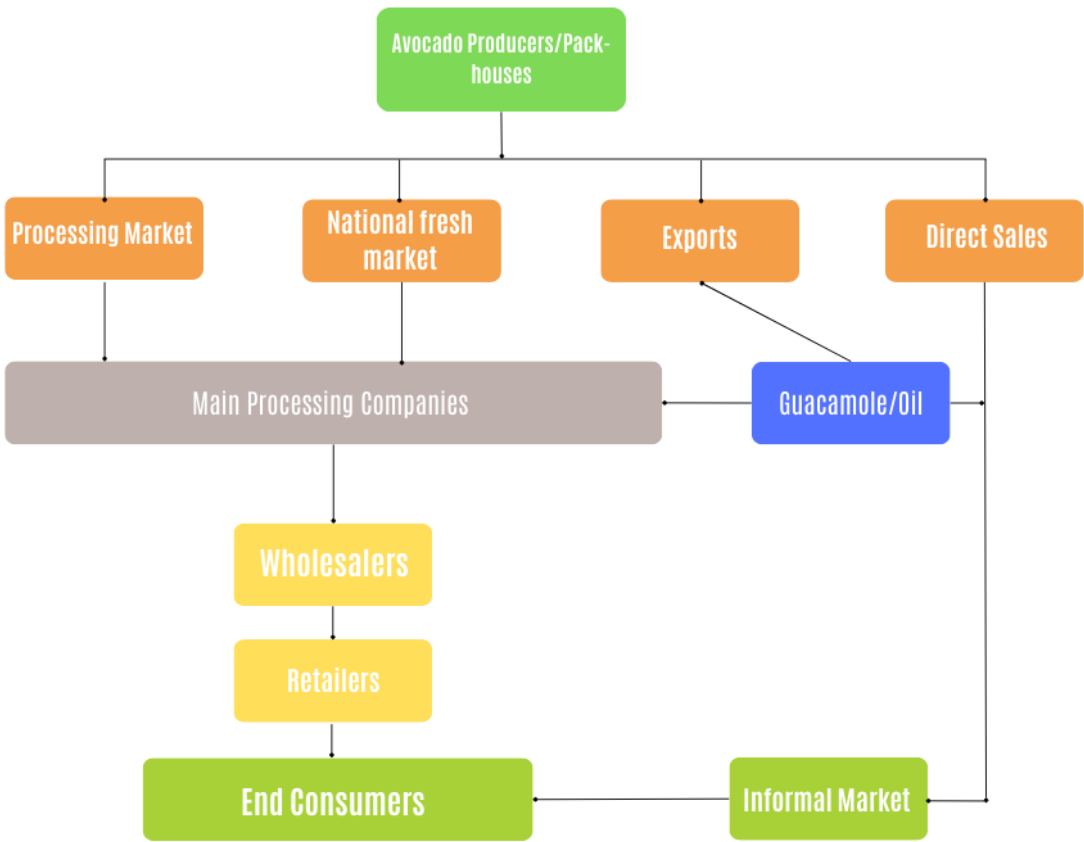


Fig. 18 Overview Supply Chain of Avocado Fruit [24].

## 2.2. Avocado Production

Avocados have gotten a well-ranked position during the last years and despite they are consumed worldwide, this fruit is only produced in few countries as they require a warm-tropical weather to grow, making it impossible to be produced in very northern countries. Therefore, the closer the country is localized to the equator, the more possibilities the avocado crop to survive, taking into account also other soil and cultivating requirements in order to supply the avocado crop with the best conditions.

According to the bar chart of the production worldwide from 2000 to 2021, it is possible to see that the produced amount has increased constantly as an overall passing from 2.71 million tons at the beginning of the century to 8.69 million tons in 2021 meaning an increasing of roughly 220% which could be considered as a boom in the production of this fruit due to the fact that has grown up more than twice in 20 years [25] Likewise, it can be seen that the production was increasing very slightly in the first 6 years followed by small drops in 2007 and 2008, then the amount of avocado produced was expanding strongly with a compound annual growth rate (CAGR) of 7 %; during that time, favorable prices and returns contributed to the growth of production in important regions [26].

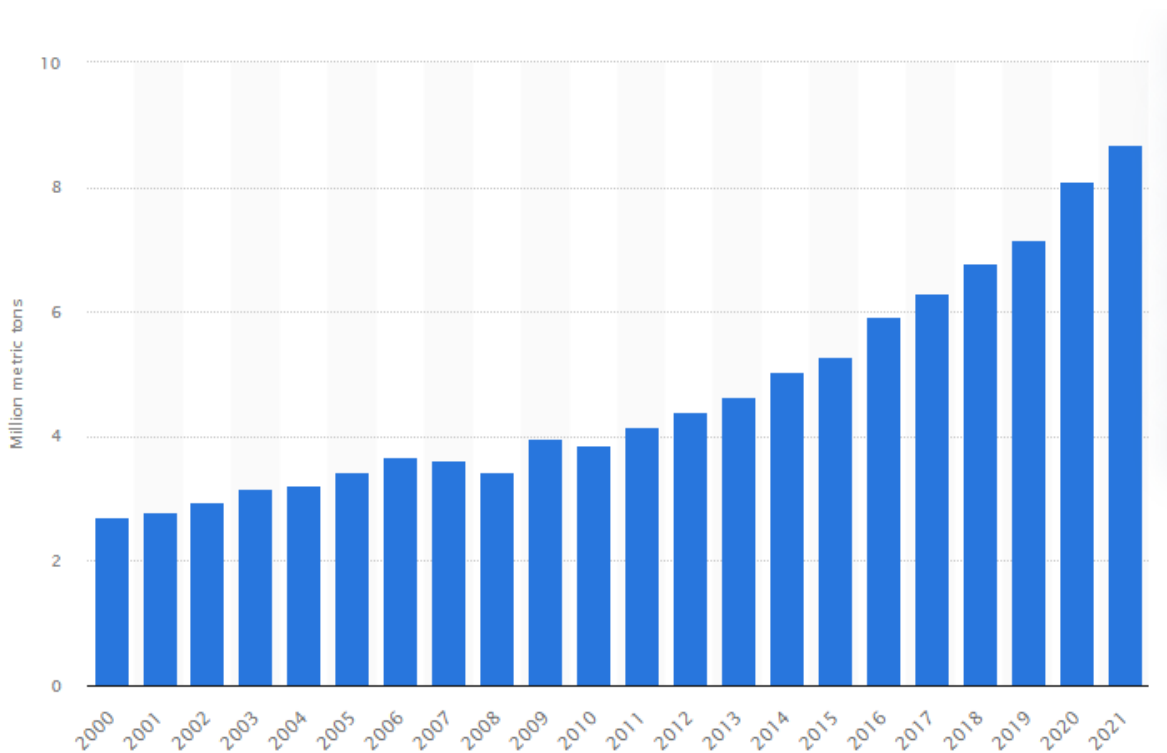


Fig. 19 Worldwide avocado production from 2000 to 2021 [25]

When it comes to the production by country in 2021 year, it can be stated that the top leader of avocado production with a great difference is Mexico with 2442,94 tons grown in the country which an accountancy of 30% of the global market output at a CAGR of 6% followed by Colombia with 979.62 tons with a 12% market share at higher CAGR of 15% followed by Peru and Kenya with its production growth of 12% and 11% with a market share of 9% and 6%

respectively [26]. In fact, this supremacy of Mexico comes from the essential fact that it is where avocado were born taking part of the Mexican lives throughout many centuries. Likewise, due to the increased demand of its border neighbor United States where an average American passed from eating 1.5 pounds of avocado per year to 5 pounds as well as the European people who consume 1kg per capita per year which is 150 times higher than the amount consumed in 2008, therefore Mexico and even the other manufacturing countries were forced to produce more in order to cover this increasing demand [27]. Moreover, places such as Michoacan have perceived 2 million US dollar to maintain and ensure the production requirements, meaning a government commitment.[28]. In terms of Colombia, the Department of Agriculture has explained that the area dedicated to the cultivation of avocado has abruptly increased to 126% because of the global demand, the opening of new markets, the high expectations and positivism in this markets accompanied by the improvement of the productive processes of this supply chain [29].

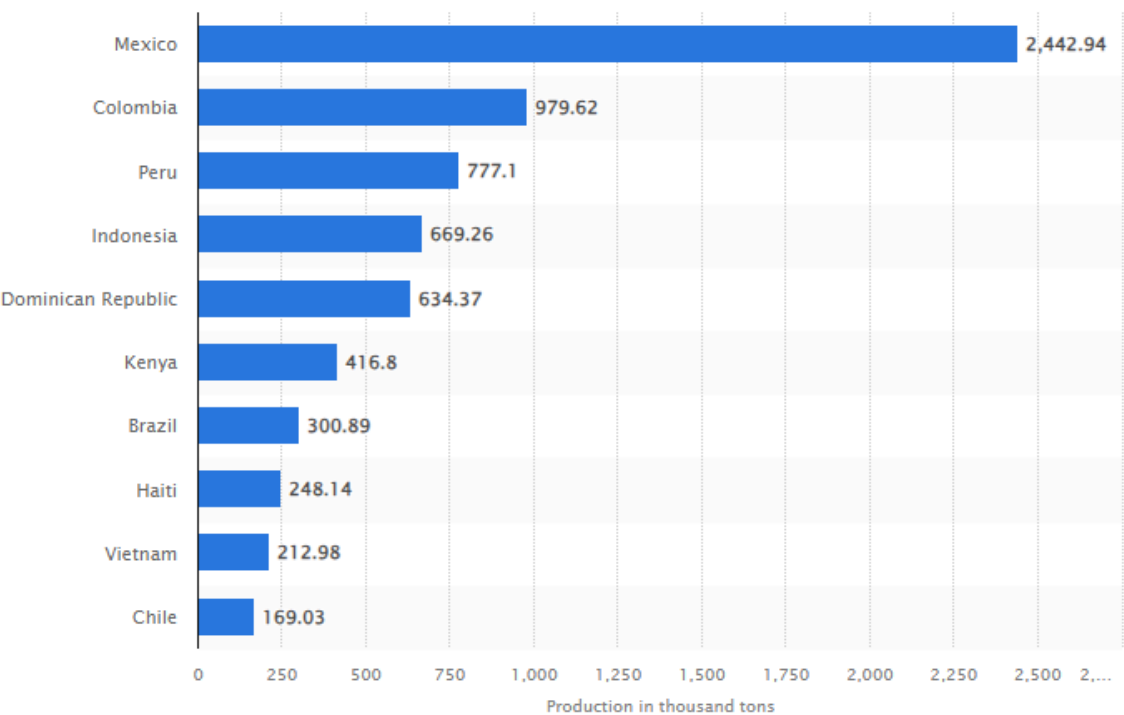


Fig. 20 Avocado production by country [25]

The largest producers of avocado (>300.000 tons) in the world are in decreasing order Mexico, Colombia, Peru, Indonesia, Dominican Republic, and Kenya. The common thing between these countries is that all of them are located near to the equatorial line making them suitable to cultivate avocados because of its proper warm climate and huge water resources regardless of the continent they are on.

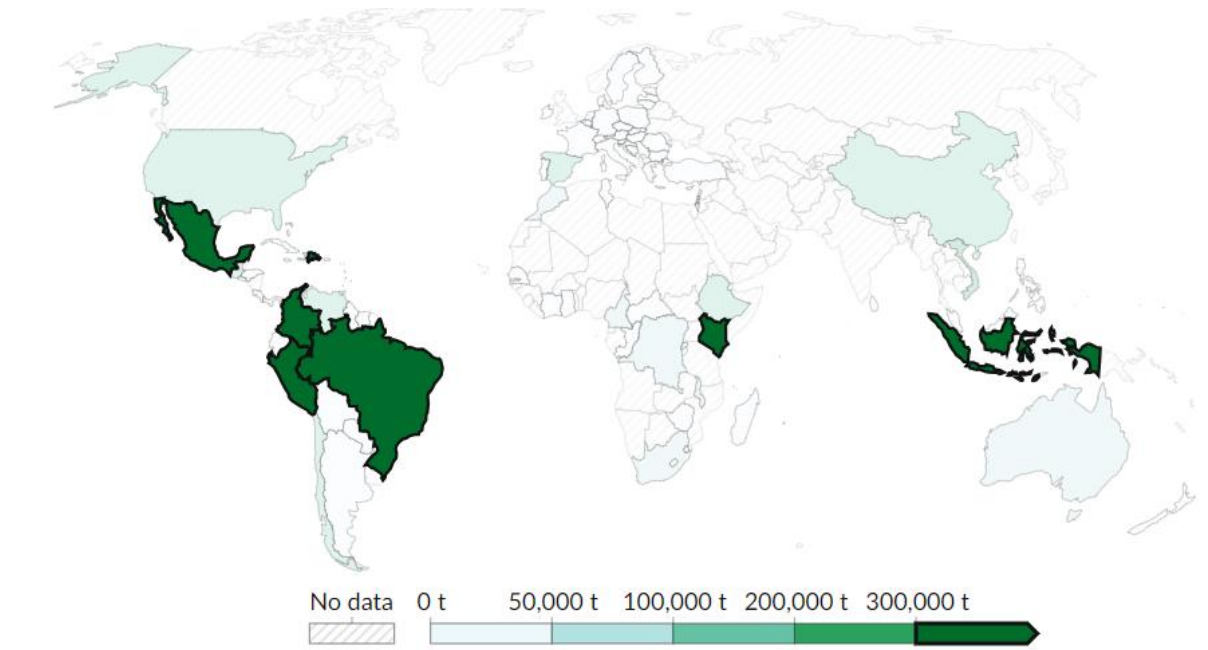


Fig. 21 Top largest avocado producers worldwide [26]

As it was previously said, Mexico has been the largest producer of avocado worldwide and it has had a steady growth, followed by Colombia which start to increase its production rapidly from 2017 year due to its efforts and investment from the government to the farming sector. Peru, which has experienced a rather constant growth and where the government has implemented certifications to small farming villages in order to increase the total production to supply the global demand with the established requirements [30]. In the Asian case (Indonesia), the trend is similar to the previous one, in which the farmers started to be part of the avocado producers in order to supply the global demand focused on the Asian region as well as due to the fact that farmers were looking for new way to generate incomings [31]. On the other hand, one of the possible reasons to explain why Dominican Republic reached up a valley in the production of avocado is because of land constraints as they are an island with no so many hectares to dedicate to avocado exclusively. In Kenya, the production boom started in 2005 when the European Union demand began to rise as high rate of health conscious making that Avocado accounted for 84.48% of Kenya fruit export revenue [32].

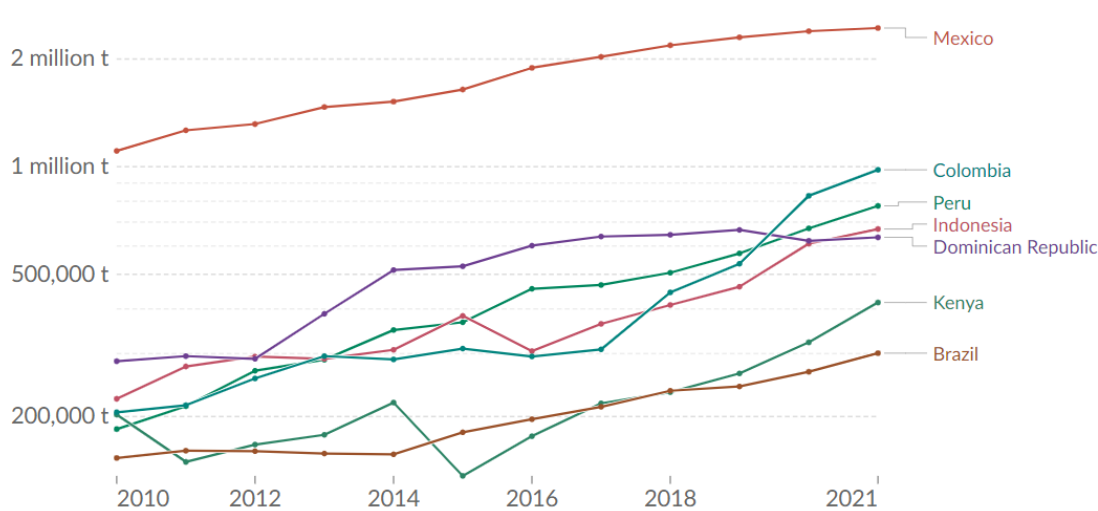
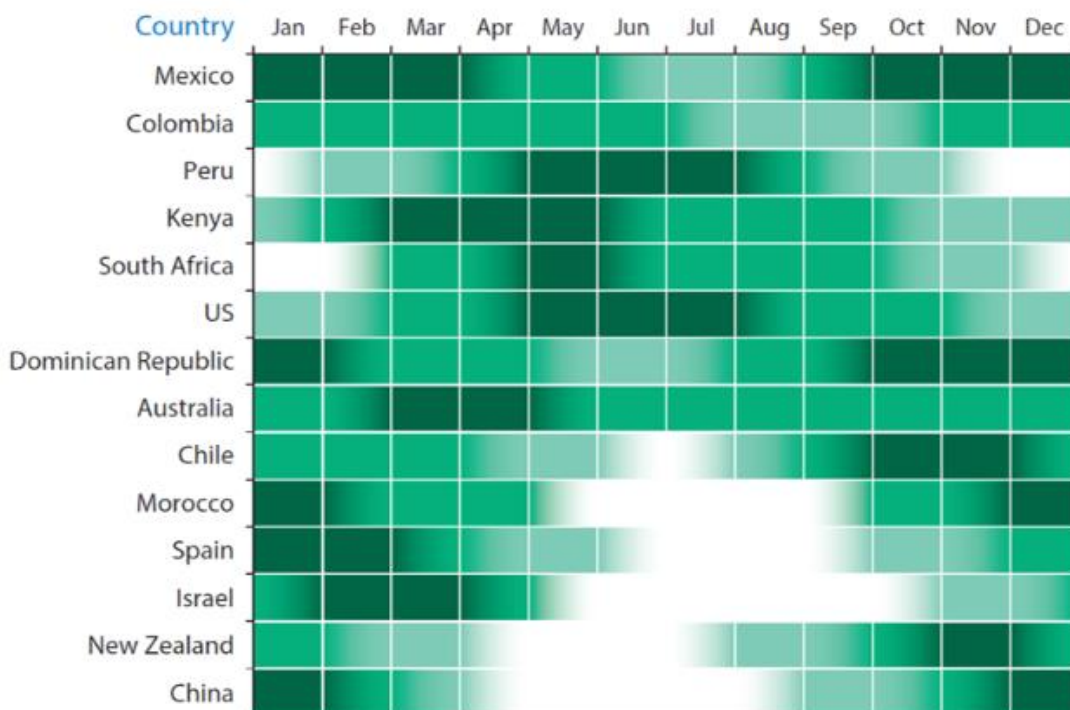


Fig. 22 Timeline of the avocado producers [26]

Furthermore, based on the diagram displayed below it is possible to analyze that these 7 countries due to its geographical location and their climate conditions are able to cultivate and harvest avocado throughout the whole year which means exports and incomes during all the year without stopping and supplying the EU and US steadily; different from countries such as Spain, New Zealand or even China which experience seasons and for them it is difficult to produce in a specific period of the year,



Source: Hass Avocado Board, Rabobank 2023

Fig. 23 Avocado Harvest of each country [26]

## 2.3. EXPORTS AND IMPORTS OF AVOCADOS

### EXPORTS

As it can be evidenced in the area chart that the exports situation has been increased constantly. In fact, according to World's Top Export researches, the value of avocado exports per country worldwide reached up \$7.27 billion in 2021. This sum reflects a growth of on average 28.5% for all avocado exporters from \$5.66 billion in 2017. Likewise, as a result of the reduced impact of COVID-19 on the international fresh fruit markets from 2020 to 2021, the value of avocado exports increased globally by 13.2%, reaching \$6.42 billion in 2020. However, the amount of exports worldwide felt 5% in 2022 although the rapid increments in exports from countries such as Peru, Kenya, South Africa [26]; indeed, this situation according to the Food and Agriculture Organization of United Nations can be explained by adverse weather conditions in Mexico (a catastrophic storm that took place in June accompanied by a long drought in most producing areas), causing its exports to be reduced by 16.2% (200.000 metric tons) in 2022 dropping to 1.2 million metric tons [33].

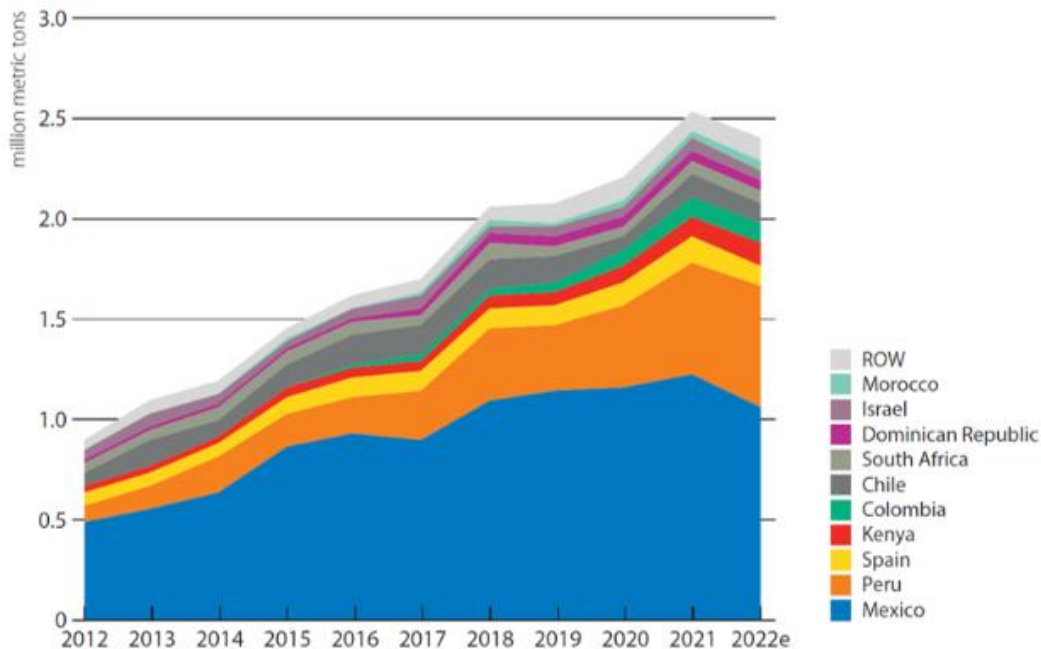


Fig. 24 Global avocado exports over the decade [26]

In 2021, the largest exporters of Avocado were Mexico (\$3 billion) followed by a huge difference Netherlands (\$1,2 billion) and Peru (\$1 billion); these only three countries accounts 71,4% of the total market share value; other top exporting countries are Spain and Chile with \$462 million and \$213,8 million respectively. Compared to the export value of 2020, South Africa, Colombia, Peru, and Kenya were the fastest-rising up avocado exporters among the leading countries in 2021, with growth rates of up to 43.7%, 40.1%, 38.1%, and 20.5% respectively [34]. Summarizing, Mexico, Peru, and the Netherlands jointly represented 75% of the total global avocado exports and stood as the top three countries in terms of export value. Following behind, Spain, Chile, Colombia, the United States, Morocco, Kenya, South Africa, and the Dominican Republic collectively contributed 17% of the global avocado exports [35]. In the Colombian case, it can be considered as the newest avocado exporter guided to be the “Plan B” for the USA market, passing from the position eight in 2018 to the sixth one in 2022

thanks to the new young orchards cultivated by its investors looking forward to the next decade. One of them is Westfalia Fruit which has planted 100.000 and pretend to be one of the main competitors of Mexico in the American market [36].

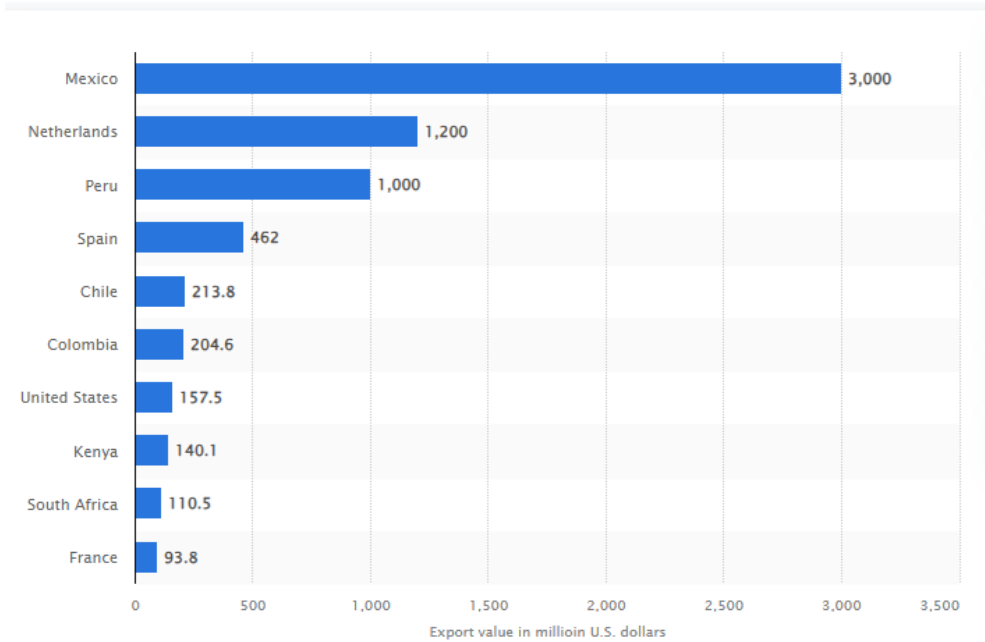


Fig. 25 Avocado Exportation of each country [25]

According to the report from TRIDGE in regard to the main avocado trade flows worldwide, it is possible to say that the three most important avocado trading flows worldwide are:

- 1) **Mexico-United States:** Being Mexico the largest cultivator and exporter of avocado in the world and US as the most important importer worldwide, both countries have traded \$3.01 Billions in 2022. The amount of Mexican avocados shipped to the United States grew increased four times between 2010 and 2020, from 229,890 to 925,218 tonnes, with 2012 seeing the largest percentage growth, up 38.1% from the year before. Meanwhile, the Mexican exportation of 925.218 tons to the American territory meant the great figure of 34.5% share in world avocado exports. Throughout the year, this nation imports Mexican avocados, primarily at the end of the year and at the beginning of the following one, but these shipments decline between April and September, when local output in the United States increases, with California as the primary producer. It also important to highlight that a Mexico also ships great amounts of avocados to Canada and Japan being the 4<sup>th</sup> and the 10<sup>th</sup> most relevant commercial flows respectively [35].
  
- 2) **Peru-Netherlands:** Despite Peru is the fourth largest producer of avocados, it is the second largest exporter in the world and the first one in South America. Over the past several years, the volume of avocados shipped from Peru to the Netherlands has incredibly grown. The amount shipped to the Netherlands rose up by 5 from 2010 to 2020, from 26,570 to 137,299 tons, with 2018 showing the most percentage growth of 50.7% over 2017. Additionally, Peru also exports substantial quantities of avocado to the US and Spain representing the 5<sup>th</sup> and 6<sup>th</sup> most important flows [35].



3) **Netherlands-Germany:** Although avocado shipments from the Netherlands to Germany were the third largest in terms of volume in 2020, they came in second in terms of value, with 342 million dollars, greatly outpacing the 254 million dollars in exports from Peru to the Netherlands. It is crucial to highlight that the Netherlands does not grow avocados locally. Consequently, its supply to Germany and France, make it ranks as the seventh-largest exporter based on the re-exporting process from other nations such as Peru, Therefore, Netherlands serves as the primary distributor of this product in Europe [35].

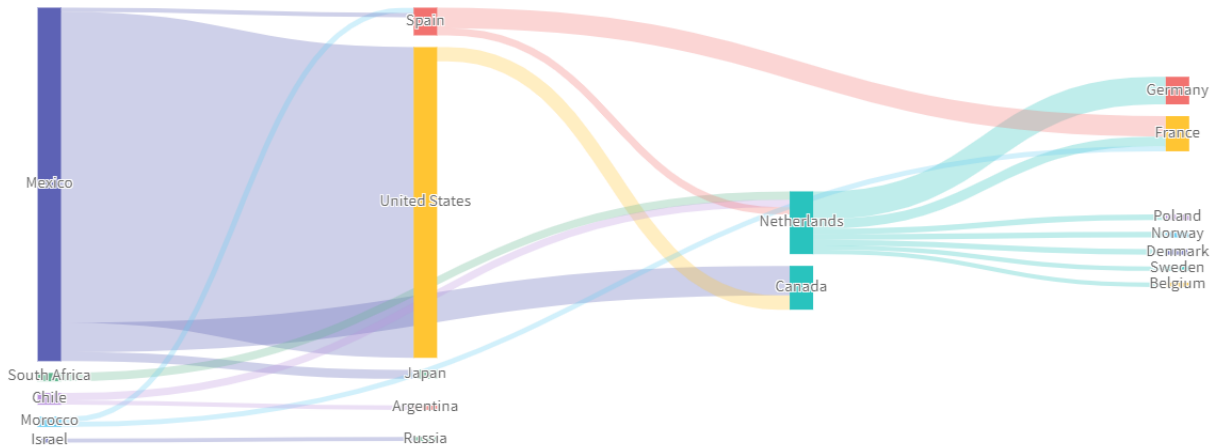


Fig. 26 Top Export flows [36]

## IMPORTS

In contrast, it is possible to observe that the main importers are those ones which are not part of the top producers at all. As previously said, United States acts as the solely main importer worldwide with a value of \$3,389.39 millions representing 42% of the total imports, being Mexico its largest exporter, followed by Netherlands that acts not only as importer (flows from Peru and Chile) but also as distributor in the European Union to countries such as France and Germany. The most recent data and figures show that, in 2022, worldwide avocado imports decreased by 7% to 2.4 million metric tons. Although the United States and the European Union accounted for 45% and 28% of all imports in 2022 respectively, there was an ineffective exporting process from Mexico due to its inadequate weather conditions that caused limited international trade activity [33]. Between 2012 and 2022, the United States witnessed a consistent annual growth in avocado imports, averaging at a rate of +13.6%. Notably, the Netherlands and France experienced the most substantial average annual rates of import growth among the other importing countries, with rates of +17.1% and +10.2% respectively [35].



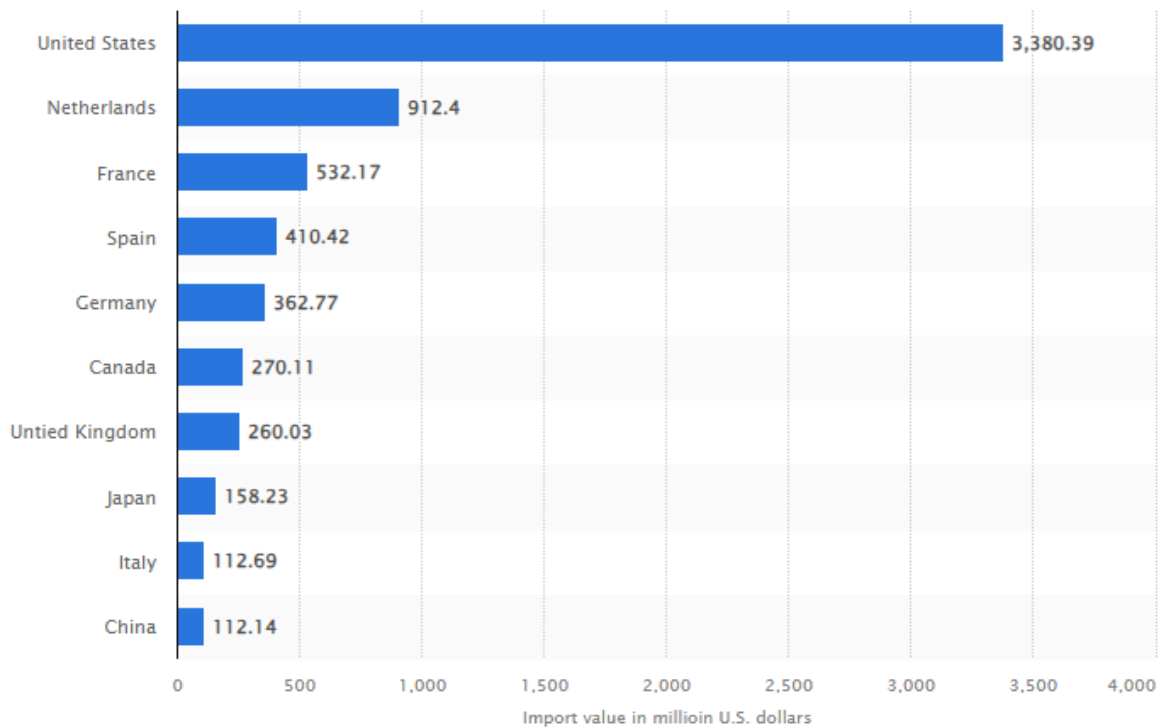


Fig. 27 Import value in million U.S. by country [25]

When it comes to the perspective to the following decade about the imports it can be seen that the imports are expected to grow up as an overall, therefore the production of avocado is expected to rise up as well in order to cover these forecasts. Reports suggest that by 2030, the United States and the European Union are expected to maintain their positions as the leading global importers of avocados, with projected shares of 40% and 31% of all imports, respectively [34].

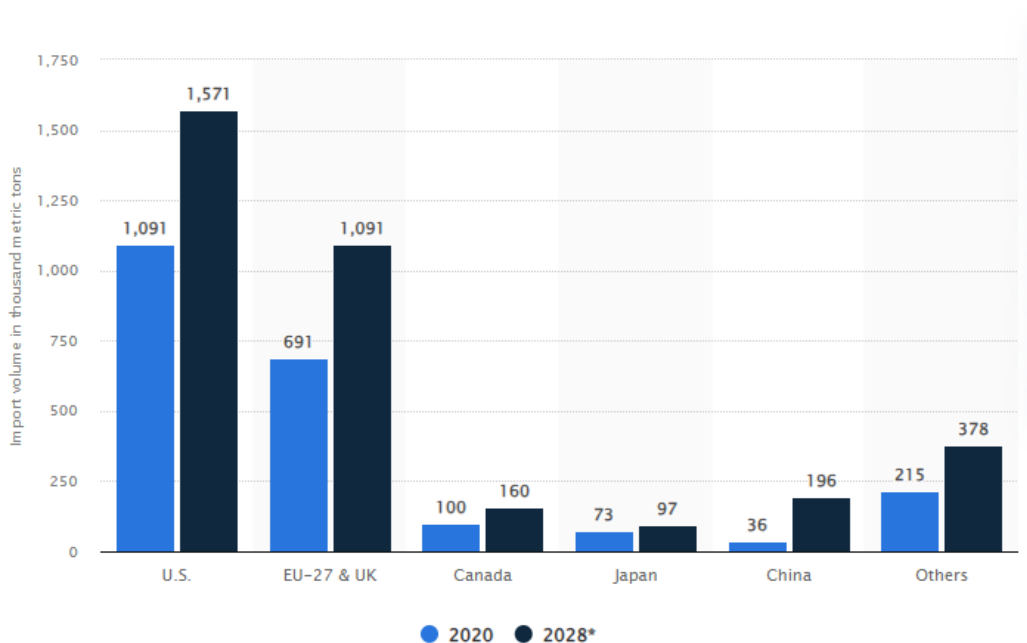


Fig. 28 Forecast of importations by 2030 [34]

## 2.4. Avocado Demand

The worldwide demand for avocados is on the rise, driven by an increasing consumer awareness of its health benefits and its widespread availability in the market thanks to the efforts of the producers around the world. The global avocado industry has experienced a significant boost due to the growing health consciousness among consumers, who perceive avocados as a superfood rich in omega-3 fatty acids and various other essential nutrients. Avocado stands out as one of the top nutrient-dense foods per serving, with a rich content of fiber, folate, potassium, vitamin E, and magnesium. Furthermore, the expanding food retail sector, along with the introduction of various avocado-based products such as dips in fast-food chains, has contributed to the increased demand for avocados in continental and other cuisines served in restaurants [39]. As it has been analyzed previously, the avocado demand/consumption has been increasing throughout the years as well as the exports, imports, and production. From the beginning of the century to the year 2012 it can be seen a slightly increase, followed by a rapid growth rate from year 2013 to nowadays. The avocado consumption in 2000 and 2021 was 2,71 million metric tons and 8,69 million metric tons respectively, meaning a huge increment of 221% in a timeframe of 20 years.

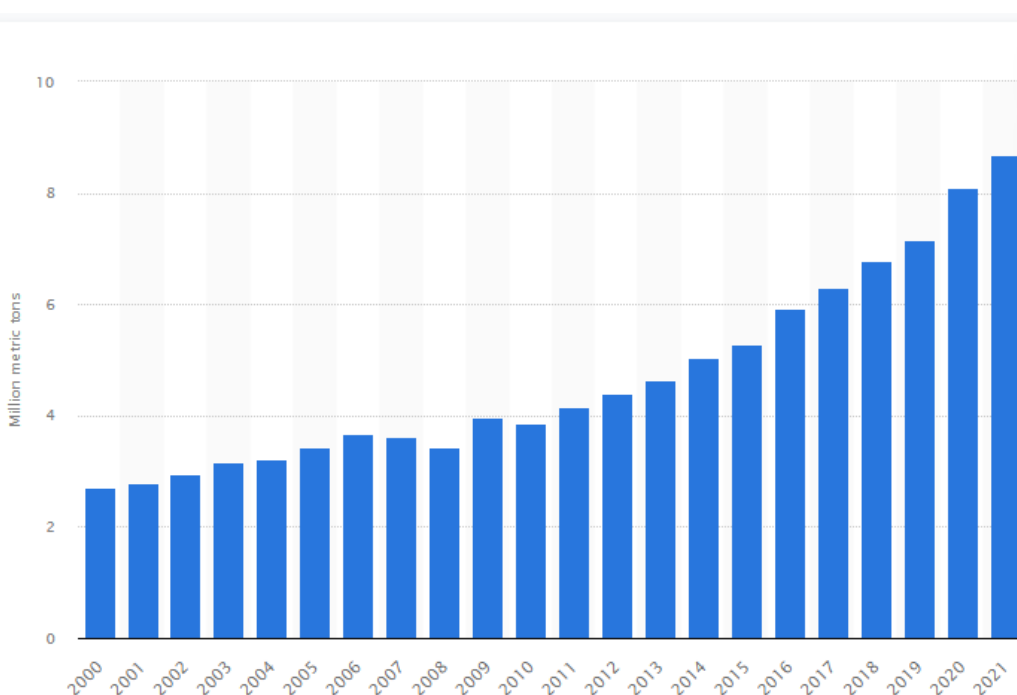


Fig. 29 Avocado demand worldwide [40].

In regard to the US, the avocado consumption passed from 220.000 metric tons in the year 1985 to 1.37 million metric tons in 2021 which means an increment of 522%. In contrast, the avocado market in Europe has grown five times reaching up a figure of 667.000 metric tons from 2013 to 2021. In terms of the avocado consumption, in Europe a person consumes 1.15 kg on average annually, but this only represents nearly one third of how many an American person would consume annually due to in US there is a consume per capita of 5 kg [40].

If a further look is taken in the European context, it is possible to say that the highest consumption in the avocado markets comes from France which 148.965 metric tons in 2021 followed by Spain (which is considered as a distributor as well) with 113.617 metric tons and UK with 107.662 metric tons in 2021. Germany, Italy, and the Eastern European countries still have a lot of promise in the upcoming years, even though the growth in several of these top consuming nations is slowing down. Many of these nations receive their supplies from Dutch traders [40].

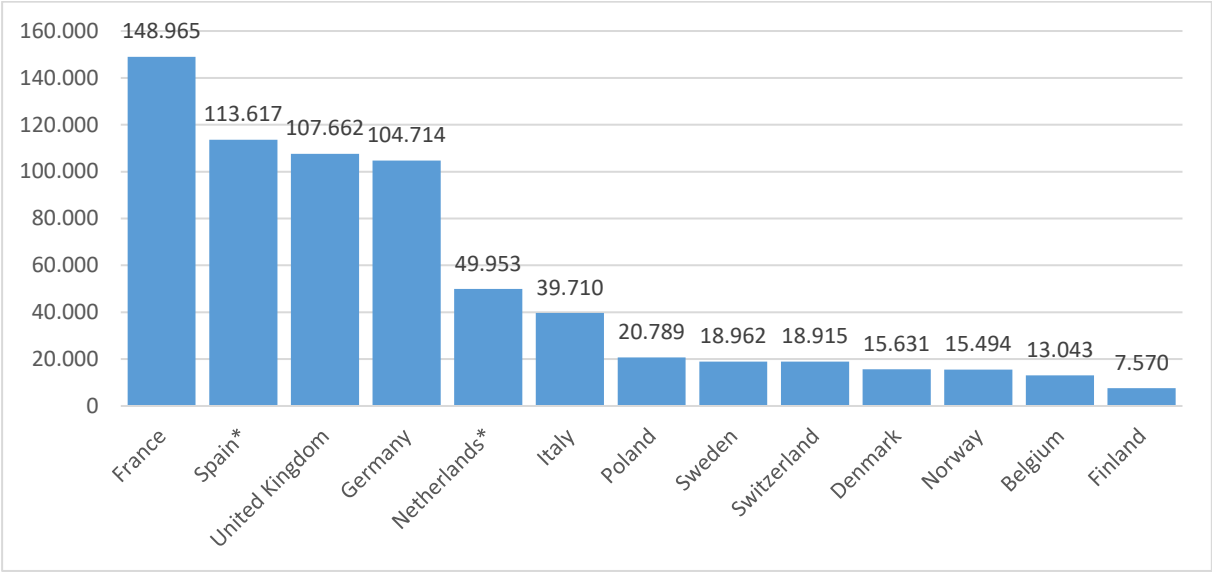


Fig. 30 Avocado consumption in tons by each European country[40].

However, although Norway is considerably behind in the total consumption (14.494 tons), it accounts the highest consumption of avocado per capita with 2.87 kg meaning that its inhabitants are those ones who eat more avocados per person annually, closely followed by Netherlands (2.85kg) and Denmark. In fact, people from the Scandinavian area (Norway, Sweden, Finland, Denmark) has been well attracted to this product representing a considerable part of the top consumers in Europe. The data regarding Netherlands and Spain is not totally reliable due to these countries also acts as producers (Spain) and distributors causing misunderstanding in the product flows. It is expected that the demand for avocados will grow in both the U.S. and the European Union, driven partly by their expanding use in the food industry as well as in the cosmetics and pharmaceutical sectors. Avocados are being utilized in various ways within these industries, presenting new economic prospects and opportunities for further market growth [40].

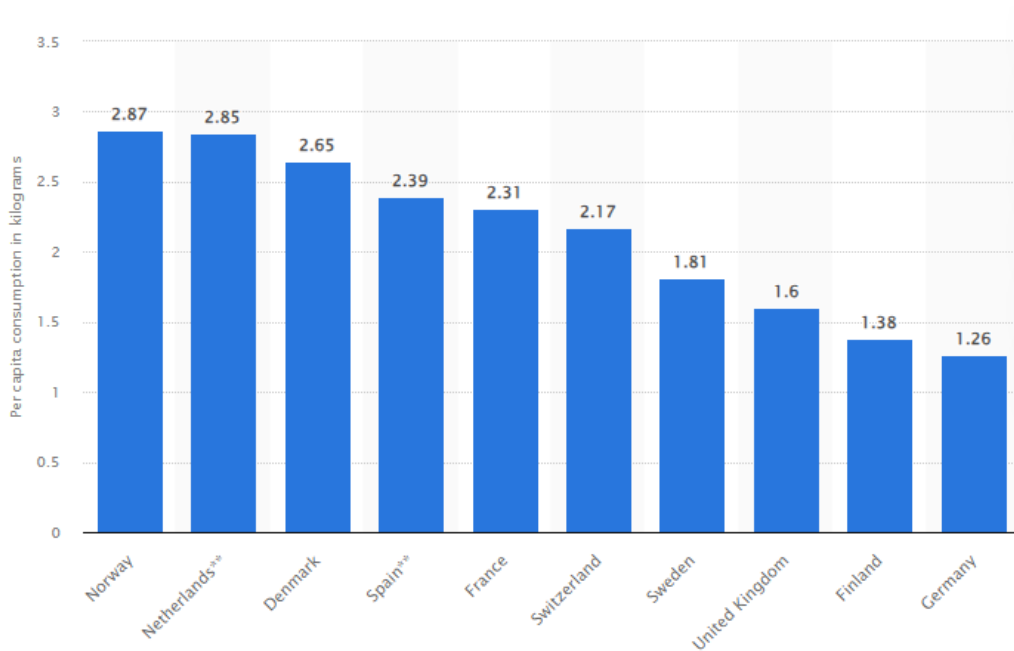


Fig. 31 Consumption per capita by European country[40]

According to the bar chart displayed below, it can be observed little consumption increments in countries such as UK, France or Germany and little consumption decreasing rates in Scandinavia. However, the really surprising aspect comes from Italy which has increased its consumption from 2020 to 2021 by 37%, meaning a huge consumption boom in regard to this tropical product. In spite of this abrupt growth in the consumption, the Italian consumption keeps being very low compared to its population amount (less than 700g per capita) and far less than the rest countries of Western Europe on average. The reason is that Italians continue to eat traditional fruits and vegetables as before, therefore it takes time to launch “exotic” products like avocados. Notwithstanding, people are becoming more and more concurrent consumers of avocados such as the Hass type. The mean distributor to Italy is Netherlands which trades the 90% of the Hass type in Europe [40].

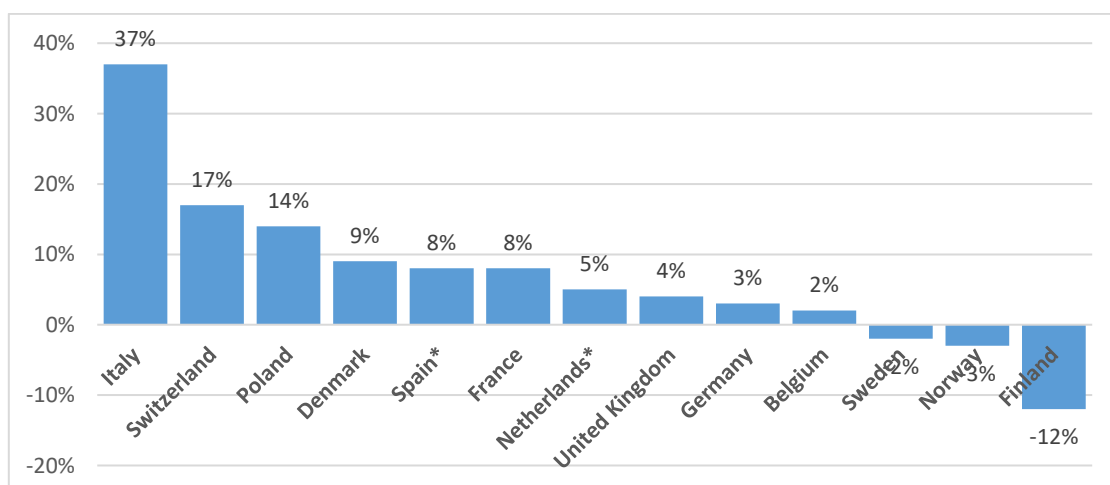


Fig. 32 Consumption growth of avocados in Europe between 2020 and 2021 by country [40]

According to a report published by Shabandeh on the Statista portal about why consumers buy avocados in 2021, the majority of the grocery shoppers choose them because they think they are useful for the people health and for its good fats content with 79% and 73% respectively, meaning that this fruit is chosen due to its healthy characteristics rather than for its taste [41]

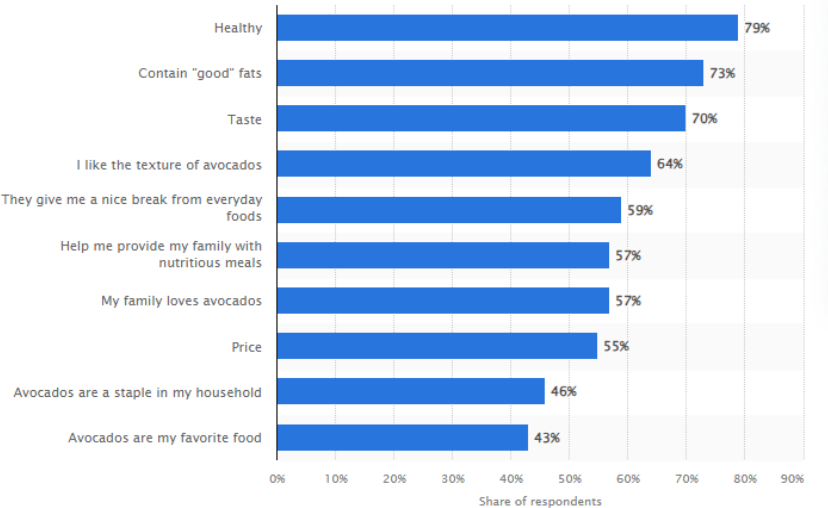


Fig. 33 Main drivers for consumers of avocados in 2022[41]

On the other hand, according to another report about why people prefer not to buy avocados, the 74% of people would not buy them because of its high prices followed by four reasons related to its ripeness that people do not like. Therefore, grocery shoppers do not purchase avocados mainly for its commercial price or for its physical conditions [42].

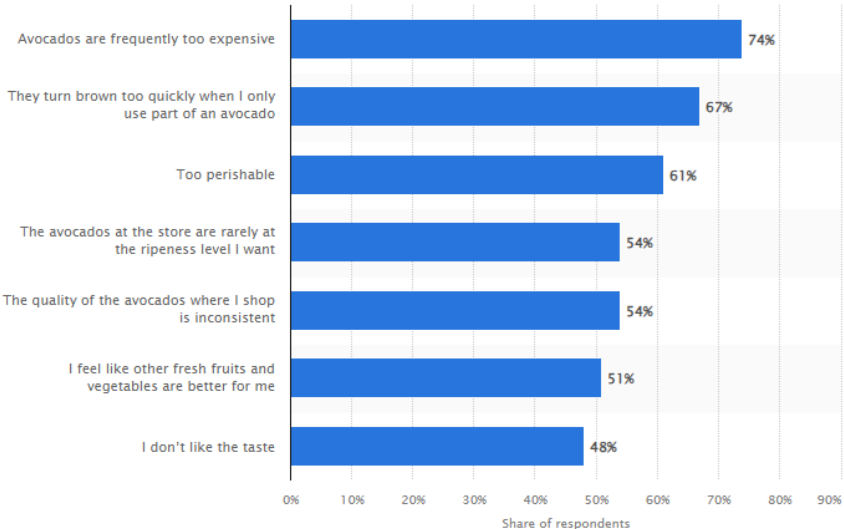


Fig. 34 Main barriers for consumers when buying avocados in 2022 [42]

## 2.5. Avocado Pricing and market value

According to the bar chart displayed below the avocado market has a value of \$13.97 billion currently and it is expected to rise up gradually throughout this decades reaching up a figure of \$26,04 billion by 2030 which means a difference growth of roughly 86,4% compared to the current value increasing at a CAGR of 7.3% from 2023 to 2030 [43].

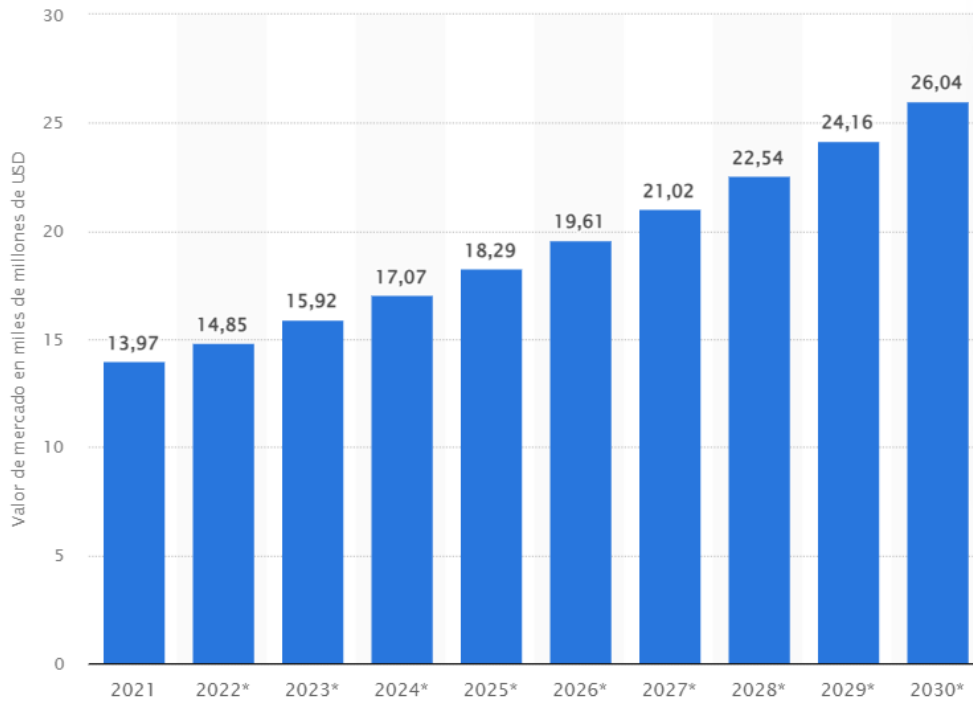


Fig. 35 Avocado market value worldwide from 2021 to 2030[43].

In the matter of the avocado market share by country, it can be noted that US accounts the half of the market share followed by Europe with the 31%, therefore between these two areas accounts practically most of the avocado market, largely related to the exporting and importing situations explained previously. Moreover, the Latin American countries accounts only 3% of the market share although they are the main producers worldwide implying that the avocado fruit is a product with high exporting conditions [44].

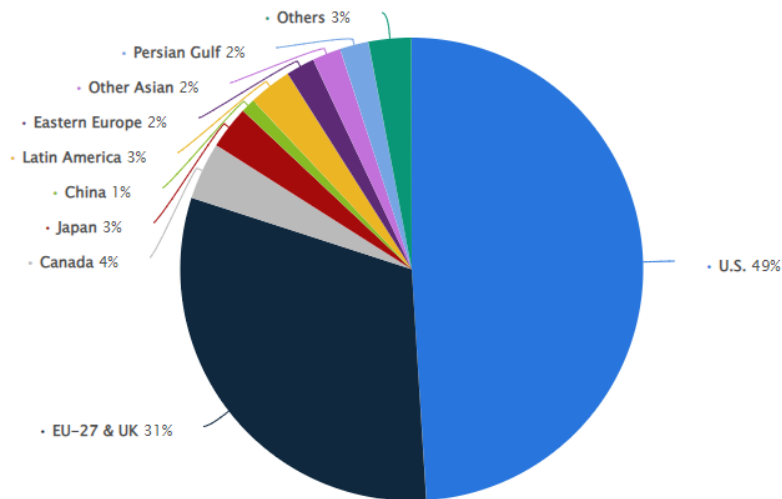


Fig. 36 Avocado market share by country [44]

Additionally, the trading of avocado into the market is mostly dominated by the business-to-business relationship accounting roughly 80% and the rest by the business-to-customer relationship. It is important to highlight that the B2B segment considers the processing industry and the foodservice industries and expected to rise at an 8.3% in the following years whilst the B2C channel can be divided by the supermarkets, small local stores, e-commerce, specialized and retail stores. In fact, with changing dietary preferences, consumers are increasingly willing to invest in a diverse array of high-quality products that are fresh, secure, and convenient. To capitalize on this trend, retail outlets which belong to the B2C sector are expanding their offerings of ready-to-eat fruits and pre-cut items, aiming to enhance sales. These stores play a vital role in influencing the presentation of fruits and vegetables, thereby shaping consumer choices and preferences. Moreover, because of its nutritious qualities, avocado is growing in popularity. Customers are choosing more nutritional meals including sandwiches, salads, and healthy chips like avocado chips at cafes and restaurants because of greater health consciousness, particularly among the youthful population [45]. Some of the key players that highly influence the avocado market are West Park Avocado, Del Rey Avocado, Westfalia Fruit with annual revenues of \$14 million, \$18,1 million, and \$43.3 million respectively.

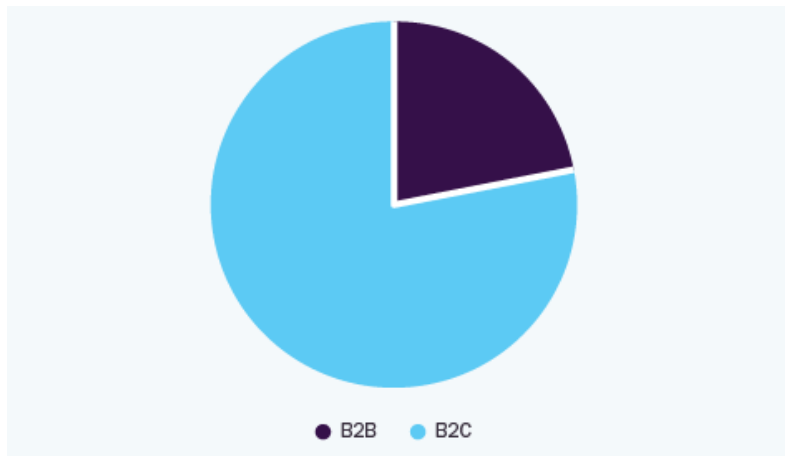


Fig. 37 Global avocado market by distributor in 2022 [44]

When it comes to the pricing behavior about the avocado, it is possible to observe, based on the line chart below, that the price (USD/kg) has not been stable year after year during the last 20 years. In the first five years the price was roughly \$1,74/kg, reaching its minimum at \$1,13/kg in 2005, then in 2010 experienced a considerable increase to \$2,75/kg meaning a growth of 91% compared to the previous year. Then, from 2011 to 2015 the avocado price was \$2/kg approximately followed by a peaks-and-valleys behavior until reaching up a value of \$3,22/kg currently. The current price has increased 130% approximately compared to the year 2000. Experts from Wells Fargo Agri-Food Institute state that prices for avocados are determined by supply and demand laws as it happens in the other goods industries. In 2019, a shortage in the Mexican supply due to poor weather conditions accompanied by a short crop in California made the avocado price to increase passing from \$2,18/kg to \$2,97/kg. One of the most affected players in the B2B model for the high prices are the restaurant which have been forced either to cut earnings from their dishes (due to very fluctuating prices do not give so much response time to change Menu presentation) or to temporarily remove avocado from their menu [46].

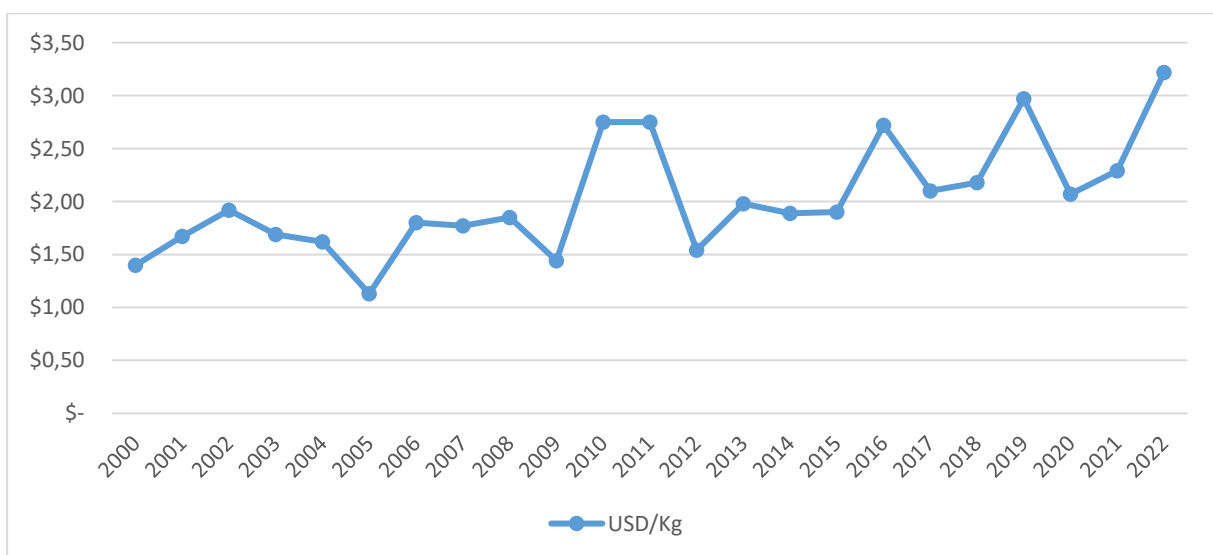


Fig. 38 Avocado Price per kg from 2000 to 2022[46]



### 3. Most important companies in the international market of avocados

After analyzing the overall market of the avocados, it is essential to study the most important key players of the Avocado market worldwide. In fact, knowing about the leading companies in this sector provides vital insights into the dynamics of food production, distribution, and consumption. Likewise, it provides a better understanding of who is practically dominating the market and how it is driven to. Additionally, a comprehensive understanding of key players within the avocado economy provides information about what they are doing currently in order to be more sustainable on its agricultural practices and how they are facing the climate change dynamic due to their ecological footprint is as much large as their economic activity. This analysis also consider the some financial data and a brief summary of each company. It is important to note that the analysis of each company will depend on the information availability.

#### 3.1. Westfalia Fruit

Westfalia Fruit is a leading global provider of fresh fruits and associated goods to the worldwide market. They participate in the whole avocado supply through its all vertical integration; taking part in the cultivation, the ripeness, the packing process and distribution during the whole year in order to ensure the avocado quality and its availability. All of the main avocado-producing regions—southern Africa, Chile, Colombia, Peru, Portugal, the United States, and India—cultivate the avocado of Westfalia. Moreover, they are recognized as the company with the largest avocado-growing footprint worldwide, being an important supplier for both wholesalers and retailers located in Europe, North America, Latin American and Southern Africa. Additionally, Westfalia Fruit has started to more fresh products such as: mangoes, citrus, cherries, apples, grapes accompanied with an improvement of both the manufacturing capacities and effectiveness enlarging the brand recognition, and particularly in markets where exist a high demand for fresh fruits. Likewise, they own several accreditations which vary from BRC and HACCP to Sedex, GlobalGAP, and IFS ensuring a high-quality product, the sustainable and responsible management in terms of bio resource as well as the communities implied. Apart from the supply chain of fresh fruit, Westfalia Fruit also produces avocado oil, avocado guacamole, dried mango, avocado oil mayonnaise and macadamia oil mayonnaise [48].



Fig. 39 WestFalia Logo[49].

In 1929, Westfalia Fruit was bought by the geologist Dr Hans Merensky who removed invasive plants and restored native plant species to regain the overgrazed and poorly maintained property. He experimented with a variety of ecologically friendly farming techniques during his lifetime, including composting, and the company's environmental ethos has been maintained ever since due to the success of these projects [48].

In order to include a member to its grower association, the Westfalia Technological Services (WTS) and the R&D department select and evaluate both the avocado and the mango type to identify choices that satisfy particular requirements established by Westfalia's overall plan. Once they meet the proper requirements, the material is legally protected and the licensed growers can start to produce by the support of the technical staff while marketers are assigned to ensure earnings to the producer [48].

One of the examples of sustainability regards a launch of a 100% plastic-free bagged avocado program developed in USA. Furthermore, Westfalia Fruit has become the pioneer fresh produce company to partner with CIRT, an easily accessible QR code that offers location-specific, real-time guidance in terms of the composting and recycling potential of its packaging. This collaboration demonstrates the high commitment of company on promoting sustainable practices and empowering consumers to make informed, eco-conscious choices regarding waste management. Last but not least, a sustainable goal of Westfalia is to generate zero waste to landfill by 2025 and a carbon neutrality by 2030 followed by a measurement of lifetime carbon footprint by 2049 [49].

When it comes to Westfalia Fruit Colombia, in 2014 this company performed the first exportations of avocado hass to Europe and nowadays they own two packaging plants located in Rionegro and Sonson (Antioquia) with a total of 500 hectares for own production and development and 1500 additional ones coming from allied producers. Westfalia Colombia is increasing considerably its exportations passing from 10.000 metric tons in 2020 to 16000 in 2021 meaning a growth of 60%. Similarly, this company accompanied fruit suppliers in affected areas of the eastern Antioquia by the conflict and violence prioritized in the scheme of good agricultural practices with social responsibility, thus Westfalia has been one of the key players for the succeed production and exportation of Colombian avocados worldwide being the most important exporter of avocado hass in this territory.

Westfalia Fruit has huge expectations to expand its production worldwide by a funding of US 300m from three banks \_ (HSBC UK, International Finance Corporation (IFC), and a Standard Bank) with the purpose of increasing its avocado production at its existing supply chain facilities whilst expanding through new markets [51].

According to the data available for the Westfalia Fruit Uk Limited, it is possible to observe that the EBITDA experienced a cycling behavior of increases and decreases related to certain periods of large investments in order to expand its production capacity as well as its good offerings which affected the earnings the following years, however the EBITDA has increased 82% from 2013 to 2021 [52]

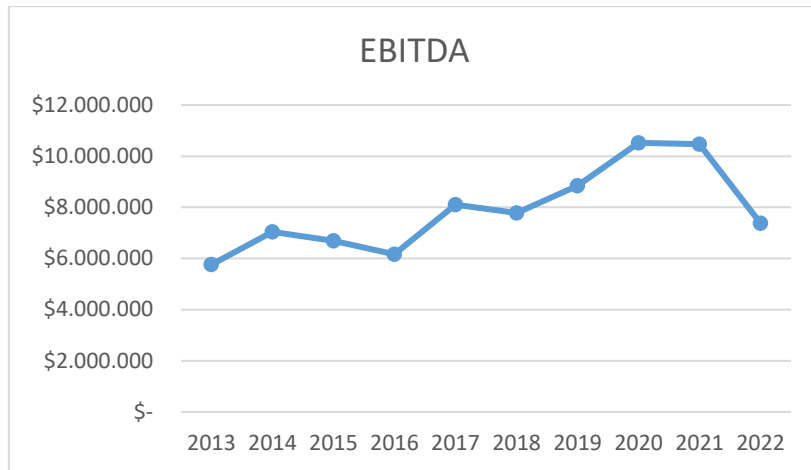


Fig. 40 EBITDA of Westfalia fruit

In terms of the ROA, it is possible to observe a steady decreasing year after year and it may have happened by the yearly strong investment of WestFalia Fruit have made in each country with the purpose of growing up rapidly, therefore the total amount of assets could not compensate its expected return while the ROE has been increasing progressively but from year 2020 has been decreasing considerably until a value of 19.9% in 2022 which may be caused for several situations such as the Covid-19 Pandemic as well as the investment and loans performed with the goals of expanding in the following years, therefore in the last years the shareholders have not perceived additional value on its shares. On the other hand, the gross profit margin indicates how well the senior management team of a business generates income and it can be perceived a constant increment from the year 2017 reaching up a value of 9.37%, meaning that WestFalia is able to generate revenues that overpass the costs of its activities despite its other financial indicators [52].

Table III Financial indicators of West Falia Fruit

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>ROA</b>	14.54%	12.10%	12.10%	9.96%	8.19%	7.04%	6.86%	6.19%	7.08%	4.96%
<b>ROE</b>	24.53%	28.33%	28.33%	29.38%	30.28%	31.12%	30.82%	28.71%	26.88%	19.9%
<b>Gross Margin</b>	7.66%	6.33%	6.33%	4.85%	4.78%	5.13%	5.66%	6.70%	8.94%	9.37%

### 3.2. Fresh Del Monte

Fresh del Monte is a producer and distributor of fruits and other agricultural products. The company was born from a division of Del Monte Corporation by two companies, Fresh Del Monte and Del Monte Foods and both own the same logo. Fresh Del Monte has its HQ in Caiman Islands and has agricultural operations in many countries around the world such as: Costa Rica, Guatemala, Ecuador, Colombia, Philippines and other ones. In 2004, Fresh del Monte acquired the European part of Del Monte Foods consolidating the presence of Del Monte in the EU. The first international fruit and vegetable seller, Fresh Del Monte, has committed to the Science Based Targets program, which gives businesses a clear route for cutting their greenhouse gas emissions in order to help slow down global warming. As well as Westfalia

Fruit do, Fresh Del Monte has a vertical integration of its supply chain ensuring the high quality of its products. Apart from the avocado, Fresh del Monte also offers Pineapples, Grapes, Blueberries, Lemons and bananas [53].



*Fig. 41 Fresh Del Monte Logo [38].*

In terms of sustainability, the company planted 574.800 trees and 29.7% of its owned farms accounts a regenerative agricultural model, while its carbon emission decreased by 27.5% compared to the 2020 year. The company emphasized the importance of integrating renewable energy sources, stating that these sources accounted for 21% of their global electricity consumption last year. This move was highlighted as a critical part of their conservation strategy [54].

In regards to the EBITDA, it can be seen as an overview that the panorama has been positive due to it increased from \$3,68 Bln in 2013 to \$4,44 Bln in 2022 being a growth of 20.65% in 10 years. The EBITDA rose up greatly from 2016 to 2017 thanks to a diversification of its business according to Mohammad Abu-Ghazaleh [54].

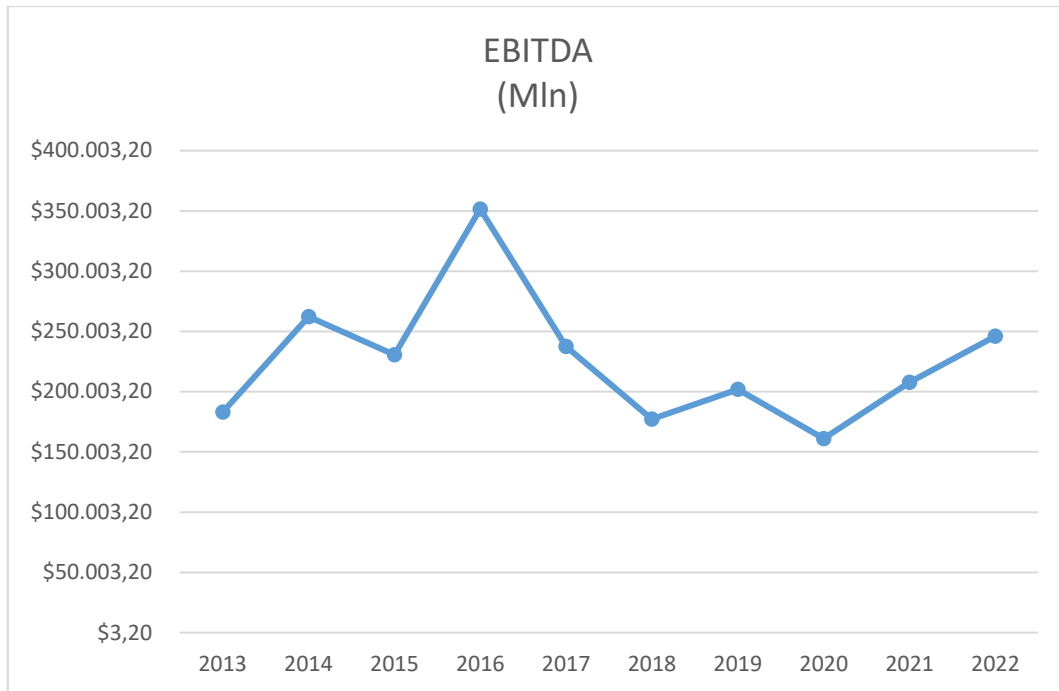


Fig. 42 EBITDA of Del Monte

The ROA suffered a high decrease from 2016 to 2018, passing from 8,48% to -0,67% respectively, due to high fruit and distribution costs throughout its supply chains, but followed by a significant restoration in the last years. The same situation may affect also the gross margin but to a lesser extent [55].

Table IV Financial Indicators of Del Monte

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>ROA</b>	1,33%	5,32%	2,40%	8,48%	4,37%	-0,67%	1,99%	1,47%	2,35%	2,85%
<b>ROE</b>	4,99%	4,27%	2,73%	3,70%	-1,24%	6,74%	12,39%	3,56%	7,97%	-1,96%
<b>Gross Margin</b>	9,74%	9,42%	8,48%	8,88%	8,43%	10,50%	13,44%	10,22%	11,16%	9,77%

### 3.3. Calavo

Another well-known company in the avocado industry is Calavo, which came from the foundation of the California Avocado Growers Exchange as a grower-member owned cooperative in 1926. In 1998, they became the first avocado company that opened a packinghouse in Mexico as well as the first avocado marketer which began to trade on the Nasdaq. Calavo also has acquired companies such as Renaissance Food Group, which has allowed them to expand its offerings in terms of fruits and vegetables. Its headquarter is located in Santa Paula, California and owns processing plants and packing houses throughout US and Mexico [56]. When it comes to sustainability, the corporation is making great efforts to lessen its environmental effect by setting a goal to reduce its carbon footprint by 50% over the next ten years as well as to reduce by half the food wasting. By 2025, It has pledged to contribute a minimum of US\$1.5 million toward multi-year relationships with community organizations at each Calavo facility as well as turning its 100% packages into recyclables and reusable ones;

then, they aim to produce no less than 50% of its packages with recycled content until 2030 [57].



Fig. 43 Calavo Logo [56]

According to the line chart displayed below of the EBITDA throughout the last 10 years, it is possible to see a steady increase from 2013 to 2019, passing from \$32,330 million to \$82,669 million respectively, unfortunately Calavo has been affected by poor management and operating decisions making the revenues to decrease by 62,09% in 2022.

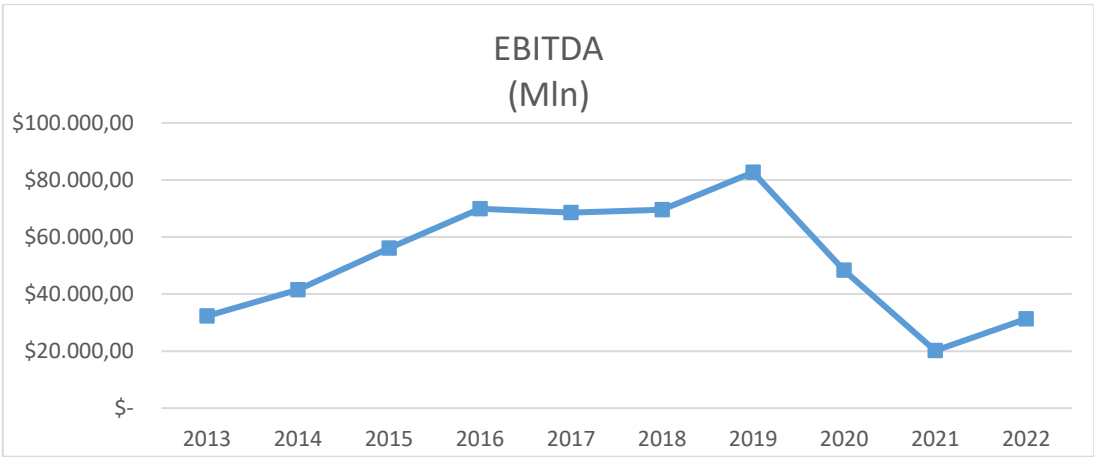


Fig. 44 EBITDA of Calavo

A similar situation has been occurred with the financial indicators that had abruptly decreased from the year 2019, even reaching negative values such as the ROA which decreased 140% from 2019 to 2020. Similarly, the gross margin has been decreased the last years but not as

much as the ROA and the ROE, it passed from 11,86% in 2019 to 7,74% in 2022 meaning a fall of 34,73%.

*Table V Financial Indicators of Calavo [57]*

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>ROA</b>	-0,75%	0,03%	9,55%	11,59%	10,24%	8,78%	9,39%	-3,17%	-2,65%	-1,62%
<b>ROE</b>	-1,51%	0,05%	14,70%	17,78%	15,33%	12,26%	12,90%	5,35%	5,24%	-2,81%
<b>Gross Margin</b>	9,52%	9,99%	11,39%	12,43%	11,64%	11,63%	11,86%	10,01%	7,13%	7,74%

### **3.4. MISSION PRODUCE**

Mission Produces is one of the companies which leads in the global avocado industry. Since 1983, it has played an important role in sourcing, producing and distributing not only avocados but also fresh mangos to numerous clients located in more than 25 countries. Through its vertically integrated structure, they can ensure a consistent supply of top-tier produce throughout the year. This capability can take place thanks to its ownership and management of four state-of-the-art packing facilities situated in key cultivation regions worldwide, such as California, Mexico, and Peru. Likewise, the company's sourcing capacity extends to various other countries, including Chile, Colombia, the Dominican Republic, Guatemala, Brazil, Ecuador, and South Africa. To facilitate its global distribution, Mission Produce™ has established 13 advanced distribution centers strategically positioned across North America, China, Europe, and the UK. These facilities not only enable efficient distribution but also provide additional services such as ripening, packaging customization, and tailored packing solutions[58]. Seasoned figures in the food industry, Steve Barnard and Ed Williams, who were engaged in avocado farming, established Mission Produce TM in 1983. Recognizing the considerable potential of avocados, they developed what has now evolved into the most advanced avocado network globally until becoming a publicly traded company in 2020.



*Fig. 45 Mission Produce Logo[58]*

Colombia has been one of the most important countries that Mission produce has been working with; in fact, Jim Donovan (vice president of global information and industrial affairs) states that one of the advantages of the Colombian avocado production is its strategical harvesting season which is similar to Mexico, but this country is very concentrated to the USA market, therefore, Colombia can supply outside markets different from USA and can cover several markets if there is any problem with the rest of producers. Another advantage for Colombia as avocado supplier is its proximity to key markets; it is only five days from USA by sea and owns an optimal access to Europe and Asia thanks to its ports in the Pacific Coast and in the Atlantic one; Despite the avocado production is focused in the European market, it is also increasing its presence in the USA market. Finally, the Colombian production can be presented the whole year due to its different altitudes which makes possible to harvest not only in a specific season. Trees cultivated below 2000 meters the fruit is harvested between September and May and from 2000 meters the harvest takes place between January and May [59].

On behalf of the financial performance, it is possible to observe that the EBITDA is on a decreasing behavior from 2019 to the current days passing from \$122.973 million in 2019 to \$37.100 million in 2022. Steve Barnard pointed out that this situation is driven by a decrease in average per-unit avocado sales prices due to a higher avocado supply in the market, making the revenues to decline year over year [60].

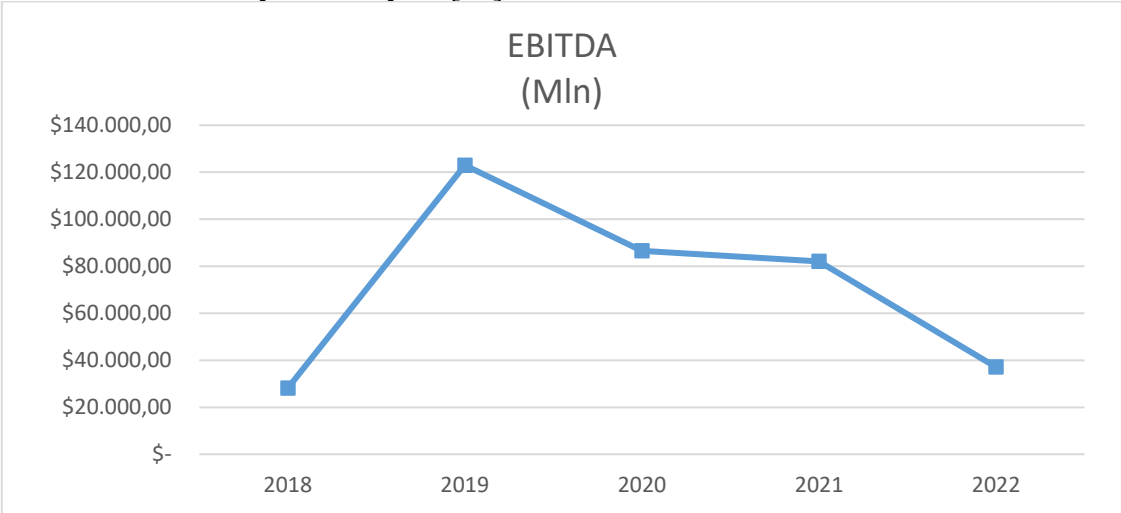


Fig. 46 EBITDA of Mission Produce

In terms of the gross Margin, it experienced a decline of 33,89% in 2022 compared to 2020 despite it increased from 2018 to 2019. This behavior is driven by lower pricing on avocados sold from company owned farms [60]; affecting also other indicators such as the ROA and ROE that have a similar behavior.

Table VI Financial Indicators of Mission Produce [60]

	2018	2019	2020	2021	2022
<b>ROA</b>	11,65%	10,40%	3,71%	5,14%	-3,93%
<b>ROE</b>	23,11%	18,92%	6,09%	8,41%	-6,89%



<b>Gross Margin</b>	7,37%	19,38%	16,55%	16,21%	10,94%
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Moreover, there are other companies such as Del Rey Avocado and West Pak Avocado which have also an important role in the vertically integrated supply chain of avocados, from the cultivation to the end-consumer. Likewise, they also influence the market dynamics of the avocado commercialization. Lastly, a table displaying the revenues obtained during the year 2022 shows that the company with the highest values was Fresh del Monte with \$4.440 million and with a huge difference followed by Calavo and Mission Produce with \$1.200 million and \$1.040 million respectively. Then, we can find companies with revenues below \$50 million such as Westfalia Fruit (\$43.3 million), Del Rey Avocado (\$18,1 million) and West Pak Avocado (\$18,1 million) which still being important as well. It is important to highlight that these revenues also take into account other fruits and products that the companies commercialize as well; indeed, the Avocado market is not the most important revenue driven for Fresh del Monte as if it is for Mission Produce and Calavo which were born thanks to the commercialization of the avocado and afterwards expanded their offerings; therefore it can be concluded that the most relevant and recognized companies regarding the avocado market are Calavo and Mission Produce.

*Table VII Revenues of the most important avocado companies*

<b>Company</b>	<b>Revenues in 2022 (USD Million)</b>
Fresh del Monte	\$4.440
Calavo	\$1.200
Mission Produce	\$1.040
WestFalia Fruit	\$43,3
Del Rey Avocado	\$18,1
West Pak Avocado	\$14

## **4. COLOMBIA AVOCADO MARKET**

The purpose of this chapter is to explain the overall situation of the avocado market in the Colombian territory in terms of supply chain, production, exports and imports, demand and pricing; how it has been evolved and changed throughout the years and which challenges it has to face with currently.

### ***4.1. History of Colombian Avocado***

The first presence of this product inside Colombia took place in the Precolumbian era according to Martín Fernández de Enciso in his book “Suma de Geografía”, published in 1519 in Seville,

Spain. In fact, it is considered as the first written document in America which talks about the discovery and the description of the Colombian avocado and it was in the Yaharo community in the proximities of Santa Marta and the author described it as “An orange that when you cut it to eat it it is yellow: What is inside is like butter, it has a delicious flavor and leaves a taste so soft and so good that it is something wonderful”. Then, despite it is not known the accurate year in which the avocado started to be produced with commercial purposes during the modern era, it is certain that the first avocado orchards were cultivated in the Montes de María area nearby to Santa Marta with the purpose of giving shadow to the coffee plantations. At that time, avocado production took a secondary role, to the point that its harvest was used to feed pigs. Subsequently, the avocado was turning into an important source of incomes for the local farmers in this area as the coffee orchards disappeared progressively. The product achieved such a recognition in both regional and national market that in the sixties the first shipments started to be made to Medellin, Barranquilla and Cartagena. Indeed, the avocado producers in the Montes de María consolidated themselves as the largest producing area in the country although their crops had very low techniques of modernization [61]

The Montes de María area, located in the states of Bolivar and Sucre accounts and approximate are of 2.677 square kilometers and an average temperature of 27°C. The land goes from the sea level to the maximum height reached in the state of Bolivar (800 meters) and in Sucre with 600 meters above sea level. However, this zone has been affected by the armed conflict throughout the years making that many farmers were killed and displaced. Additionally, the trees started to rot and subsequently to dead because of the fungus *Phytophthora Cinnamomi* Rands y *Verticillium* sp6 caused by the desertion of the crops. This undesirable situation made that both the production and the quality of the avocados were affected in the last years [61].

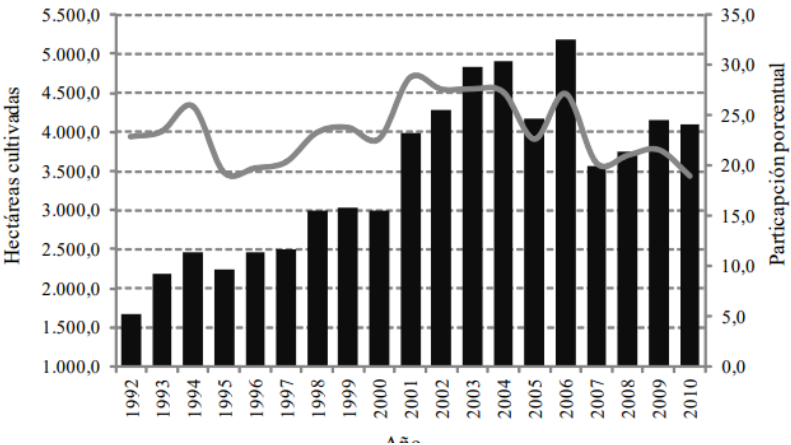
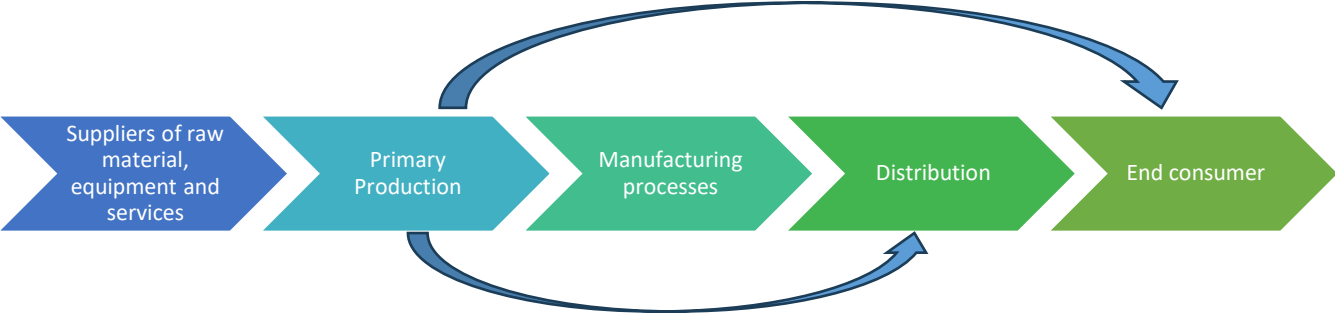


Fig. 47 Cultivated hectares of avocados in Montes de María [61].

At the beginning of the 2000s, the history of avocado production and planting began with the aim of exporting and marketing this product through farmers' campaigns. Many varieties began to be planted; Bacon, Reed, Hass, Fuerte. After several rigorous studies, the most suitable avocados for exporting and commercialization ended up being the Hass avocado due to its longer ripening time, thicker rind, better flavor, better quality of the fruit and greater quantity of the crop since planting. It was where Colombia and the farmers' union realized this and decided to start the first export of Hass-type avocados to the United States in 2009 with a planting of 1,200 hectares. In fact, the Mexican success as avocado exporter and producer was

taken as reference for Colombia to grow up in the international market and to generate high revenues resulting on the third place at the ranking of the largest Hass avocado producers with a 5.7% of total worldwide production resulting in investments of \$520 million in regards to lands, cultivations and packinghouses; likewise it is forecasted that 26.000 direct employments are generated and roughly 3.000 indirect employments in zones which were affected by the armed conflict [62].

**4.2. Avocado supply chain in Colombia**



*Fig. 48 Colombian supply chain structure*

Several are the organizations which distribute the essential supplies that allow a proper and efficient avocado production inside the Colombian territory; one of them is Camara de procultivos ANDI which is an union entity formed by eleven companies that provide crop protection and nutrition technologies in regards to insecticides, fungicides, herbicides and fertilizers both nationally and internationally, to contribute to food security; one of its affiliates is the German multinational Bayer.



*Fig. 49 Procultivos ANDI [63].*

In addition to providing innovative products and technology to increase farm productivity, Procultivos also focuses on achieving better harvests in terms of quality, driving the avocado production in accordance with the appropriate practices and effective habits of farm producers. In fact, Procultivos has been developing the “Disruptive Agronomic Management” project, with the firm purpose of activating another mode of interaction with producers, to transform the countrysides; It is about the knowledge and experiences that the beneficiaries acquire through our CuidAgro and Mentas Fértiles programs, fulfilling the promise of improving the productivity and quality of crops, but also, the certification deserved to the farms and products

in Good Agricultural Practices, as well as organizational improvements and human development, which allow the discovery of the entrepreneurial nature in each farmer [63].

Other key organizations are Agro in-vitro, which is in charge of providing cultivation materials of high quality, productivity and resistance in order to contribute to the development of the Colombian Agronomy [64]; Profrutales which is a leader company in the production and distribution of fruit expansive supplies [65]; Agrosavia which is a science, technology and innovation entity which contributes to technical change to improve productivity and competitiveness of national agriculture through the research processes, knowledge transfer, and technological linkage to small producers thanks to its productive programs [66]; other governmental entities that contribute to being the first player in the supply avocado chain are SENA, Secretary of Agriculture, Ministry of Agriculture, Universidad Nacional de Colombia. Lastly, in each state there are many regional agro shops which supplies each farmer with the proper supplies for their crop, being very flexible according to what it is produced the most in the region; likewise, they are very crucial in the avocado supply chain because they can reach the most hidden orchards and offer a competitive price to the farmers.

**4.2.2. Primary producers**

This group is formed by associated farmers and the no-associated farmer. Among the most important associations of avocado producers there are Corpohass which is a private law corporation; its purpose is to guide, promote and project the production and commercialization of Hass avocado in Colombia towards the markets of both the national and internationally, seeking the well-being of the producer and the exporter. Corpohass represents its associates to public and private organizations both nationally and internationally, managing the needs, aspirations, programs and projects of Hass avocado growers and marketers and always working towards their objectives. The participation of CorpoHass in the Colombian markets is crucial due to its affiliates represents the 70% of the total avocado producers approximately resulting in revenues of USD 293.234 and it is expected to increase in the following years.

Año	Representación Afiliados	Recaudo	Crecimiento
2020	61%	\$951.352.957	—
2021	64%	\$1.198.380.810	26%
2022	68%	\$1.172.555.352	- 2%

*Fig. 50 Performance of Corpohass[67].*

After meeting all the requirements and being affiliated with Corpohass, they ensure that its production will be sold; likewise, the producer can take advantage of many alliances they have with many other organizations that cover all the needs the producers could have. More than 1700 producers affiliated to Corpohass represents the 70% of the total exported avocados from Colombia. Furthermore, in 2022 thanks to a hardworking of 8 years with the public entities, Corpohass opened the possibilities of exporting Colombian avocado to Chile as well as in South Korea with an investment of roughly 15.324 in terms of admissibility [67].



*Fig. 51 Corpohass Logo [67]*

Another key producer in the avocado market is Hass Colombia which is an agricultural society in transformation established since July 26, 2007 by avocado producers from various parts of the country. Nowadays, they have 50 associates and more than 100 allied producers. Hass Colombia is an avocado packaging and marketing plant; they have state-of-the-art machines and equipment with the capacity to select and pack 8 tons/hr. Avocado Hass owns a nursery garden which is in charge of the production of high quality material production; it is located in the Western Antioquia where there are optimal weather conditions for the plants development [68].

The steps of services that Avocado Hass offers are: 1) Agronomic visit to evaluate the state of the crop, 2) fruit collection visit to carry out the first dry matter analysis, 3) Fruit collection visit for residuality analysis, through a certified laboratory, 4) Training on the practices and tasks that must be carried out during fruit harvesting, 5) Support during harvest and indication of actions after harvesting the fruit. Likewise, the company offers boxes to transport the avocado harvest as well as the transportation from the crops to the warehouse [68].



*Fig. 52 Hass Colombia Logo [68].*

Furthermore, other principal producer of avocado in Colombia refers to Westfalia Fruit which has established two avocado packhouses in Colombia, in Rionegro, Antioquia and Sonson. This currently satisfies the needs of clients in North America and has increased the origin's trust in the European marketplace.

Lastly, the largest producer and exporter of Hass avocado in the country is Cartama (AvoFruits), composed by a set of association with orchards located mainly in Antioquia and Eje cafetero, where small producers take participation such as Jose Alverto Velez, ex CEO of Grupo ARGOS (the biggest cement company in Colombia), who has had the opportunity to export with 1000 hectares cultivated. Cartama was the first company to open the Chinese market with an exportation of 24 tons. In 2017, it benchmarked with Fresca Group from UK, founding Cartama Europe and Cartama UK in order to supply the increasing demand in th European market. Then, it signed an agreement of commercialization and distribution with Mission Produce (the largest distributor in US) to increase its presence worldwide. Cartama and Westfalia accounts 50% of the Hass avocado exportations in Colombia [69].



*Fig. 53 Cartama Logo [69]*

#### **4.2.3. Manufacturing Companies**

After having been harvested, the avocado can be transported to a manufacturing plant in order to be used as a raw material for the production of other final products. The Agro industrial can be regional formed by specific small companies of each region or larger companies which have presence in the whole Colombian territory. One of the most important national companies is Biocate, that is dedicated to the agroindustrial development of avocado through research, development and innovation and commercialization of the avocado oil and other products used as a natural alternative for the health and beauty care [69]. Likewise, there is Terravocado which manufactures food products such as Guacamole, avocado pulp, and avocado oil, taking advantage of even defective avocados that do not meet the physical requirements [70], as well as Fresh Colombia company [71].



Fig. 54 Logos of the most important manufacturing avocado companies [69] [71] [70]

#### 4.2.4. Avocado Distribution

Certainly, the distribution of avocado has gained significant attention in recent years due to the gaining as a prominent player in the global avocado market. Therefore, the avocado distribution from Colombia is performed by several companies in order to cover the high demand both nationally and internationally.

Talking again about the case of CorpoHass (which it is a company that participates in the whole vertically integrated supply chain), they have 23 exporters among their affiliates that work closely with their producers. Furthermore, it is possible to observe that the largest concentration of commercial activities is in the center of Colombia followed by Antioquia. In fact, the distribution of both production and commercialization is concentrated in the Andes region that is basically the extensive center of Colombia thanks to its weather conditions as well as the largest development [67].

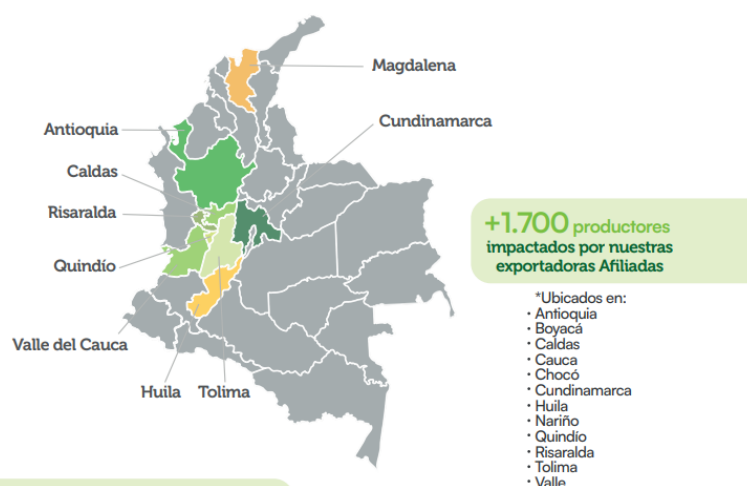


Fig. 55 Distribution of avocado commercialization and production of CorpoHass [67].



Then, the exported avocados have Netherlands, USA, and United Kingdom as the main destinations with 49,3%, 21,3% and 8,5% of the total exportation respectively; but, it is possible to see that the European Union plus UK means the 75,5% of the total exportation of CorpoHass association [67]. In addition, other key players in the exportation of avocado are Pacific Fruits, Wolf and Wolf, WestFalia Fruit and Hass Colombia. In terms of the regional distribution, the main channels are street market places and the most recognized supermarkets in Colombia.

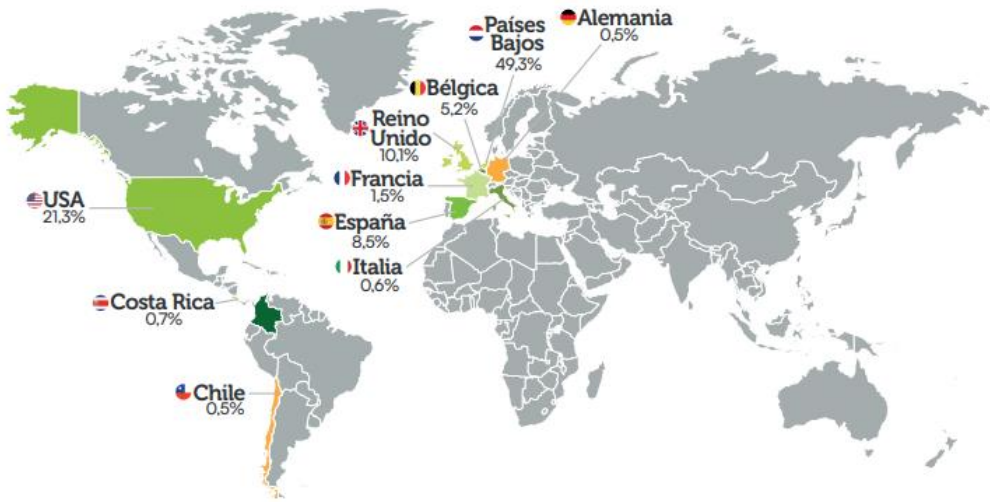


Fig. 56 Mean importers of Hass avocado by Corpohass[67].

**4.2.5. End consumer**

This group includes both the national and international consumption. In terms of the national consumption, the buyers can get their fresh avocados by the fresh fruit and vegetables markets which corresponds to a traditional and well-recognized way to acquire these products in Colombia. One of the most recognized fresh market place is Corabastos located in the south of Bogota (Capital of Colombia), which was born on March 6 in 1970, because of the need to create an entity with the capacity of establishing prices and steady supplies to Bogota and its surroundings, also it is in charge of organizing the food marketing system and its centralization. In fact, it is considered as the largest fresh market place in Colombia and south America and the second largest one in America[72]. Moreover, Colombian consumer can acquire avocados in the large supermarkets such as: Grupo Exito, Olimpica and Jumbo.



Fig. 57 Corabastos in Bogotá[72]



There are several entities which must participate into the supply chain in order to ensure its consolidation. In terms of supplies, there are Procultivos and Profrutales that were mentioned previously. In research, there are AGROSAVIA, CIAT, Universidad Nacional de Colombia and Corporación Colombia Internacional (an entity that develops a comprehensive supply and implementation of competitive and profitable agro-business productive projects with social inclusion, achieving living improvements in the Colombian countryside [73]). When it comes to Government, we can find the Ministry of Commerce, Agencia de Desarrollo Rural, Instituto Colombiano Agropecuario, that is responsible of bilateral or multilateral sanitary and phytosanitary agreements that allow the commercialization of agricultural products abroad ensuring the growth of exports [74] and Procolombia, that is in charge of promoting the Colombian tourism, the foreign investments and the non-energetic renewables exportations [75].

When it comes to some generalities about the avocado supply chain, there are evidences stating that the 86% of the total produced avocado is concentrated in the states of Tolima, Antioquia, Caldas, Santander, Bolivar, Cesar, Valle del Cauca and Quindio while it is estimated that around 16.500 farmers in Colombia has the avocado production as its mean economic activity. Likewise, 62.500 people are related to the avocado supply chain both directly and indirectly. Lastly, it is estimated that the avocado consumption per capita in Colombia increased 70% in the last five years, passing from 6.1 kg to 12,3kg [76].

### ***4.3. Avocado Production in Colombia***

As it was mentioned previously, Colombia is the second largest avocado producer worldwide. In fact, the avocado industry has experienced a rapid growth in the last years thanks to organizations such as CorpoHass or Hass Colombia that has been working on the recognition of the Colombian Hass avocado, which has a large expanding potential compared to other important producing countries whose hectares growth is very limited; being very attractive to abroad investor who keep funding in the Colombian avocado market [77].

According to the data provided by the Agricultural Ministry, the cultivated hectares has been growing up constantly from 2015 to 2021, passing form 57.826 cultivated hectares in 2015 to 92.699 hectares, meaning an increase of 60,31%. Likewise, the harvested area has experienced a larger growth throughout the years reaching up a figure of 67.107 hectares by 2021, being an increase of roughly 75% compared to the year 2015.

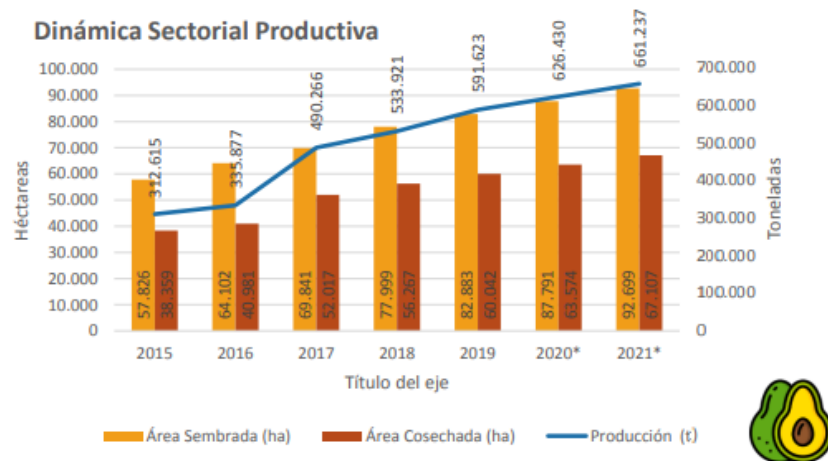


Fig. 58 Harvested-Cultivated area and Avocado Production in Colombia [78]

Furthermore, it is logical to see that if both the cultivated and harvested area has risen, the avocado production has increased as well, passing from 312.615 metric tons in 2015 to 661.237 metric tons in 2021 (this figure were forecasted by the Agricultural Ministry), however the World Economic Forum calculated that the Colombian avocado production were 970.000 tons by 2021, being three times larger than the initial year 2015 [79]. Likewise, it can be seen that the effectiveness of the avocado production has increased from 8 metric tons per cultivated hectare in 2015 to 10 metric tons per cultivated hectare in 2021 due to the research and development that the companies and the public institutions has performed in order to improve the orchards and manufacturing conditions. Additionally, The Agricultural Ministry has reported that about 72% of cultivated area in the country is in productive stage and the 28% is in development stage [78].

Año	Área Sembrada (ha)	Área Cosechada (ha)	Producción (t)	Rendimiento (t/ha)
2015	57.826	38.359	312.615	8
2016	64.102	40.981	335.877	8
2017	69.841	52.017	490.266	9
2018	77.999	56.267	533.921	9
2019	82.883	60.042	591.623	10
2020*	87.791	63.574	626.430	10
2021*	92.699	67.107	661.237	10

Fig. 59 Data about the avocado production in Colombia [78].

The most produced avocado type is the Hass avocado, which corresponds to the 34% of the total cultivated area in the country which comes from more than 4.000 produces. It is estimated that the 65% of the cultivated area is in the productive stage and the rest in development stage. The cultivated area has increased gradually from 2015 to 2020 and experiencing a sharp increase in 2021, passing from 13.530 hectares in 2015 to 31.518 in 2021, which corresponds to an increase of 133%. Similarly, the harvested area has also grown up throughout the years, passing from 7.429 hectares in 2015 to 20.446 hectares in 2021 (which means a growth of 175% compared to the initial year). Likewise, as it was stated previously, it is expected that the avocado production has incremented as well. Currently, the avocado production is 330.935

metric tons approximately, which is more than five times larger than the production of the year 2015 [78].

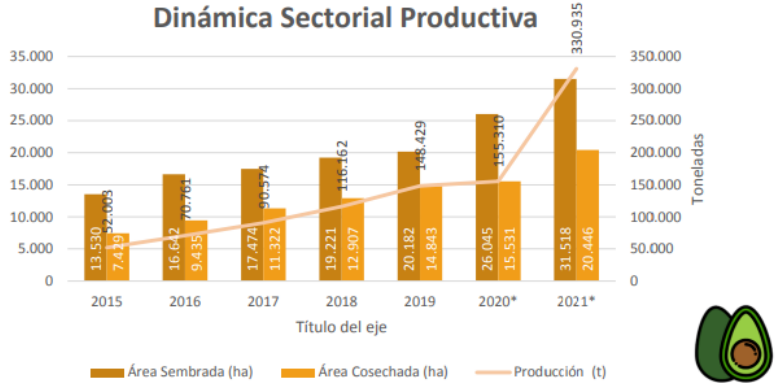


Fig. 60 Producing dynamic of the Colombian avocado [78]

In fact, this sharp increasing behavior on the Hass avocado is caused by the succeed placement of the fruit on the international markets and the continuous support from the national government in the opening processes of strategic market for the exportation. Likewise, this governmental contribution has supported to improve the supply and demand coherence. In contrast, the productive performance has experienced a considerable growth from 7 metric tons in 2015 to 11 metric ton in 2021, thanks to the development and investment on the cultivation techniques, processes and research [78].

Año	Área Sembrada (ha)	Área Cosechada (ha)	Producción	Rendimiento
			(t)	(t/ha)
2015	13.530	7.429	52.003	7
2016	16.642	9.435	70.761	8
2017	17.474	11.322	90.574	8
2018	19.221	12.907	116.162	9
2019	20.182	14.843	148.429	10
2020*	26.045	15.531	155.310	10
2021*	31.518	20.446	214.678	11

Fig. 61 Producing dynamic of the Colombian avocado with performance [78]

When it comes to the production divided by region, it is possible to see that Antioquia has remained as the territory with largest cultivated area throughout the years except of the year 2017 (which it was Tolima) and counts the 20.83% of the total cultivated area in Colombia. Then, there are Tolima and Caldas, with a less sharp increasing behavior with 14.930 hectares and 12.698 hectares by 2021 respectively. The rest of regions follows a similar pattern varying

their cultivated hectares from 2.519 hectares to 5000 hectares [78]. It is expected that this pattern keeps growing up due to the large investment made from different organizations such as Corpohass [78].

*Table VIII Avocado Production in terms of area (hectares) by state [78]*

	<b>2.017</b>	<b>2.018</b>	<b>2019</b>	<b>2.020</b>	<b>2.021</b>
<b>ANTIOQUIA</b>	11.992	15.980	17.107	18.289	19.313
<b>CALDAS</b>	9.821	10.229	11.189	12.025	12.698
<b>TOLIMA</b>	13.348	13.309	13.603	14.139	14.930
<b>VALLE DEL CAUCA</b>	3.060	4.427	4.661	4.939	5.216
<b>META</b>	1.649	3.264	3.322	3.587	3.788
<b>SANTANDER</b>	5.572	4.194	4.421	4.593	4.850
<b>RISARALDA</b>	3.751	4.340	4.578	4.894	5.168
<b>QUINDIO</b>	3.644	4.275	4.424	4.737	5.002
<b>HUILA</b>	2.817	3.295	3.382	3.647	3.851
<b>BOLIVAR</b>	2.972	2.519	2.549	2.414	2.550
<b>OTROS</b>	11.215	12.166	13.645	14.527	15.332
<b>Total</b>	69.841	77.999	82.883	87.791	92.699

Regarding the metric tons produced, it can be said newly that Antioquia is placed on the first position as the largest avocado producer in Colombia, with a steady growth throughout the five years reaching up a figure of 155.278 metric tons. Although Tolima counts a larger cultivated area compared to Caldas, the second region is able to produce a larger quantity of avocados due to Tolima maintains a considerable amount of hectares in growing stage. The avocado production of the rest of regions such as Huila, Bolivar, Valle del Cauca, Santander and other ones, varies between 17.145 metric tons to 35.485 metric tons throughout the years characterized by an increasing pattern in all the regions, which it is really advantageous for the overall production of Colombia [78].

*Table IX Avocado Production in terms of quantity (metric tons) by state [78]*

	<b>2.017</b>	<b>2.018</b>	<b>2019</b>	<b>2.020</b>	<b>2.021</b>
<b>ANTIOQUIA</b>	133.461	121.010	137.179	146.946	155.278
<b>CALDAS</b>	81.447	95.804	94.776	102.218	108.014
<b>TOLIMA</b>	72.063	82.500	83.110	86.570	91.479
<b>Valle del Cauca</b>	21.535	28.208	31.182	32.754	34.611
<b>META</b>	15.570	23.769	31.037	33.581	35.485
<b>SANTANDER</b>	24.732	23.101	28.094	28.878	30.515
<b>RISARALDA</b>	24.259	25.412	27.175	28.995	30.639
<b>QUINDIO</b>	20.597	25.336	26.417	28.306	29.911
<b>HUILA</b>	17.145	21.256	25.668	27.657	29.225
<b>BOLIVAR</b>	26.744	24.144	25.049	23.547	24.882

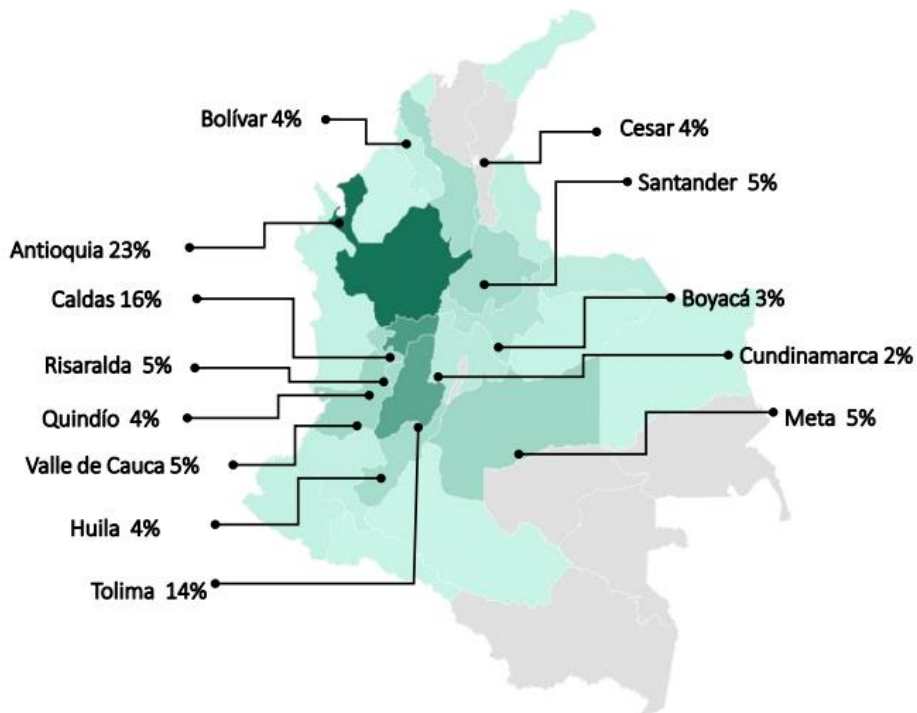
<b>OTROS</b>	52.712	63.381	81.935	86.979	91.200
<b>Total</b>	490.266	533.921	591.623	626.430	661.237

Despite Antioquia is the region with the largest produced amount, Caldas counts the best performance in terms of Tons per hectare cultivated thanks to the investments from the Israelian Embassy on sprinkler drip irrigation system that facilitates the irrigation and fertilization [79] In fact, Antioquia have maintained its performance throughout the years while the rest of regions has experienced at least one growth in their avocado production performances [78].

*Table X Performance (Ton/hectares) by region*

	<b>2.017</b>	<b>2.018</b>	<b>2019</b>	<b>2.020</b>	<b>2.021</b>
<b>ANTIOQUIA</b>	11	8	8	8	8
<b>CALDAS</b>	10	12	14	11	11
<b>TOLIMA</b>	7	8	8	8	8
<b>Valle del Cauca</b>	9	9	10	10	10
<b>META</b>	9	8	11	9	9
<b>SANTANDER</b>	7	8	10	8	8
<b>RISARALDA</b>	10	10	10	10	10
<b>QUINDIO</b>	8	8	9	8	8
<b>HUILA</b>	11	10	10	10	10
<b>BOLIVAR</b>	11	11	12	11	11
<b>OTROS</b>	11	11	12	11	11
<b>Total</b>	9	9	10	10	10

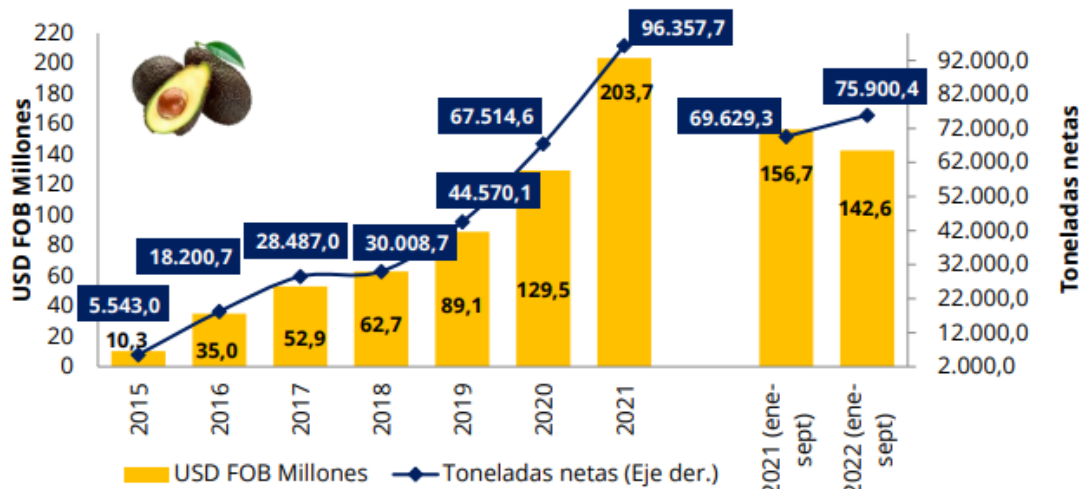
Geographically, the avocado production can be divided into five zones; West and eje cafetero zone formed by Antioquia, Caldas, Quindío, Risaralda and Valle del Cauca composing the 53% of the total production and where the Hass and Papelillos types are produced by large and medium enterprises. Then, the Center zone formed by Tolima with a 14% of the total production in which the Hass and Papellillos types are produced by small, medium and large enterprises. Moreover, it can be found the Atlantic coast zone composed by the regions of Bolivar and Cesar which compose the Montes de María area (pioneer area in the production of avocado) and where only criollos antillanos types are cultivated by small producers. Santander zone, which accounts 5% of the total avocado production, related to the criollos antillanos type cultivated only by small enterprises. Last but not least, there is the East zone composed by Cundinamarca, Boyaca and Meta (10% of the total production) and corresponds to the papelillos type cultivated by small enterprises [78]. As an overview, the most important states in terms of avocado production are Antioquia, Caldas and Tolima which account the 53% of the national avocado production [78]. Additionally, the avocado production in Colombia is well-distributed throughout all the territory, taking advantage of the different conditions of the regions such as the high altitude and cold weather in Cundinamarca and Boyacá or the low altitude and warm weather in the Atlantic coast and thus, making possible to produce several avocado types in the same nation.



*Fig. 62 Territorial distribution of the Colombian avocado [78]*

#### ***4.4.EXPORTS, IMPORTS AND DEMAND IN COLOMBIA***

In terms of exportations, the Hass avocado is the most exported type due to its great recognition and reception from the consumers worldwide. In fact, during the period period 2015 to September 2022, Colombian avocado exports have displayed consistent yearly increases ranging from 15% to 50%, resulting in a cumulative export value of USD FOB 725.8 million and 366,582.1 net tons. Notably, there was a remarkable surge of over 200% in 2016, with overseas sales amounting to USD FOB 35 million and 18,200.7 net tons as well as the exportations in 2021 that experienced an increase of 57% compared to year 2020 , reaching up USD FOB 203,7 million and 96.357,7 tons. Indeed, this specific increase was supported by the Decree 1085 of 2020 which create the exclusive identification of the Hass avocado for exporting by the number 0804.40.00.10 category A which passed from a taxation of 15% to 0% [81].



Fuente: Analdex, datos de LegisComex

Fig. 63 Value and Tons of exportations from 2015 to 2022 [81]

In the first nine months of 2022, the exportations of aguacate Hass experienced a decline of 9% compared to the same period in 2021, registering a value of USD FOB 142,6 million. However, although the value decreased, the metric tons exported increased 9% reaching up a figure of 75.900,4 net tons [81].

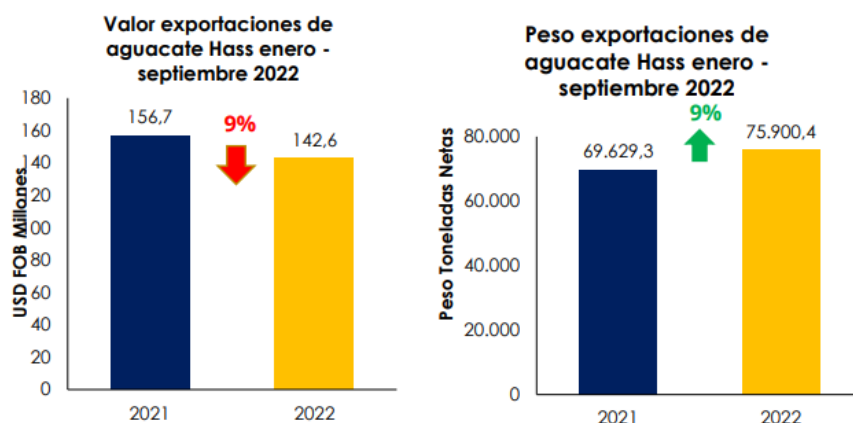


Fig. 64 Exportations in 2021 and 2022 [81].

If the exportations are split into months, it is evidenced a strong increment during the first months of each year followed by a rapid decrease from May to July. During the year 2018, the largest figure was registered in April with USD FOB 9,2 million and 3.941,2 exported tons, while by 2019 these figures were USD FOB 12, million and 6.016,8 tons in February. Additionally, in April 2021, it was registered the largest figure of exported Hass avocados with USD FOB 22,7 million and 12.301 net tons. This pattern is driven by the reduction of producers worldwide because of the seasoning conditions while Colombia can take advantage of its constant harvesting period during the round year [81].

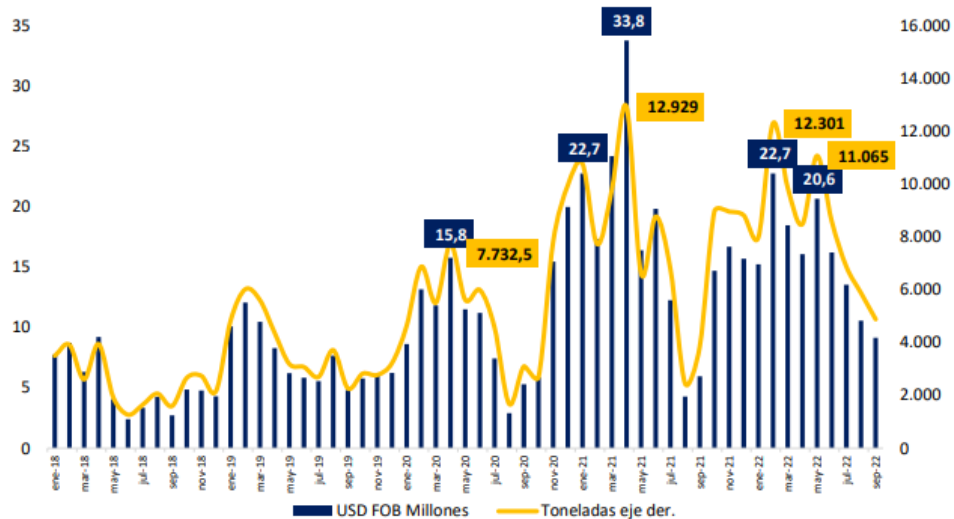


Fig. 65 Exportations of Hass avocado split into months from 2018 to 2022 [81].

The top three most important destinations of the Colombian Hass avocado between January and September 2022 were: Netherlands, United States and UK; being Netherlands as the mean destination with a share of 42.7% of the total exported followed by United States with 26.2% and United Kingdom with 9.6% [81]. In regard to US, the exportation passed from USD FOB 4 million in 2021 to USD FOB 41 million in 2022 and according to Jorge Enrique Restrepo, CEO of CorpoHass, the exportations increased by 446% to US due to a greater number of orchards enabled to commercialize thanks to sanitary work performed by the avocados unions and their workers. Moreover, Restrepo stated “During the course of 2022, we submitted 591 applications from 10 departments to the United States Work Plan, totaling 7,586 hectares. To date, 465 properties and 27 plants have been authorized for export to that market; our focus is the East Coast of US due to the West Coast is highly dominated by Mexico”, evidencing the great effort that Colombia has been performing in order to penetrate the largest market worldwide and the purpose is to increase the amount of the orchards enabled [82]. Likewise, huge events such as the Superbowl 2022 made possible to promote the Colombian Hass avocado within the US market, which was chosen to be part of this very famous event, exporting more than 2000 tons coming from the partnership between Mission Produce and Avofruit. Indeed, Avofruit is in charge of cultivating and producing the Hass avocado in the different zones while Mission Produce is in charge of supplying the product to the US market and to the other emerging markets [83].

In spite of the abroad sales declined to Netherlands (-28,4%) and UK (-40%), other countries registered increments such as United Arab Emirates (111,3%), Japan (587,3%), Singapur (39,6%), South Korea (2,8%), Canada (39,3%), Italy (414%), among others [82].



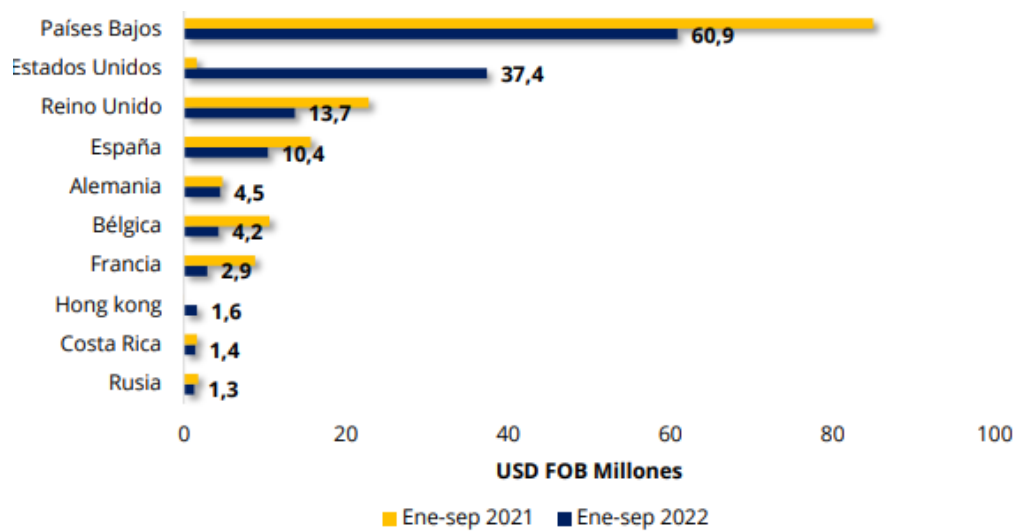
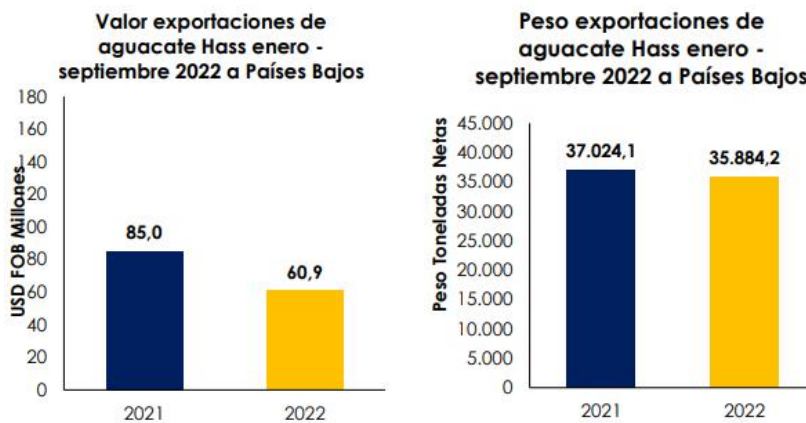


Fig. 66 Exportations of Colombian Hass avocado by country[81].

When it comes to Netherlands as the principal destination for exporting, the value has decreased from USD FOB 85 million in 2021 to USD FOB 60,9 million in 2022 as well as the metric tons which passed from 37.024 million tons in 2021 to 35.884 million tons in 2022 due to the highly competitive market in the European Union [81].



Fuente: Analdex con datos de LegisComex

Fig. 67 Exportations of Hass Avocado from Colombia to Netherlands

[81].

During the initial nine months of 2022, Antioquia emerged as the primary department for Hass avocado exports, constituting 48.4% of the overall foreign sales, amounting to USD FOB 69 million. Similarly, in the corresponding period of 2021, it maintained its position as the leading department, achieving USD FOB 79.2 million and 34,850 tons. Following closely is Risaralda,

securing a 25.1% share, equivalent to USD FOB 34.9 million and 17,536 net tons. Other shares to be considered are Caldas (9.3%), Valle del Cauca (7.6%), and Cundinamarca (3.7%).

Principales departamentos de origen de las exportaciones de aguacate Hass								
Departamentos	USD FOB		Var. (%)	Part (%) 2022	Peso Toneladas Netas		Var. (%)	Part (%) 2022
	Enero - septiembre				Enero - septiembre			
	2021	2022			2021	2022		
<b>Total</b>	<b>156.654.887</b>	<b>142.564.949</b>	<b>-9,0</b>	<b>100,0</b>	<b>69.629</b>	<b>75.900</b>	<b>9,0</b>	<b>100,0</b>
Antioquia	79.160.329	69.027.264	-12,8	48,4	34.850	39.564	13,5	52,1
Risaralda	34.878.235	35.781.967	2,6	25,1	15.910	17.536	10,2	23,1
Caldas	13.410.662	13.286.782	-0,9	9,3	5.652	6.046	7,0	8,0
Valle Del Cauca	9.531.064	10.780.314	13,1	7,6	4.532	4.863	7,3	6,4
Cundinamarca	9.013.583	5.272.364	-41,5	3,7	4.052	2.914	-28,1	3,8
Quindío	4.941.143	5.248.372	6,2	3,7	2.352	3.022	28,5	4,0
Bogotá	4.524.648	2.065.597	-54,3	1,4	1.608	1.056	-34,3	1,4
Tolima	248.704	706.772	184,2	0,5	141	464	229,6	0,6
Magdalena	60.816	224.923	269,8	0,2	56	331	495,0	0,4
Santander	194.296	156.800	-19,3	0,1	150	95	-36,8	0,1
Sucre	100.500	12.522	-87,5	0,0	79	8	-89,4	0,0
Atlántico	102.373	1.124	-98,9	0,0	54	1	-98,9	0,0
Bolívar	143.373	78	-99,9	0,0	58	0,02	-100,0	0,0
Huila		70	**	0,0		0,02	**	0,0
Meta	294.106		**	0,0	112		-100,0	
San Andrés	51.055		-100,0	0,0	24		-100,0	

Fig. 68 Mean exporting states in Colombia [81].

According to a research performed by CorpoHass and DANE (The Colombian statistical institution), the largest companies that exported Hass avocado in Colombia in 2022 are:

Table XI Principal exportation companies of Avocado Hass in Colombia [83]

Company	USD FOB	Tons
Avofruit S.A.S	\$27.220.496	12.263
Westfalia Fruit Colombia S.A.S	\$17.720.973	8.862
Hass Colombia SAT	\$12.495.213	6.953
Fruty Green Packing S.A.S	\$10.267.656	5.166
Jardin Exotics S.A.S	\$9.464.141	5.134

In terms of importations, they are considerably lower than the exportations due to Colombia do not require them as it is a producing country, however they take place within the territory because of the market dynamics and the bilateral agreements among countries. The historical avocado supplier for Colombia is Ecuador, which has decreased its exportations to Colombia as it has been producing higher quantities year after year. Likewise, it is reported an importation from Netherlands considered as a re-importation after being exported from Colombia. Additionally, the worker unions have also reported importations from Peru but by a non-official way; therefore the Agricultural Ministry has started to make bilateral agreements with Peru in order to establish commercial conditions between both countries and to mitigate the negative impacts from informal importations to the national market [78].

Pais de Origen	2015	2016	2017	2018	2019	2020	2021*
Ecuador (Ton)	1.130	217	133	0	0	734	0
Holanda (Ton)	0	0	0	0	49	0	0

Fig. 69 Avocado importation to Colombia [78]

If a commercial equilibrium is performed, it can be analyzed that a huge part of the Colombian avocado production goes to the national fresh market instead of going abroad; that explains why Colombia is ranked fifth on the top largest avocado exporters although it is the second largest avocado producer worldwide. Indeed, it is calculated that around 63% of the national production is maintained into the national market and the 37% is exported to the abroad consumers, but it is expected that both the production and the exports keep increasing in the following years [78].

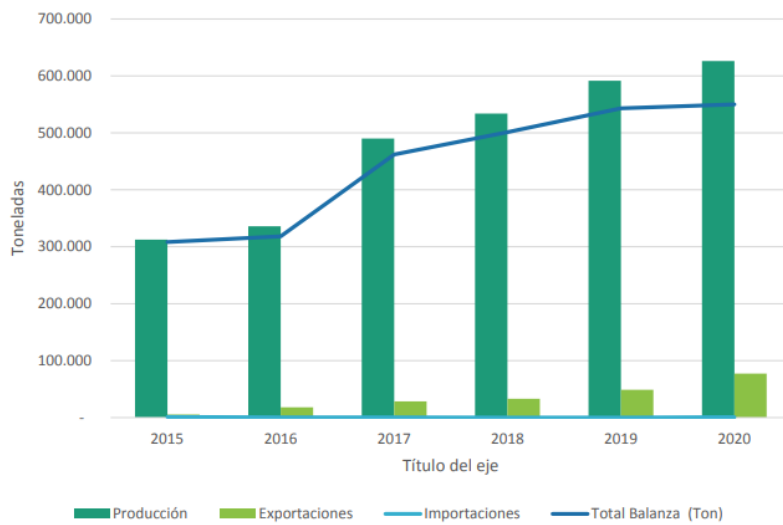


Fig. 70 Commercial equilibrium of the Colombian Hass avocado production [78].

#### 4.5. Avocado Pricing

Colombia has a competitive edge in that it can grow avocado throughout the year. However, market prices are affected by supply, which is mediated by the seasons of the year, which is why the peak of avocado production comes between October and March. Moreover, the price per kilo of avocado of Colombian origin varies according to the country of destination, due to the logistical costs of shipping to different destinations. This is how in Netherlands the price per pound is USD 1.80, while in the United States the price per pound is USD 0.9. Likewise, the price of the avocado within the national fresh market is also influenced by the market dynamics such as the growth in production, demand and exportations [85].

According to the line charts displayed about the avocado prices throughout the last five years, it is possible to observe that all the types experienced a similar cycling pattern throughout the years with an increasing trend until nowadays due to both national and international demand are increasing year after year. Indeed, the papelillo and common types have reported a pretty similar behavior, with their lowest prices in July-August due to the oversupply of avocado within the market whilst the period from January to April the prices are higher due to the supply

of avocados is lower. Moreover, the papelillo type is more likely to change prices abruptly due to its production and availability are not as larger as those ones from the common and Hass types, thus its average price is the highest between the three types with a current commercialization price between USD 1,31/kg and USD 2,44/kg while for the common type, its prices varies from USD 1,19/kg to USD 1,56/kg [86]

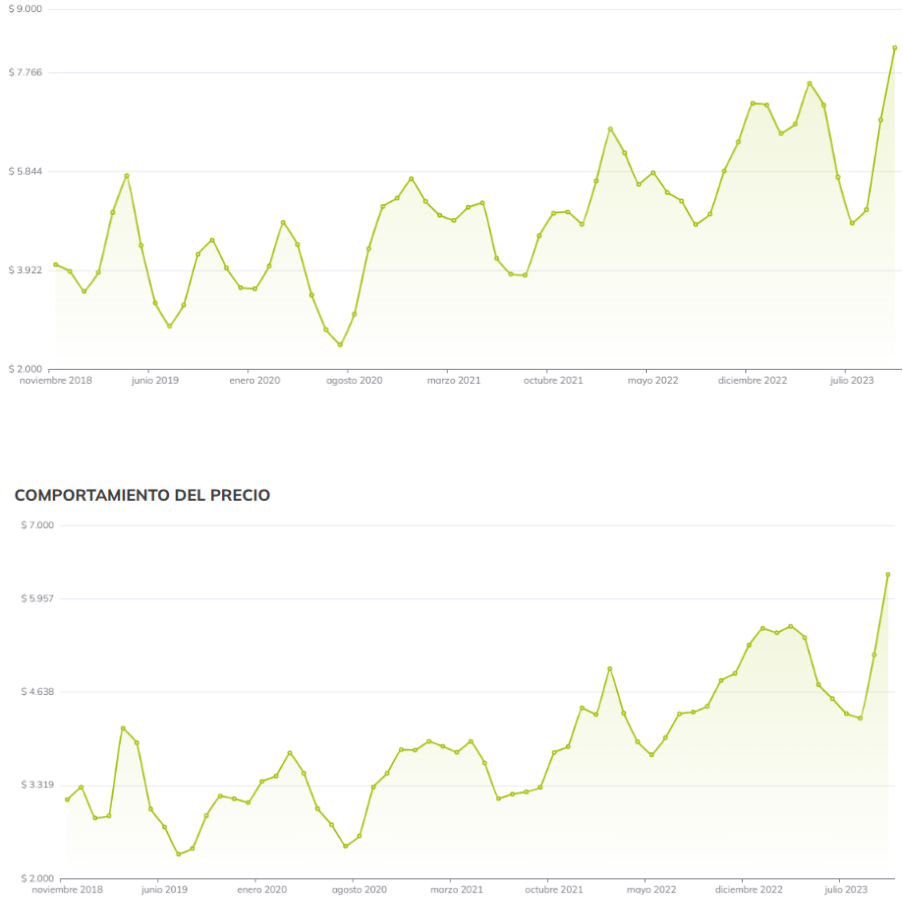


Fig. 71 Prices of Papelillo and Common type from 2018 to 2023 [86]

When it comes to the Hass type, its pattern is kind of similar to the previous ones, having its lowest prices in July-August and its pricing peaks in April or even in September due it is generally more demanded than the previous ones. In fact, the Colombian Hass avocado is commercialized worldwide while the rest ones are not, causing its price to be also influenced by the abroad dynamics. In fact, this year the price for the Hass type has been increasing even in July and August because of its both national and international overdemanding. Moreover, its price has increased 214% passing from USD 0,64 in June 2020 to USD 1,36 in October 2023 while its current price varies from USD 0,98/kg to USD 1,33/kg [86]. Lastly, the average price for Hass avocado in the international market is around USD 1,81/kg [78].



Fig. 72 Prices of Hass type from 2018 to 2023 [86]

#### ***4.6. Environmental Impact of avocado cultivation***

The cultivation of avocados has also passed from a simplified agriculture to a monoculture in order to supply the huge demand worldwide, in fact the dynamic of the supply and demand has caused the relative and permanent overproduction of avocado, implying high cost technology which affects the environment and the public health due to the overwhelming levels of the use of organophosphates and fossil fuels [87]. In Colombia, it is still not possible to generate a responsible analysis on the relationship of costs related to environmental compensation, since current market interest rates and replacement rates of nature, in many cases, are not similar as well as in other Latin American countries that produce avocados. In the case of Colombia, the geospatial characteristics related to the cultivation of avocado largely coincides with regions that already have a history of agricultural production and ideal zoning for such cultivation in terms of slopes, rainfall, relative humidity, sunlight, land suitability, and even irrigation. In other words, these are areas where coffee, yuca, plantains, and bananas have historically been produced in Colombia. Additionally, these regions boast infrastructure such as road networks, access to productivity, electrical systems, fuel availability, and access to organophosphates [87]

The water requirements for the avocado monoculture are really demanding; understanding that the planting density and spatial rearrangements of monoculture require permanent irrigation management. Indeed, an avocado tree requires on average 70 liters of water per fruit or 320 liters per kg, much higher than the production of other goods, such as the tomato trees that requires 5 liters per fruit or apples (avocados use around 15 times more water). In analyzing monoculture typologies, it has been determined that as the rate of gain increases, there is a corresponding greater loss of biodiversity. However, this pattern is only sustained for a specific period. Subsequently, the equation is affected and reduced diversity leads to increased investment and diminished profits. This particularly impacts small and medium-scale producers [87].

In terms of the carbon footprint, as per the expert panel of the United Nations, the existing production-centric model of advanced industrial societies, heavily reliant on fossil energy, has sparked a widespread environmental crisis across the globe. Contemporary agriculture, shaped

by the Green Revolution and now advanced with digital processes, artificial intelligence, genetic engineering, and various remote techniques geared towards productivity, is a key factor directly associated with the environmental crisis and the challenges posed by the global agri-food system. Consequently, the carbon footprint, recognized as an international measurement standard in agriculture, serves as a benchmark for monitoring and overseeing the major plantations. It can be estimated that the carbon footprint for the avocado productions is 0,19 kg CO<sub>2</sub> per avocado approximately (five times higher than producing bananas) considering the whole life cycle. In terms of deforestation, avocado trees require a lot of space to grow up, meaning that less trees occupy the same area, therefore less carbon will be absorbed from atmosphere; likewise, deforestation can also lead to soil erosion, which can cause flooding [87].

#### 4.7. Challenges in the Colombian avocado market

The Colombian avocado market faces several challenges in terms of environment, society, and politics that might affect both the Colombian society and the economy in the long run. According to Sanchez, maintaining high levels of productivity in this monoculture, it is required extensive developments in applied research in areas such as biotechnology, genetically modified organism management, molecular manipulations, tissue culture conservation, cutting-edge technologies and irrigation systems, and, in short, digital agriculture advances. High-cost technologies that are difficult for small and medium-sized enterprises to employ. Additionally, there is not an investigation about the measurement of the loss of natural resources (water, soil, fertility, biodiversity) for the production of the avocado monoculture. In fact, The United Nations considers that the current productive model of the monocultures based on non-renewables energies, has caused an environmental crisis worldwide. Moreover, Sánchez states that there is not a proper political and financial support for small-medium sized producers in Colombia [87].

On the other hand, the Agricultural Ministry has worked strongly on the identification of issues and the implementation of strategy in order to improve the current situation of the avocado production. First, the Colombian government has prioritized several zones in the whole territory with the purpose of organizing the production and once the areas are identified and focalized, it is possible to apply the specific strategies. The prioritized areas are located in the regions of Antioquia, Caldas, Huila, Risaralda, Norte de Santander, Santander, Tolima, Quindío and corresponds to the areas with the largest producing avocado activity [78].

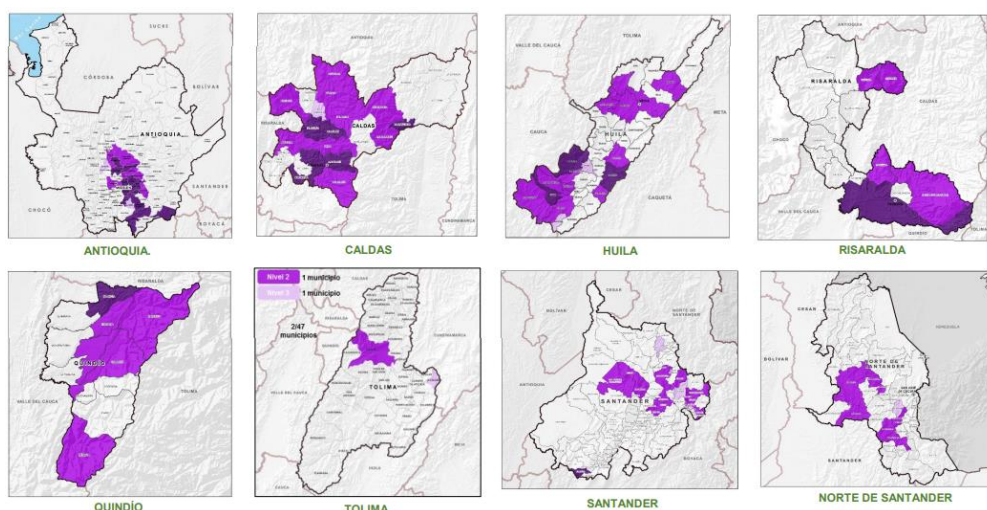


Fig. 73 Main Prioritized Areas for Avocado Cultivation [78]

The strategies proposed by the Ministry of Agriculture in order to perform in the prioritized areas are:

- 1) Production of quality plant material that guarantees optimal genetic, sanitary, and physiological conditions for the production of suitable areas.
- 2) To focalize new zones for the growth of new areas.
- 3) Creation of added value in order to diversify destination markets.
- 4) To strengthen the strategy of following-up, monitoring, and controlling.
- 5) To promote the certification of traceability, quality, and safety protocols (exports registration, BPA, Global GAP)
- 6) To adjust production loans and payment deadlines of individual and associative credits.
- 7) To promote a culture of use of the Agricultural Insurance Incentive for cultivation and harvest.
- 8) To obtain the recognition of the supply chain organization.

Furthermore, The Ministry of Agriculture has other additional strategies such as the technical assistance to implement technological infrastructure in order to improve the performance of the production as well as the calculation the environmental footprint of the avocado cultivation accompanied by the establishment of sustainable goals to reduce the environmental impact of the avocado production in Colombia and to be aligned with the global environmental objectives [78]. In conclusion, it is expected that these objectives of the Ministry of Agriculture in terms of the avocado production in Colombia will be met in the following years as both production and commitment of the government increase. Likewise, the Colombian situation can be useful for other countries to implement similar strategies or even the Colombian government can take other strategies from the rest of producing countries in order to complement their actions to be more sustainability.



## 5. Avocado market in the Italian context

As it was stated in the first chapter, Italia experienced the largest growth of avocado consumption with 37% between 2020 and 2021 and even though Italy is not one of the top five importers in Europe right now, its avocado industry has to rank among the most promising. Indeed, according to research performed by the Centro Servizi Ortofrutticoli, the avocado volume bought by the Italian households has increased more than three times in the last five years, experiencing a considerable increment of 35% between 2020 and 2021, reaching up a figure of 15.000 metric tons in the last year. In terms of value, the 2021 year rose by 38% compared to the year 2020, ending up in roughly 70.000 euros. In contrast, the mean avocado price increased abruptly by 28.88%, reaching up the value of €4.15/kg due to market dynamics and despite this price can be considered high and a constraint when buying it, its consumption by the Italian families keeps increasing year after year [89].

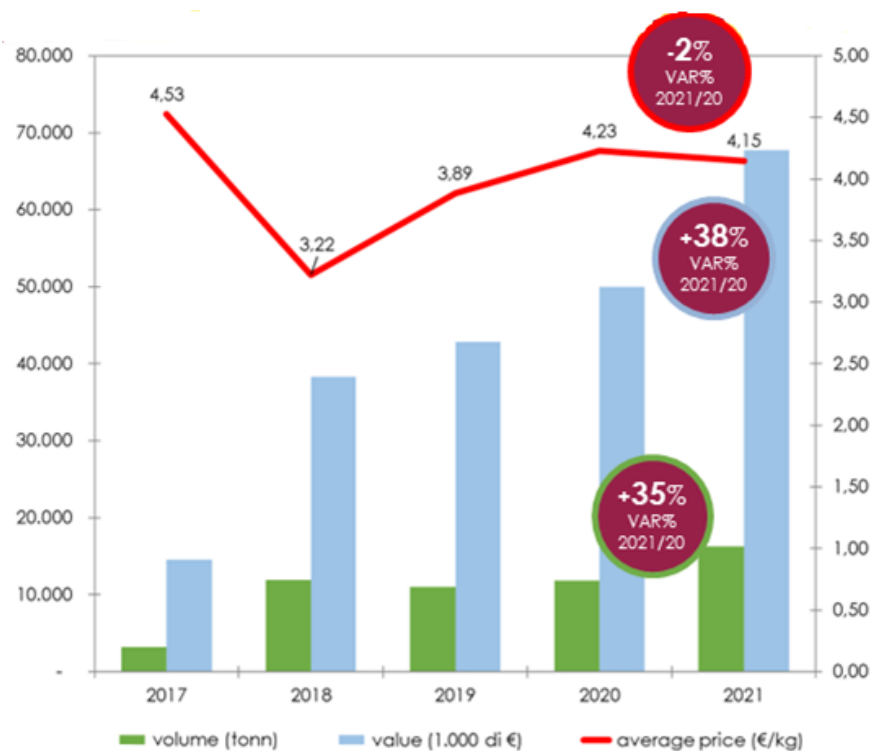


Fig. 74 Italian Households consumption [89].

In the exotic fruit category, not including the pineapples and the bananas, it can be seen that the avocados account the most important volume with 41% followed by the mangoes with 20% and with a notable distance the Papaya and the Coco. In fact, 25% of the Italian households have acquired avocados at least once in the year 2021, evidencing that the avocados in Italy have experienced an important trend inside the Italian food shopping as this value was 8.3% five years ago. Each household bought during 2021 2,53 kg with a value of €10.5 on average. When it comes to the mean organized distribution channels, the supermarkets accounts 46% of the avocados sold followed with a considerable percentage difference by the convenience stores



(LIDL, ALDI) with 20%, then the hypermarkets which account 10% and finally the small stores with 2% of the avocado distribution. As a counterpart, the traditional channels (fresh fruit marketplace) accounts 22% of the avocado distribution but are losing share year after year as well as it is also happening with the other fresh fruits.

Geographically, the consumption is driven by the central area and the Sardegna Island, where the variation is 74% compared with the year 2020 and account the largest consumption share (32% of the total national volume). The Northwest area occupies the second place with the 30% followed by the Northeast with 19% and finally, the southern Italy and Sicilia with the 23% of the total avocado consumption. It is important to note that the avocado has not well penetrated the Sicilian market despite it has the best conditions to cultivate it and the lowest prices in the whole territory. Indeed, in this part of Italy 18% of the families have consumed it, which is lower than the national average of 25%.

In terms of age, it is possible to observe a well distribution among the majority of ages. Surprisingly, young people only account 8% of the avocado consumption being the least consumers although it is expected that they are those ones who consume the most amount of avocado. Actually, the older the age the higher the probability to consume avocado, and people who are aged from 35 to 44 years accounts 18% and consume 2.5kg on average per year followed by people which are between 45 years old and 54 years old who consume 2.7 kg of avocado per year. Finally, it is possible to see a decrease regarding people from 55 to 64 years which account 20% of the total avocado consumption and unexpectedly the oldest people (65 years old and above) are those ones who consume the most amount of avocado with 28% [89].

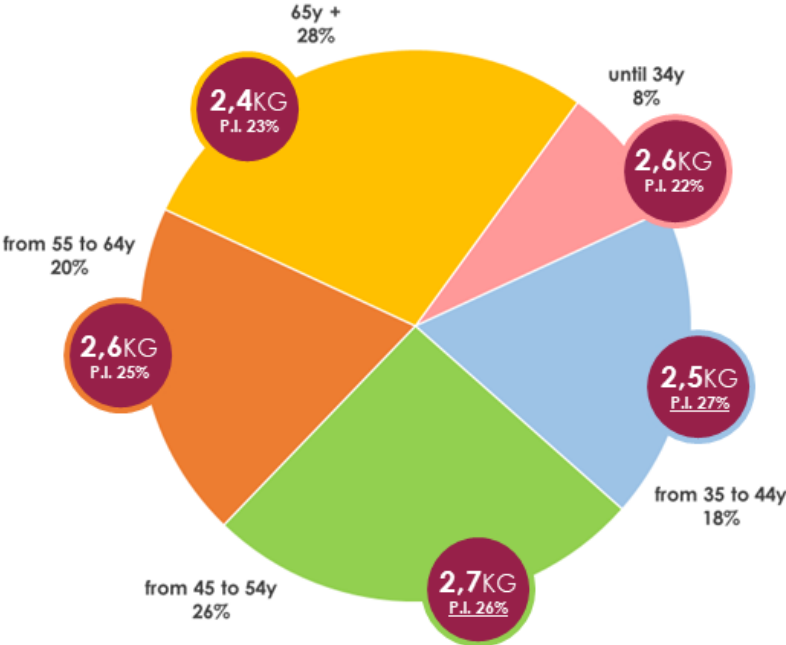


Fig. 75 Avocado consumption based on demography in Italy [89].

An important point to highlight is that 30% of the 4.500 metric tons of avocado in Italia were acquired by families composed by at least one kid or teenager; people that will recognize this fruit in the future and will keep buying into their families. On the other hand, the number of bio-avocados acquired were 10% of the total consumption with an evident increase of 45% compared to the year 2020; stats that are expected to increase in the following year due to the awareness of environmental situation [89].

### ***5.1. “Agricola Persea” a project of avocado commercialization between Colombia and Italy***

Battaglio is an Italian company that is in charge of importing and distributing both exotic and traditional fruit which come from south hemisphere, especially in off-seasonal conditions. Battaglio was born in 1972 in Torino specifically in the fresh fruit market and opened its first fresh fruit warehouse by 1994 followed by its importation opening the next year. In 2014, they opened its second fresh fruit warehouse in Roma and took presence in the Italian supermarkets with its fresh fruits categorized as exotic ones [90].



*Fig. 76 Battaglio Logo [90]*

In 2018, the company Agricola Persea was born thanks to an agreement between Battaglio and C.I Tropical (a Colombian company dedicated to the commercialization of bananas), with the purpose of cultivating and producing Hass avocado in order to be exported directly to Italy. The chosen area was Valle del Cauca located between 1600 and 2200 meters above sea level; the land extends parallel to the Pacific coast and is indicated as among the most suitable for agriculture, thanks to prolonged sun exposure and abundant rainfall. Moreover, the land on which AGRICOLA PERSEA cultivates today was an area dedicated to extensive livestock farming where silt and deep soils predominate. This has a mixture of organic materials and abundant nutrients that enhance the crops, making the Hass avocado production more sustainable while the soil and the natural resources of the local communities are preserved. Nowadays, the orchards occupy 1000 hectares, and it is expected this figure to increase yearly. The harvest period takes place in March/April and October/November, being a potential advantage in the competitive market due to the Hass avocado harvesting in other production zones is low in those periods.



Fig. 77 Agricola Persea Logo[91]

## 5.2. Persea Italia: Bio Avocado

In Italia, there is a project which is being developed in the Sardegna Island called Persea Italia, its objective is to produce bio avocado by regenerative agriculture and short supply chain. 280 hectares will be cultivated in the Ussana area (Sardegna) and Cosenza (Calabria) and will be irrigated by drip system. Previously, the land was used for cultivation of corn and cereals but they were removed in order to “heal” the land conditions, indeed, the purpose is to diversify the zone, cultivating not only avocado but also olive trees where will be the home for around 75 million of bees accompanied by the reforestation of the degraded zone. Paolo Frigati, the founder of Persea Italia, have chosen the avocado product because of its long-run profitability and the current trend that is taking place in Europe, he is also thinking about planting not only Hass type but also Bacon, Ettinger, Fuerte, Lula in order to cover at least 6 months of demand during the year. The regenerative agriculture proposed by Persea Italia is based on the recovery of degraded soil for monocultures and provide it with excellent microorganisms provided by “Biostimolanti” an Italian enterprise in charge of the supply of high-quality microbiota [92].



Fig. 78 Persea Italia Logo[92].

Furthermore, the project expected to start exporting 5000 tons of avocado to Italia and the rest of Europe by 2025 and it is being financed by sustainable credits through tokens codified by pretty advanced informatic structures (blockchains) which enable the commercialization through the platforms; making it an investing alternative for those ones who are looking for project based on the sustainability [92].

### 5.3.SWOT for the Colombian avocado in the Italian market

The SWOT method stands for strengths, weaknesses, opportunities, and threats in order to analyze both the internal and external factors which might influence specific situations, generally business model. In this case, a SWOT analysis will take place in order to examine the current situation and future perspectives of the Colombian avocado withing the Italian market.



Fig. 79 SWOT of the avocado situation

## 6. CONCLUSIONS

- 1) The avocado market is one of the most promising ones worldwide and its popularity is expected to keep growing up in the following years and it is estimated a CAGR of 10.3% from 2023 to 2031 reaching up a figure of US 45.1 Bn by 2031.
- 2) Mexico is the largest producer worldwide with 2442.94 tons in 2021 accounting 30% of the global market followed by Colombia with 979.62 tons with a 12% market share followed by Peru, Indonesia, Dominican Republic, and Kenya. In fact, the common thing between these countries is that all of them are located near to the equatorial line making them suitable to cultivate avocados because of its proper warm climate and huge water resources regardless of the continent they are on.
- 3) The largest exporters of in 2021 were Mexico (\$3 billion) followed by a huge difference Netherlands (\$1,2 billion) and Peru (\$1 billion), accounting 71.4% of the total market share value. On the other hand, Colombia can be considered as the newest avocado exporter being the “Plan B” of the USA market. The main commercial routes are Mexico-United States which accounts the 34.5% of the total avocado market followed by Peru-Netherlands, being Peru the second largest exporter in the world and the first one in South America and Netherlands-Germany having a value of 342 million dollars based on a re-exporting process. In fact, reports suggest that by 2030, the United States and the European Union are expected to maintain their positions as the leading global importers of avocados, with projected shares of 40% and 31% of all imports, respectively [34].
- 4) In Italy the consumption of avocados has increasing 37% from 2020 to 2021, meaning a huge consumption boom in regard to this tropical fruit compared to the other European countries. However, in spite of this abrupt growth in the consumption, the Italian consumption keeps being very low compared to its population amount (less than 700g per capita) and far less than the rest countries of Western Europe on average. The reason is that Italians continue to eat traditional fruits and vegetables as before, therefore it takes time to launch “exotic” products like avocados. Notwithstanding, people are becoming more and more concurrent consumers of avocados such as the Hass type.
- 5) A huge part of the Colombian avocado production goes to the national fresh market instead of going abroad; that explains why Colombia is ranked fifth on the top largest avocado exporters although it is the second largest avocado producer worldwide.
- 6) In terms of exportations, the Hass avocado is the most exported type from Colombia due to its great recognition and reception from the consumers worldwide. In fact, during the period period 2015 to September 2022, Colombian avocado exports have displayed consistent yearly increases ranging from 15% to 50%, resulting in a cumulative export value of USD FOB 725.8 million and 366,582.1 net tons.
- 7) In the case of Colombia, the geospatial characteristics related to the cultivation of avocado largely coincides with regions that already have a history of agricultural production and ideal zoning for such cultivation in terms of slopes, rainfall, relative humidity, sunlight, land suitability, and even irrigation. In other words, these are areas where coffee, yuca, plantains, and bananas have historically been produced in

Colombia. Additionally, these regions boast infrastructure such as road networks, access to productivity, electrical systems, fuel availability, and access to organophosphates.

- 8) The Colombian avocado market faces several challenges in terms of environment, society, and politics that might affect both the Colombian society and the economy in the long run. In fact for maintaining high levels of productivity in this monoculture, it is required extensive developments in applied research in areas such as biotechnology, genetically modified organism management, molecular manipulations, tissue culture conservation, cutting-edge technologies and irrigation systems, and, in short, digital agriculture advances. High-cost technologies that are difficult for small and medium-sized enterprises to employ. However, the Ministry of Agriculture is implementing strategies to improve both the production as well as stakeholder's conditions.
- 9) Since Italy is one of the most promising markets and Colombia is taking a really important place in terms of production and exportations of avocado. it would be very possible to think about the opening of a direct importing channel between these two countries and to invest more resources within this trading relationship.

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