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Article

Production and competitiveness of Mexican bananas worldwide

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Abstract

Bananas are a fruit grown in almost all tropical and subtropical regions of the world and they are considered part of the food security of developing countries; it is estimated that around 400 million people depend on bananas to ensure their food and for another part of the population, they are their source of income. The research analyzes the production and trade of bananas produced in Mexico from 1994 to 2021; information from the SIAP and FAOSTAT databases was used to calculate the growth rates of the production and trade variables and the indicators of trade competitiveness. The growth rate of production and exports is positive for the period studied; likewise, the value of the export coefficient, tradability indicator, and the degree of export openness show values greater than zero, whereas the commercial dependence coefficient has values close to zero, so it is concluded that banana production and exports in Mexico are expanding, increasingly consolidated in the domestic market and have competitive advantages in the international market.

Keywords:

exports, imports, competitive advantages.

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Introduction

Worldwide, the most important tropical fruits in terms of agricultural production are bananas, mangoes, pineapples, avocados and papayas; these fruits have shown exponential growth in international trade due to the change in consumer preferences; for producing countries, these fruits guarantee the nutrition of their population and are considered a means of livelihood for farmers (OECD and FAO, 2021).

Bananas are native to Southeast Asia, they are a fruit grown in any tropical region around the world, are considered the fourth most important food in agricultural production and trade (León *et al*., 2023), and rank first in tropical fruits that are consumed fresh (Rivera *et al*., 2018). There are more than 1 000 varieties of bananas that are produced and consumed worldwide, mainly in developing countries, where they are an important part of their diet and generate income by trading the product (FAO, 2022a).

Worldwide, bananas are a highly appreciated product in the market for being an excellent source of potassium, rich in vitamins A, B6, C and D; their consumption provides benefits to the bones and muscles of the body and helps to lower blood pressure and both the pulp and peel of the banana contain antioxidants, such as gallocatechin and dopamine; the consumption of bananas in the ripe state is associated with an increase in the level of carbohydrates associated with starch, whereas in their unripe state, they have a high concentration of starch (Blasco and Gómez, 2014; Martínez and Rey, 2021).

Bananas are considered a food with a high content of indigestible fibers, such as cellulose, hemicellulose and alpha-glucans, which is why they are attributed with effects such as restoring normal bowel activity, and they are an important source of dietary fiber (Rivera *et al*., 2018). In 2021, world banana production amounted to 124 978 578 t, exporting 19.67% of the production and the rest was destined for self-consumption; for their part, imports were equivalent to 23 336 453.6 t; India, Mainland China, Indonesia, Brazil, and Ecuador are the largest banana producing countries and together contribute more than 50% of total world production. Mexico ranks twelfth as a banana producing country with a production of 2 405 891.33 t (FAOSTAT, 2024).

Globally, 24 584 262.5 tons were exported in 2021 (FAOSTAT, 2024); Latin America and the Caribbean (LAC) are the main exporting region in the world, with a total of 15.9 million tons exported; Ecuador is the largest banana exporter with around 6.8 million tons (FAO, 2022b); it should be noted that Ecuador, Guatemala, Philippines, Costa Rica, and Colombia exported 65.70% of the total bananas traded worldwide, whereas Mexico ranks as the tenth largest exporter of bananas in 2021 with 489 522.34 t, participating with 1.99% of the volume exported in the world market (FAOSTAT, 2024).

In 2021, global imports amounted to 23 336 453.6 t; the main importing countries are the United States of America, Mainland China, the Russian Federation, the Netherlands, Germany, and Japan, which together import 46.31% of the total volume of bananas imported worldwide (FAOSTAT, 2024). From 1994 to 2021, there was an increase in the production and trade of bananas produced in Mexico.

Competitiveness analyzed from the macroeconomic point of view is determined by factors such as exchange rates, interest rates, and public deficits, as well as the availability of cheap labor and the endowment of natural resources; however, these are not decisive factors for competitiveness; therefore, the productivity of an economy is one of the main indicators of economic growth in a country (Guzmán and Abortes, 1993).

The competitiveness of nations and their development is determined by the free movement of goods, services, and capital, where the signing of trade agreements between nations allows free exchange, causing each nation to seek the increase of productive factors and generation of technological development in order to produce a good or service with greater quality and efficiency; therefore, international trade offers a guideline for competitiveness (Beltrán, 2012).

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Productivity linked to an efficient use of resources allows a nation to satisfy its internal market and be competitive in the external market, and together with the incorporation of technology, it aims to increase the productive capacity of a sector, which is why it is considered a fundamental element of a country's competitiveness (Zamora and Ortiz, 2021). A country's competitiveness in world trade will depend on its ability to produce goods and services that satisfy the tastes and preferences (through product differentiation, quality, use of technology) of consumers in other nations with which it trade through the export of goods (Chávez and Palacios, 2017).

In the international market, a country's competitiveness can be measured through the flows of exports between countries, this measurement can be carried out through indirect indicators where the participation of a country or products in the international market is analyzed (Avendaño, 2008). Indicators such as relative trade balance, tradability indicator, trade dependence coefficient, degree of export openness, and the export coefficient allow us to analyze a country's competitive trade performance in the international market (Zavala *et al*., 2023).

Productive restructuring is necessary for a country to be able to face the new challenges of competitiveness at the international level, there being a relationship between competitiveness, incorporation of technical progress, industrial dynamism, and increased productivity, so international competitiveness will be understood as the ability of a country to maintain and expand in the international market and thereby raise the standard of living of its population (Fajnzylber, 1988).

International competitiveness is known as the ability of a country to produce and market goods and services that allow it to compete in the foreign market because they are better and cheaper than those of the competition, thus achieving an increase in the quality of life of its population through increased income and job creation (Caamal *et al*., 2014).

The lack of research regarding the situation of Mexican bananas in production and trade in the world with a focus on competitiveness does not allow us to have the necessary information to develop a business plan where there is a vision of expanding the productive capacity and the market; the research aimed to analyze the behavior of the production and trade of bananas produced in Mexico from 1994 to 2021 through the calculation of growth rates of the variables of harvested area, yield, production, exports, and imports and the determination of competitiveness indicators in order to show that Mexico has the capacity to produce bananas and surpluses for export so that they are considered a competitive product in the international market.

Materials and methods

To carry out the research, the information was gathered by consulting the statistical database of the Food and Agriculture Organization of the United Nations (FAOSTAT) and the Agrifood and Fisheries Information Service (SIAP), for its acronym in Spanish for the period from 1994 to 2021; the data analyzed correspond to the production, harvested area, yield, exports, and imports of bananas by Mexico, of which the growth rate of one of the variables was calculated in order to observe its behavior throughout the period studied from 1994 to 2021.

In addition, a bibliographic review on the subject of competitiveness was carried out to calculate and interpret trade competitiveness indicators, such as relative trade balance, export coefficient, tradability indicator, degree of export openness, and trade dependence coefficient, to analyze each of them and demonstrate whether bananas produced in Mexico are competitive in the international market.

Procedures for calculating growth rate and competitiveness indicators

The growth rate shows the percentage increase or decrease of a variable in a given period of time (Zavala *et al*., 2023) and is calculated using the following formula:

$$GR=\left(\left(\frac{Vyn}{Vy1}\right)-1\right)*100$$

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Where: GR= growth rate; V_{yn}= value in the last year and V_{y1}= value in year 1. The analysis of the competitiveness of a product can be shown by expressing the participation of exports of that product in the world market and its productive capacity, supply of the domestic market and generation of surplus for export.

The relative trade balance helps to identify countries that are net importers or exporters, as well as products destined for export that have a competitive advantage in the market (Caamal *et al*., 2017); the method for calculating this indicator is by the following formula:

$$RTB_i=\frac{(X_{ij}-M_{ij})}{(X_{ij}+M_{ij})}$$

Where: RTB_i= a country' s relative trade balance for a specific product; X_{ij}= banana exports from Mexico to the world market; M_{ij}= imports of bananas by Mexico from the world market. If the relative trade balance value is positive (greater than zero), there is a competitive advantage of said product in international trade, and if the resulting values are negative (-1 to 0), the country is oriented towards imports of the product studied.

The export coefficient shows how much of the national production of a product is exported (Velín and Medina, 2011); the calculation method is as follows:

$$EC=\left(\frac{X_{TX}}{Q_{TX}}\right)*100$$

Where: EC= export coefficient; X_{TX}= total banana exports from Mexico to the world; Q_{TX}= total banana production in Mexico. The higher the value of the export coefficient, the greater the competitiveness of the product in the market.

The tradability indicator measures a country's ability to generate net exportable surpluses in relation to its domestic consumption, it shows the relationship between the trade balance and the value of apparent consumption (Magaña *et al*., 2020). The formula used for calculating this indicator is as follows:

$$T_{ij}=\frac{(X_{ij}-M_{ij})}{(Q_{ij}+M_{ij}-X_{ij})}$$

Where: T_{ij}= Tradability indicator; X_{ij}= banana exports from Mexico to the world market; M_{ij}= banana imports by Mexico from the world market; Q_{ij}= domestic banana production in Mexico.

If the tradability indicator shows values greater than zero, the sector will be considered an exporter, there is an excess of supply and a competitive product; on the contrary, with values below zero, the product is not competitive and the needs of the domestic market are covered by imports of said product.

The degree of export openness refers to the degree of insertion of a product in a specific market, indicating the share of exports of the product over apparent consumption (effective demand), the calculation method is by the formula:

$$DE=\frac{X_{ij}}{Q_{ij}+M_{ij}-X_{ij}}$$

Where: DE= degree of export openness; X_{ij}= banana exports from Mexico to the world market; M_{ij}= banana imports by Mexico from the world market; Q_{ij}= domestic banana production in Mexico. If the index shows values close to zero, the country will be less competitive, most of its production will be destined for the domestic market (Luquez *et al*., 2022) and with values close to one, the country will be more competitive. The higher the value of the index, the greater the competitiveness.

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The trade dependence coefficient measures the degree of penetration of imports of a product in a country, it indicates the relationship between the value of imports and the value of apparent domestic consumption (Velín and Medina, 2011). The following formula is used to calculate this indicator:

$$DI_{ij}=\frac{M_{ij}}{Q_{ij}+M_{ij}-X_{ij}}$$

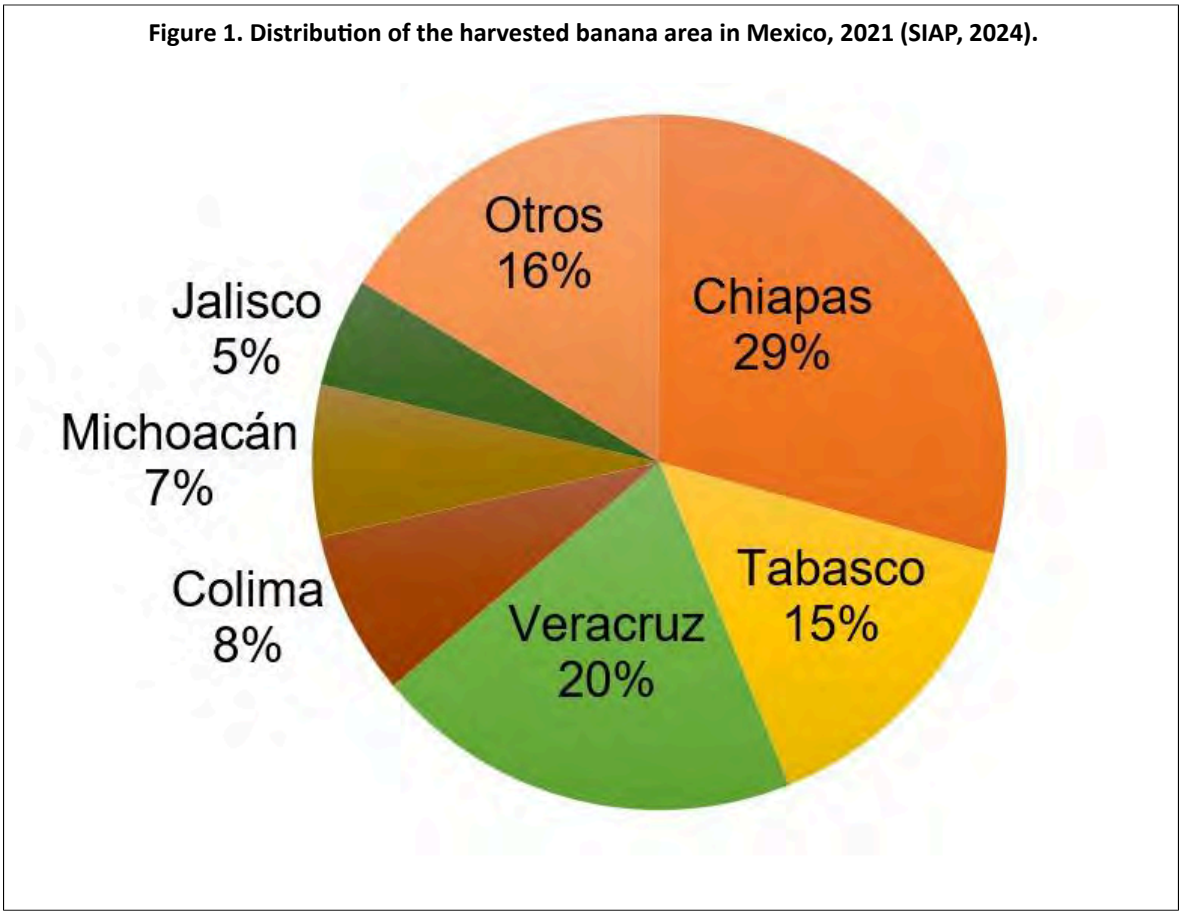
Where: DI_{ij}= trade dependence coefficient (degree of penetration of banana imports in Mexico); X_{ij}= banana exports from Mexico to the world market; M_{ij}= banana imports by Mexico from the world market; Q_{ij}= domestic banana production in Mexico.

The higher the value of the coefficient, the greater the dependence of domestic consumption on imports, but as this indicator approaches zero, the competitiveness of the sector or production chain will be greater, assuming that the country has the capacity to supply its domestic demand with national production and at the same time allocates part of the production to export.

Results and discussion

In 2021, the states of Chiapas, Veracruz, and Tabasco had the largest banana harvested area (50 893.31 ha) according to data SIAP (2024), they concentrated 64% of the total harvested area at the national level (79 663.62 ha) (Figure 1).

Figure 1. Distribution of the harvested banana area in Mexico, 2021 (SIAP, 2024).



The harvested banana area at the national level shows a growth rate of 5.96% during the period from 1994 to 2021; the harvested area, although it has not shown large increases, has maintained a positive trend throughout the period studied (Figure 2), it went from 75 183 ha in 1994 to 79 663.62 ha in 2021 (SIAP, 2024).

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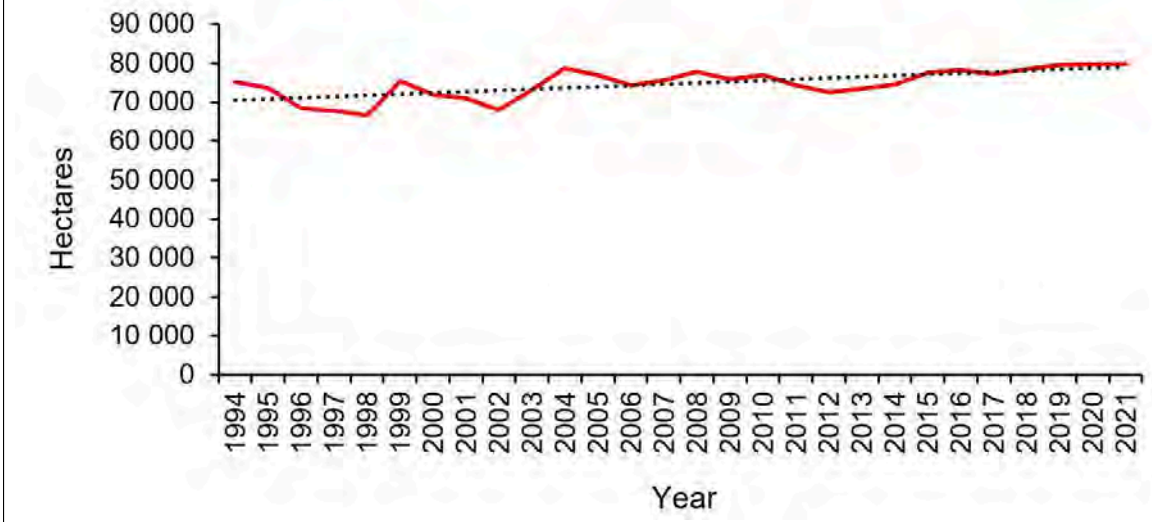
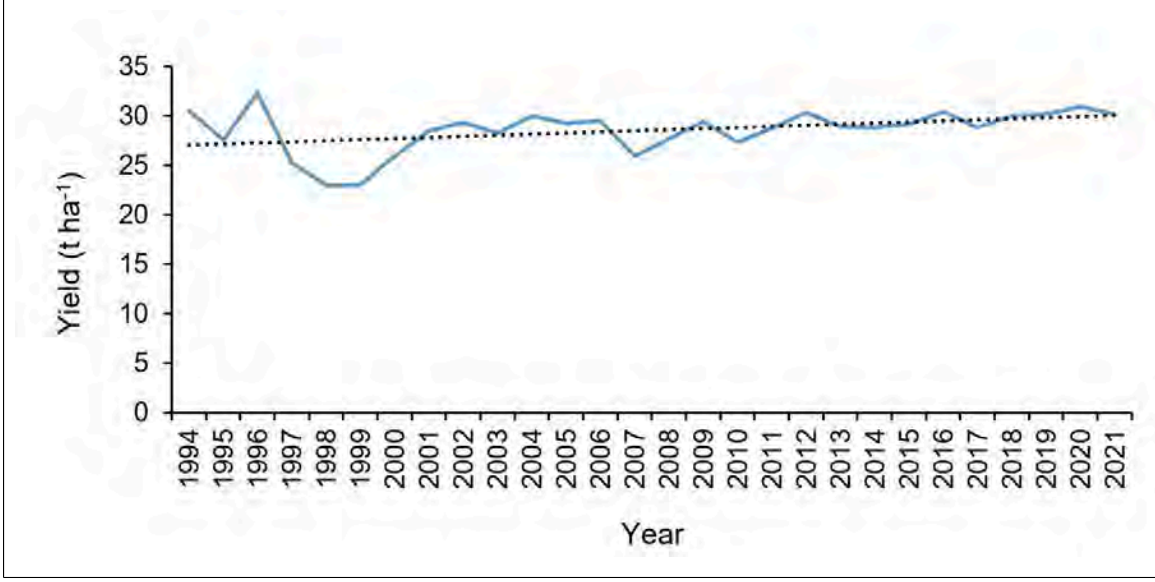
Figure 2. Behavior of the harvested banana area in Mexico, 1994-2021 (SIAP, 2024).



In Mexico, the yield in banana growing areas has maintained an increasing trend throughout the period from 1994 to 2021, reaching an average yield of 22.92 t ha^{-1} in 2021; the yield shows ups and downs for 1998 and 1999, where the yield was only 22.97 and 22.94 t ha^{-1}, respectively (SIAP, 2024); in contrast, the maximum yield was reached in 2020 with 30.9 t ha^{-1} (Figure 3); the results obtained are similar to those stated by SENASICA (2020), where the national yield from 1980 to 2021 went from 19.7 t ha^{-1} to 30.2 t ha^{-1}, showing variations throughout the period studied. At the national level, Tabasco stands out with 53.19 t ha^{-1}, followed by Jalisco, Colima and Michoacán with a yield of 43.61, 34.06 and 31.66 t ha^{-1} (SIAP, 2024).

Figure 3. Behavior of banana yield in Mexico, 1994-2021 (SIAP, 2024).



SIAP (2024) data at the national level show that total banana production in Mexico in 2021 is 2 405 891.33 t, where banana production was concentrated in 16 states, among which Chiapas (670 289.36 t), Tabasco (620 975.14 t), Veracruz (297 656.95 t), Colima (207 756.23 t), Michoacán (177 745.43 t) and Jalisco (176 372.7 t) stand out as the ones with the highest production at the national level and concentrate 89% of the total banana production in Mexico in 2021 (Figure 4).

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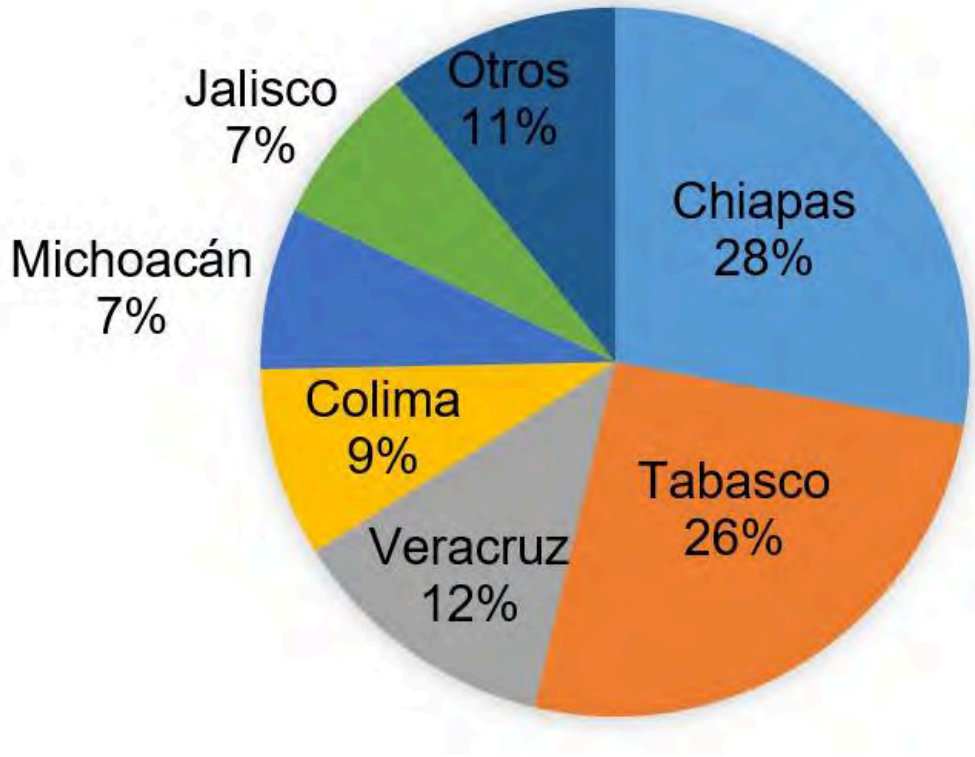
Figure 4. Distribution of banana production in Mexico, 2021 (SIAP, 2024).



These results are similar to Ibarra *et al*. (2023) results, which show that banana production depends on the states of Chiapas, Tabasco, Veracruz, and Colima, which together represent 74.47% of the national production of the crop in 2020. Banana production in Mexico in 1994 was 2 295 440 t and by 2021, this production was 2 405 891.33 t (SIAP, 2024), with a growth rate of 4.81%, so it was observed that, although the volume of production has not increased exponentially, production has remained more or less constant and with a positive trend throughout the period from 1994 to 2021 (Figure 5).

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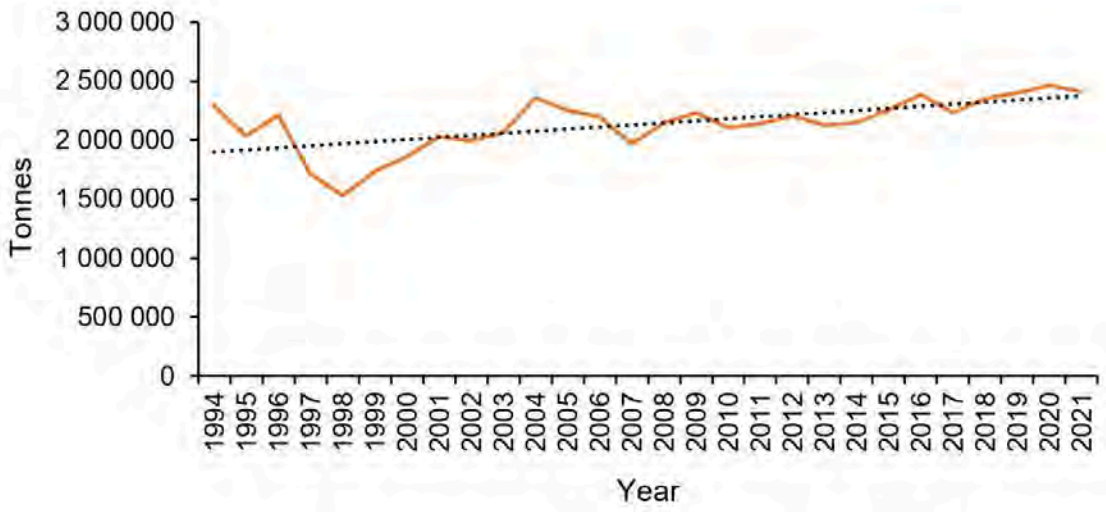
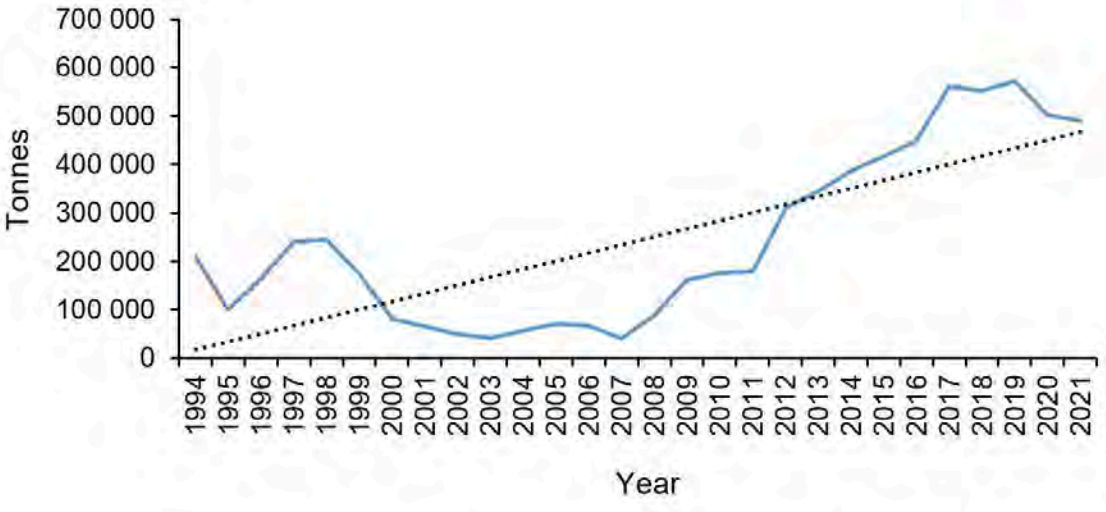
Figure 5. Behavior of banana production in Mexico, 1994-2021 (SIAP, 2024).



Globally, Mexico is among the largest banana exporting countries, reaching an exported volume of 489 522.34 t in 2021. The growth rate of banana exports from 1994 to 2021 was 135.42%, with an increasing trend throughout the period (Figure 6) in 2021, the United States of America (412 193.58 t) was the main destination, where about 84% of Mexico total exports to the international market were destined; another of the target markets in 2021 was Japan (73 533 t), where 15% of banana exports were sent; other countries to which bananas are exported in smaller quantities are the United Kingdom (1 743 t), the Netherlands (1 646.37 t), Canada (307.67 t) and Germany (98.56 t) (FAOSTAT, 2024); these results are similar to those provided by SENASICA (2020), which indicates that Mexico exports to more than 30 countries and that more than 80% of its exports are directed to the US market.

Figure 6. Behavior of exports of banana produced in Mexico, 1994-2021 (FAOSTAT, 2024).



In this sense, the results reaffirm what was described by Schwentesius and Sangerman (2014), where they indicate that Mexico is competitive in fruit production and trade and that its main market

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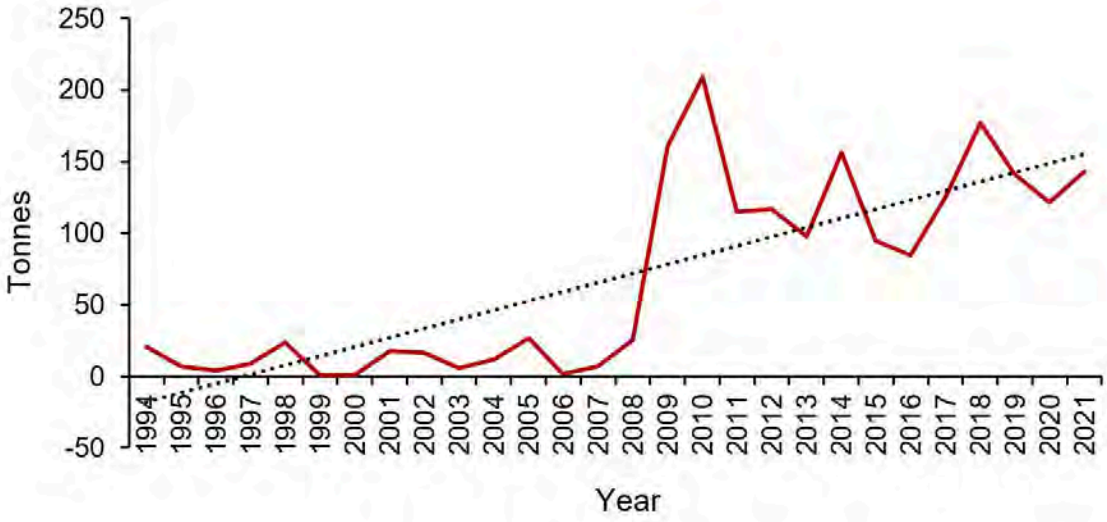
for fresh fruit is focused on a single market, which is the United States of America, which represents an advantage due to the proximity of the market but at the same time makes Mexican banana exports vulnerable due to the dependence on the North American market.

Regarding the volume of banana imports made by Mexico from 1994 to 2021, it has been minimal compared to the volume of exports since it is considered that the banana production that exists in Mexico covers domestic demand in its entirety and there is a surplus to be exported.

There has been an increasing trend in terms of the volume of imports that Mexico has made from 1994 to 2021; nevertheless, such imports have ranged from 1 to 209 tons (FAOSTAT, 2024; Figure 7), which is an insignificant figure, so it can be said that, in the case of Mexico, there is no commercial dependence on bananas. Mexico banana imports come from Peru, the United States of America, and Ecuador.

Figure 7. Behavior of banana imports by Mexico, 1994-2021 (FAOSTAT, 2024).



Banana competitiveness indices

From 1994 to 2021, the trade competitiveness indices of bananas produced in Mexico: relative trade balance, export coefficient, tradability indicator, and the index of degree of export openness, with positive values, show that Mexico is competitive in the world market in terms of its banana production and export and that it does not depend on imports, as indicated by the coefficient of trade dependence with values close to zero, so that its production is enough to supply its domestic market (Table 1).

Table 1. Main competitiveness indices of bananas produced in Mexico, 1994-2021 (FAOSTAT, 2024).

Year	Relative commercial balance	Export coefficient	Tradability index	Index of degree of export openness	Commercial dependence coefficient
1994	0.9998	0.0906	0.0996	0.0996	0.00002
1995	0.9995	0.0492	0.0518	0.0518	0.00005
2000	0.9997	0.0435	0.0455	0.0455	0.00001
2005	0.9977	0.0312	0.0322	0.0322	0.00009
2010	0.9913	0.0837	0.0913	0.0914	0.00106

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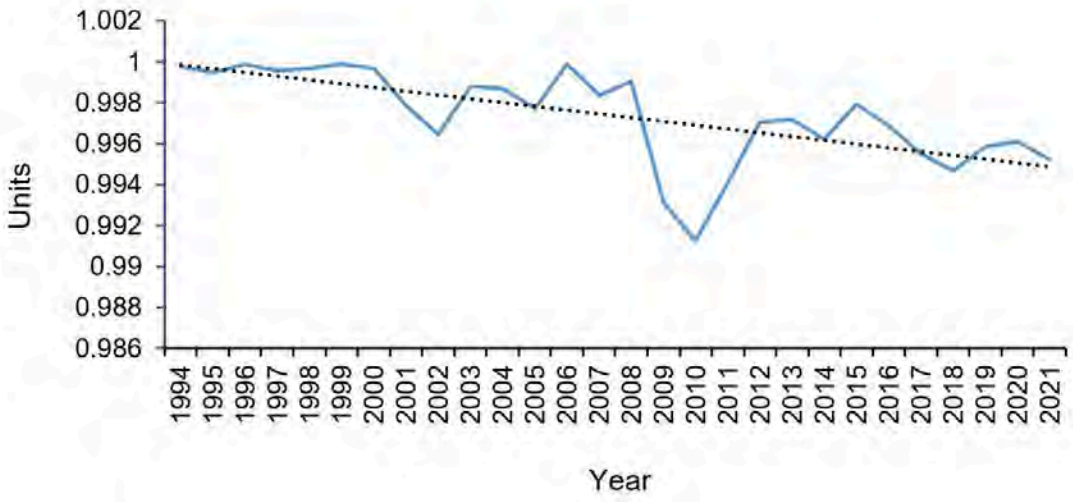
Year	Relative commercial balance	Export coefficient	Tradability index	Index of degree of export openness	Commercial dependence coefficient
2015	0.9979	0.1843	0.2258	0.2259	0.00079
2020	0.9961	0.2033	0.2552	0.2552	0.00326
2021	0.9952	0.2035	0.2553	0.2554	0.00395

The relative trade balance index during the analyzed period showed positive values close to one, with an average of 0.9974, and it reached a value of 0.9952 in 2021, which reflects that Mexico is a net exporter of bananas, where national production is enough to supply the domestic market and at the same time there are surpluses that allow it to compete in the international market; it is observed that Mexico is a country that has a competitive advantage in the market (Table 1, Figure 8) and that exports are increasingly greater than imports.

Figure 8. Relative trade balance of bananas, 1994-2021 (FAOSTAT, 2024).



The values resulting from calculating the relative trade balance coincide with what was stated by Pat *et al*. (2014), where this value may indicate a competitive advantage and allows us to identify net exporters of a product, taking positive values when the country exports more than it imports, and a value close to 1 reflected the importance of exports of the product studied in relation to its imports, indicating that it satisfies its domestic market and there is also product export.

The average export coefficient during the period from 1994 to 2021 is 0.11, which indicates that Mexico exported 11% of its total banana production; in 2021, Mexico exported 20.35% of its national production; throughout the period analyzed, the export coefficient has been maintaining an increasing trend, so the volume of production destined for export has been increasing (Table 1, Figure 9), showing that Mexico is a competitive country in the banana trade.

The results obtained are similar to those of SENASICA (2020), where it indicates that Mexico has allocated more than 23% of national banana production to the international market since 2017.

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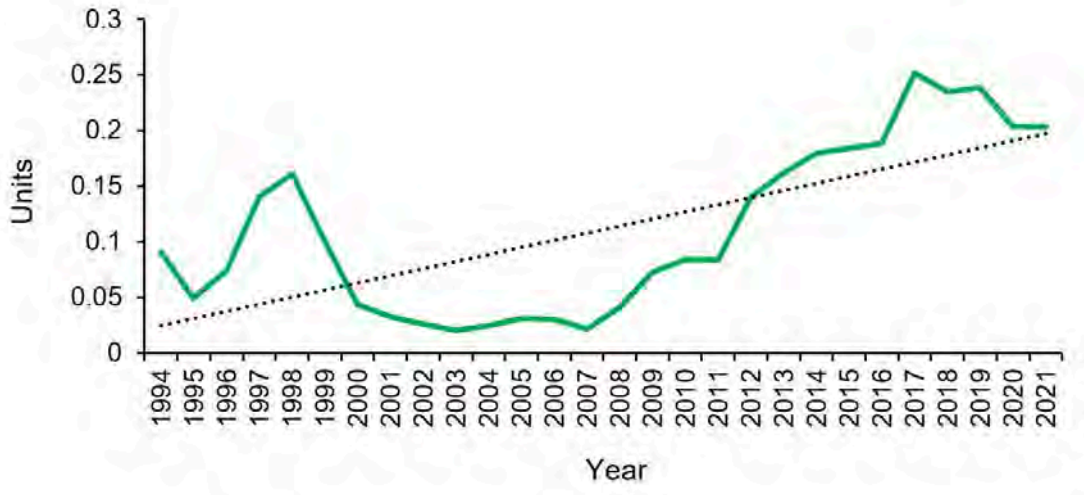
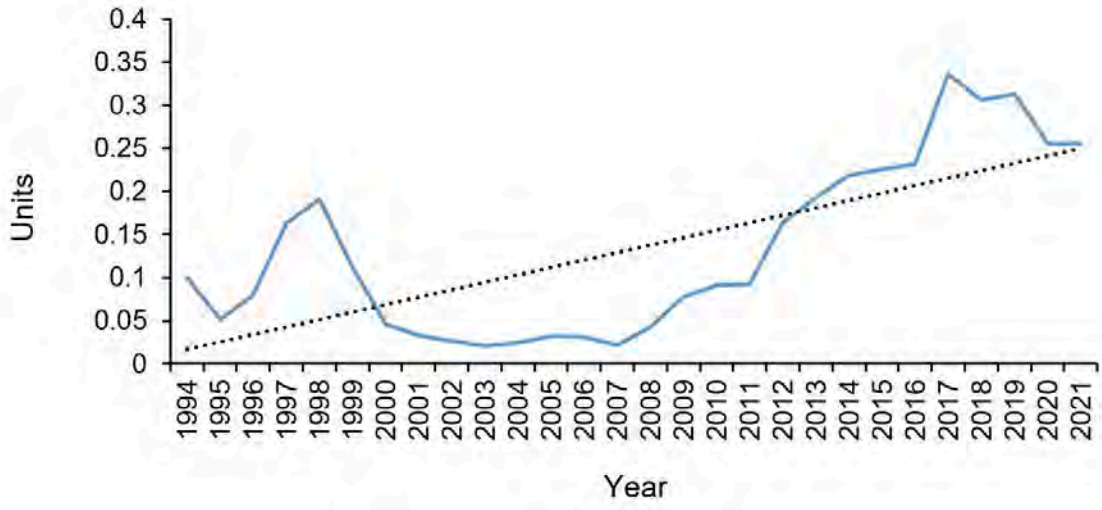
Figure 9. Export coefficient of bananas produced in Mexico, 1994-2021 (FAOSTAT, 2024).



The tradability indicator with values greater than zero (Table 1, Figure 10) shows the banana production capacity in Mexico, where the domestic market is supplied and net exportable surpluses are generated as a result of excess production; during the period studied, the indicator has shown positive values, which indicates that the banana producing sector in Mexico is competitive in the domestic market and in the export market.

Figure 10. Banana tradability indicator, 1994-2021 (FAOSTAT, 2024).



This confirms what Bonales and Ortiz (2023) mentioned, where the tradability indicator, by showing values greater than zero during the period studied, will indicate that the producing sector is competitive in the domestic market and has an export capacity due to excess supply in the market.

The degree of export openness with positive values and a growing trend reveals that banana production in Mexico satisfies the demand of the domestic market and there are surpluses that are exported, which allows the banana production sector to be competitive in the international market (Table 1, Figure 11), where the participation of bananas produced in Mexico in the international market is increasingly strong.

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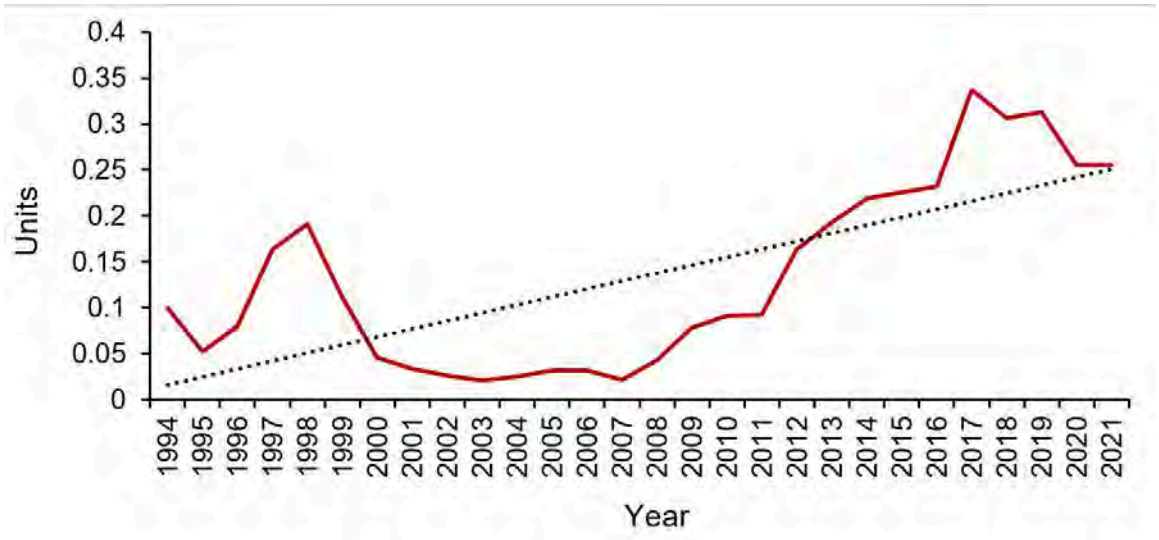
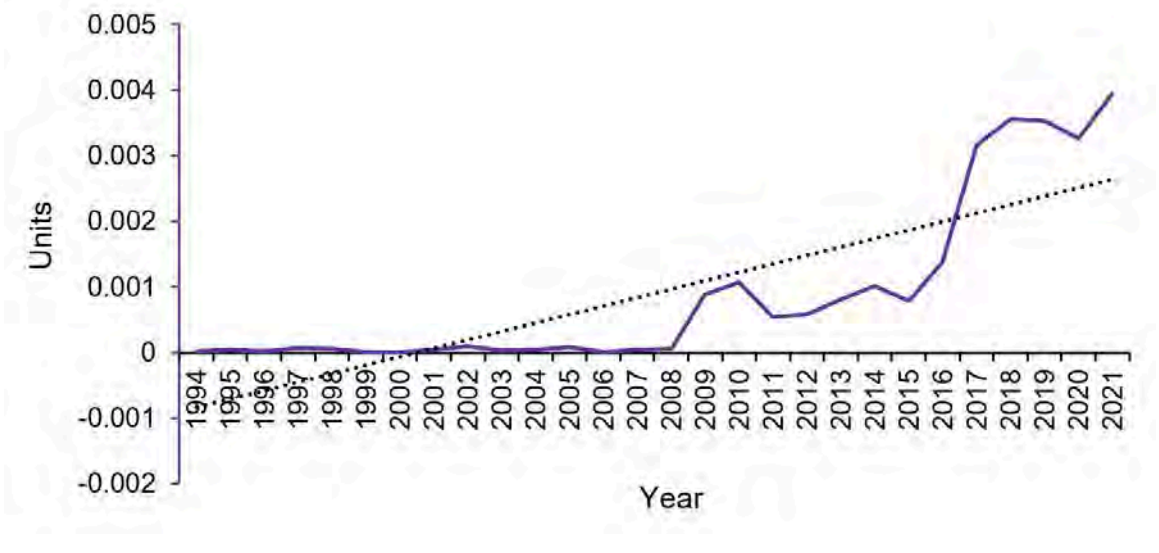
Figure 11. Index of the degree of export openness of Mexican bananas, 1994-2021 (FAOSTAT, 2024).



The results obtained for this index ratify what was obtained by Zavala *et al*. (2023), where values greater than zero of this indicator reflect that the product is competitive in the international market, being able to supply national demand and contributing to the export market, and that the growing behavior throughout the period analyzed allows us to conclude that there is a growing trend as a sector with an export vocation.

The trade dependence coefficient with values close to zero indicates the competitiveness of the banana production chain in Mexico (Table 1, Figure 12), where banana imports are almost zero compared to the volume exported; the average value of the indicator of 0.00090 during the period from 1994 to 2021 shows that Mexico is a country with a competitive advantage in the banana trade. The values obtained for the commercial dependence coefficient coincide with those obtained by Cruz *et al*. (2022), which, closer to zero, will show that the competitiveness of the export sector is greater and that imports of the product analyzed tend to be insignificant.

Figure 12. Trade dependence coefficient, 1994-2021 (FAOSTAT, 2024).



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Conclusions

Mexico is an internationally competitive country in the banana trade and ranks as the twelfth largest producer worldwide and the tenth largest exporter, with the United States of America and Japan as its main export destinations. Growth rates in production and trade indicators show an increasing trend from 1994 to 2021.

The relative trade balance with values close to one reflects that the bananas produced in Mexico are competitive in the international market and that the country is a net exporter of this product; the export coefficient, the tradability indicator, and the degree of export openness show the banana producing sector as a competitive market at the international level, which, in addition to satisfying the demand of the domestic market, has surpluses that are exported and is an expanding market; regarding the trade dependence coefficient, with values close to zero, it indicates that banana imports made by Mexico are low, thus reaffirming Mexico as an important producer and exporter of bananas.

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