Agrociencia

PRODUCTION AND EXPORT OF BERRIES IN MEXICO'S AGRICULTURAL DEVELOPMENT: A STUDY OF COMPETITIVE ADVANTAGE

Jesús Ernesto **Rocha-Ibarra**[1], Ana Isabel **Mireles-Arriaga**[2], Jorge Eric **Ruiz-Nieto**[2], Griselda **Maki-Díaz**[1*]

[1]Universidad de Guanajuato, Campus Irapuato-Salamanca. División de Ingenierías, Departamento de Arte y Empresa. Carretera Salamanca-Valle de Santiago km 3.5 + 1.8, Comunidad de Palo Blanco, Salamanca, Guanajuato, Mexico. C. P. 36885.
[2]Universidad de Guanajuato, Campus Irapuato-Salamanca. División de Ciencias de la Vida, Departamento de Agronomía. Carretera Irapuato-Silao km 9, ex Hacienda El Copal, Irapuato, Guanajuato, Mexico. C. P. 36500.
* Author for correspondence: g.maki@ugto.mx

Citation: Rocha-Ibarra JE, Mireles-Arriaga AI, Ruiz-Nieto JE, Maki-Díaz G. 2024. Production and export of berries in Mexico's agricultural development: a study of competitive advantage. **Agrociencia.** https://doi.org/ 10.47163/agrociencia.v58i5.2836

Editor in Chief:
Dr. Fernando C. Gómez Merino

Received: August 09, 2022.
Approved: February 27, 2024.
Published in Agrociencia: July 05, 2024.

ABSTRACT

The production and marketing of fruits and vegetables is one of the most important economic activities for agricultural development in Mexico. The group of berries, including raspberry (*Rubus idaeus* L.), strawberry (*Fragaria* spp.), blackberry (*Rubus ulmifolius* Schott), and blueberry (*Vaccinium* spp.), has positioned Mexico among the main exporting countries of these products, where the value of exports has maintained a growing trend in recent decades. The index of revealed comparative advantage (VCR) identifies countries that have a competitive advantage over others in a given product and compares competitive trends in the same market. The objective of this study was to determine Mexico's competitive advantage in the production and export of berries under the hypothesis that there is a positive index of revealed comparative advantage in the export of berries. The VCR and the trade openness index were computed by examining the historical trends in berry production and its involvement in both domestic and international markets. The value and volume of berry production have increased significantly since 2010, which places Mexico among the three main producing countries. It is notable that the trade openness of the Mexican agricultural sector has increased during the period 2001–2019. In addition, a comparative advantage has been demonstrated in strawberry exports, which positions Mexico as one of the main exporters of this product and represents an important competitive position in world trade since berry exports exceed imported volumes. Therefore, Mexico has a positive and growing comparative advantage, which makes it competitive with the leading countries in the production and export of berries.

Keywords: competitiveness, strawberry, raspberry, blackberry, trade openness.

INTRODUCTION

Mexico is one of the main producers and exporters of fruit and vegetable crops in the world (FAO, 2021). The fruit and vegetable sector is one of the most profitable activities

(Ayala-Garay *et al*., 2012), with a 56 % increase between 1990 and 2003 (Aksoy, 2005). The Mexican countryside is in a transformation stage, according to current trends, in agricultural production in some states in central Mexico, where traditional crops such as corn, wheat, or sorghum have been replaced by horticultural crops adapted to the local soil and climate (Bustillos-Durán, 2015; Martínez-Borrego, 2016). Other factors, such as changes in prices and consumption habits, also determine the type of crop to produce (Cruz-Delgado *et al*., 2013).

The group of crops known as "berries" has distinguished itself for its commercial worth. In the present study, raspberries (*Rubus idaeus* L.), strawberries (*Fragaria* spp.), blackberries (*Rubus ulmifolius* Schott), and blueberries or mulberries (*Vaccinium* spp.) were considered. Since 2016, these crops have presented a considerable production increase (FAO, 2021; SIAP, 2021). The value of Mexican berry exports increased from $64 815 thousand USD in 2001 to $1 048.256 million USD in 2020 (FAO, 2021; INTRACEN, 2021). Mexico is one of the main exporters of berries. In 2020, the volume of strawberry exports was 125 929 Mg, while that of the group of raspberries, blackberries, and mulberries was 47 942 Mg (INTRACEN, 2021).

The main producing states are Michoacán, Baja California, Jalisco, and Guanajuato, which contribute more than 90 % of national production (SIAP, 2021). In Mexico, in 2020, the total area planted with berries was 35 784 ha, with a production value of $41 520.358 million MXN (SIAP, 2020; 2021). Currently, consumers have expanded their acceptance of berries for their various nutraceutical qualities (Beattie *et al*., 2005; González-de Mejía and Johnson, 2017; Sangiovanni *et al*., 2017; Foito *et al*., 2018), which can be related to the increase in national and international demand.

Competitiveness of agricultural crops

Competitiveness is defined as the ability of an organization to achieve an advantage in order to attain and maintain a position in the environment. Companies generate competitive advantages from their skills, resources, and knowledge about themselves and their competitors, making it possible to obtain superior performance. This can be achieved in two ways: by creating value at a lower cost than the competition or by generating differentiation at a higher price (Porter, 2011). In contrast, comparative advantage is an indicator of the terms of trade between two or more countries or a country and the rest of the world (Ayvar-Campos *et al*., 2018).

Mexico is one of the most competitive countries in the agricultural sector. The production and export of fruits and vegetables represent one of the most profitable activities in the Mexican countryside (FAO, 2021; SIAP, 2021). In 2020, Mexico ranked sixth (23 678 584 Mg) and ninth (15 226 085 Mg) in fruit and vegetable production worldwide, respectively (FAO, 2021), and the area devoted to fruit and vegetable crops was 2 188 848 ha (FAO, 2021), which represented approximately 2.8 % of the national agricultural area. The value of fruit and vegetable exports for Mexico in the same year was $12 431.748 million USD, which placed it sixth among the main exporting countries of this group of products, after the USA (FAO, 2021).

Berries' participation in the national production of fruits during 2020 was the following: blueberry 0.2 %, raspberry 0.5 %, strawberry 3.6 %, and blackberry 1.3 % (SIAP, 2020). In world production, Mexico ranked sixth in blueberry (48 999 Mg), second in raspberry (128 848 Mg), third in strawberry (861 337 Mg), and was the world's leading producer of blackberry (298 024 Mg) (INTRACEN, 2021; FAO, 2021). Per capita consumption of berries in Mexico in the same year was: blueberry 0.1 kg, raspberry 0.3 kg, strawberry 4.7 kg, and blackberry 1.8 kg (SIAP, 2021).

International trade of berries

The positioning of berries in the agri-food market is mainly due to the fact that producers have been able to take advantage of opportunities. Appropriate technologies have been included in their production processes to raise efficiency, such as the production of varieties with optimal development characteristics, the implementation of production systems under cover, and technified irrigation, in addition to traditional cultural work such as manual harvesting to ensure the quality of the fruits (Housni *et al*., 2018).

The economic importance of berries is reflected in the increase in world production. Between 2005 and 2019, world production of strawberries, raspberries, and blueberries increased from 6 626 284 to 10 530 849 Mg. In Mexico, in 2005, the value of strawberry production was $2 248.819 million MXN, which represented 1.1 % of the total value of agricultural production in Mexico. In 2020, the value of production was $41 520.358 million MXN, representing 6.1 % of the total value of agricultural production in Mexico (SIAP, 2020; 2021). Berries ranked third in agri-food products exported by Mexico, with a value of $2615 million USD (SIAP, 2021).

In regard to total world production, in 2019, China, the USA and Mexico were the leaders in strawberry production (42 %); Russia, Mexico, and Serbia in raspberry production (51 %); and the USA, Canada, and Peru (76 %) in blueberry production, in which Mexico ranked fifth (48 999 Mg). Mexico is the second-largest raspberry producer in the world (FAO, 2021; INTRACEN, 2021). Therefore, the objective of this research was to determine Mexico's competitive advantage in the production and export of strawberries, based on the hypothesis that this country has a positive index of comparative advantage revealed in the export of Mexican berries.

MATERIALS AND METHODS

To determine Mexico's competitive advantage in the production and export of berries (strawberries, raspberries, blackberries, and blueberries), the historical behavior of berry production and its participation in the national and international markets were analyzed. A historical series from 2001 to 2019 was generated by compiling data obtained from various official sources (SIAP 2020, 2021; SAGARPA, 2017; FAO, 2021; INTRACEN, 2021) on the production and marketing of berries in Mexico and in the main producing and exporting countries.

Similarly, the revealed comparative advantage index (VCR) proposed by Vollrath (1991) was used, which analyzes the comparative advantages or disadvantages of a country's trade with its trading partners. This indicator identifies countries that have a competitive advantage over others in a given product and compares trends in competitiveness among competitors in the same market. It is expressed as follows:

$$VCRai = VCEai - VCIai$$

$$VCE = ln \left[\frac{Xai}{Xin} \frac{Xra}{Xrn} \right]$$

$$VCI = ln \left[\frac{Mai}{Min} \frac{Mra}{Mrn} \right]$$

where *VCE* is the revealed comparative advantage of exports, *VCI* is the revealed comparative advantage of imports, *r* indicates the world value minus the value of the country under analysis (country i), *n* is the trade value of all goods minus the value of a good, *a* is the value of the good under study, *i* is the country for which the analysis is being conducted, X are exports, and M are imports.

The calculation of the trade openness index (AC) requires the values of total exports, total imports, and agricultural gross domestic product (GDP). It is obtained using the following formula:

$$AC = \frac{BVlue \text{ of agricultural exports} + \text{Value of agricultural imports}}{\text{Gross domestic product from agriculture}} * 100$$

RESULTS AND DISCUSSION

Domestic production of berries

The value and volume of production of the group of berries analyzed had a significant increase from 2010 onwards (Figure 1), where strawberry and blackberry crops stood out considerably. By 2019, strawberry production was 861 336 Mg, with a value of $20 584.207 million MXN; blackberry production was 298 024 Mg, with a value of $13 068.299 million MXN (FAO, 2021).

Michoacán is the largest blackberry producer in Mexico, where 66 % of the domestic production of the group of berries under study is concentrated (Table 1). In that state, blackberry became a strategic crop and managed to position itself for its profitability

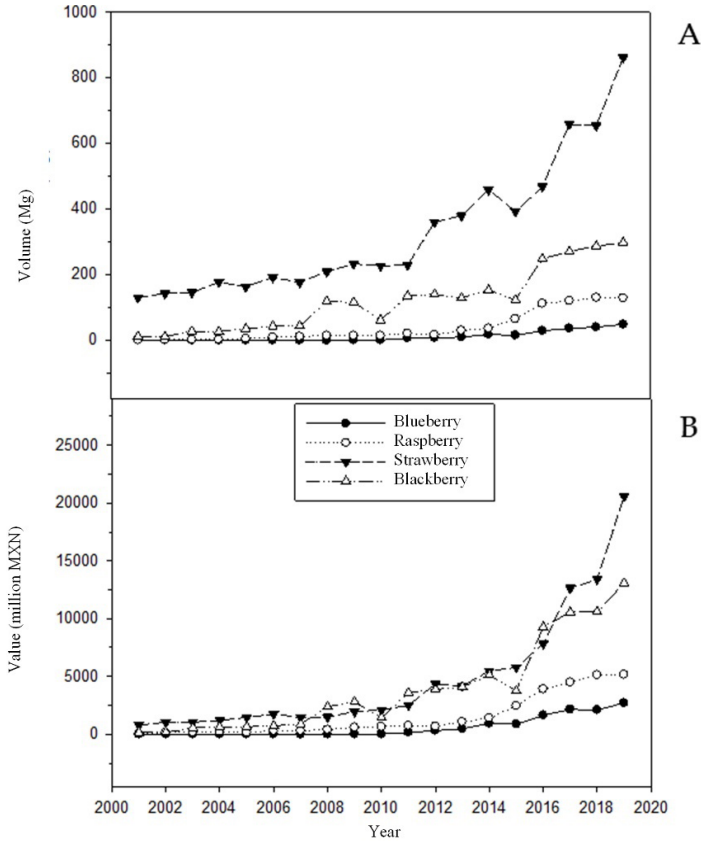

Figure 1. Berry production in Mexico from 2001 to 2020 (Own design with data from INTRACEN, 2021). A: production volume; B: production value.

and potential in the export market (Coronado-García *et al*., 2014; Muratalla-Lúa *et al*., 2018). This berry is recognized for its antioxidant properties, flavor, and various forms of marketing and consumption (Oszmiański *et al*., 2015; Souza *et al*., 2015). Regarding strawberries, 52 % of production is destined for the international market, while in the

Table 1. Value (millions of MXN) and volume of berry production by state in Mexico.

State	Volume 2018 (Mg)	Volume 2019 (Mg)	Volume variation 2018–2019 (%)	Value 2019
Michoacán	760 428	883 762	1.2	27 207.176
Baja California	134 577	216 829	1.6	9 456.085
Jalisco	120 834	129 016	1.1	3 308.293
Guanajuato	67 693	82 034	1.2	939.869
Rest of the country	27 659	25 566	0.9	608.934

Source: SIAP, 2020; 2021.

domestic market, 85 % of production is destined for the agroindustry for the production of jam (SAGARPA, 2017). Programs focused on the promotion of agriculture as well as efficiency in the application of production methods have contributed to the increase in Mexican strawberry production (Ramírez-Padrón *et al*., 2016).

Berry production in Mexico is concentrated in Michoacán (66 %), Baja California (16 %), Jalisco (10 %), and Guanajuato (6 %) (Table 1). Michoacán is the most important state in strawberry and raspberry production, where the establishment of marketing companies has increased, as well as the area used for cultivation, labor, and the opening of new markets (Sánchez-Rodríguez, 2008). The case of Guanajuato also stands out; even when the state presents the lowest percentage of berry production, strawberry stands out as a specialization crop (Bustamante-Lara *et al*., 2020) and is one of the most relevant, with a production of 20 257 Mg in 2005 and 79 752 Mg in 2019 (SIAP, 2020).

Based on the above, berries are considered one of the groups with high growth potential in the agricultural sector (González-Razo *et al*., 2019). Strawberry production contributes 1.14 % of the national agricultural gross domestic product (GDP) and represents 2.19 % of fruit production in Mexico, while the raspberry, blackberry, and blueberry contribute 2.15 % of the national agricultural GDP and represent 1.83 % of fruit production (SAGARPA, 2017; SIAP, 2021).

Mexico's notable relevance in berry production places it third among the main producing countries (Figure 2). Its participation in the last 10 years stands out, with an increase in production from 392 635 Mg in 2011 to 1 337 208 Mg in 2019 (FAO, 2021). The main reasons for this boom are attributed to the increase in global demand (SAGARPA, 2017), high profitability, export opportunities (González-Razo *et al*., 2019), and the health benefits of its consumption, which are associated with the nutraceutical

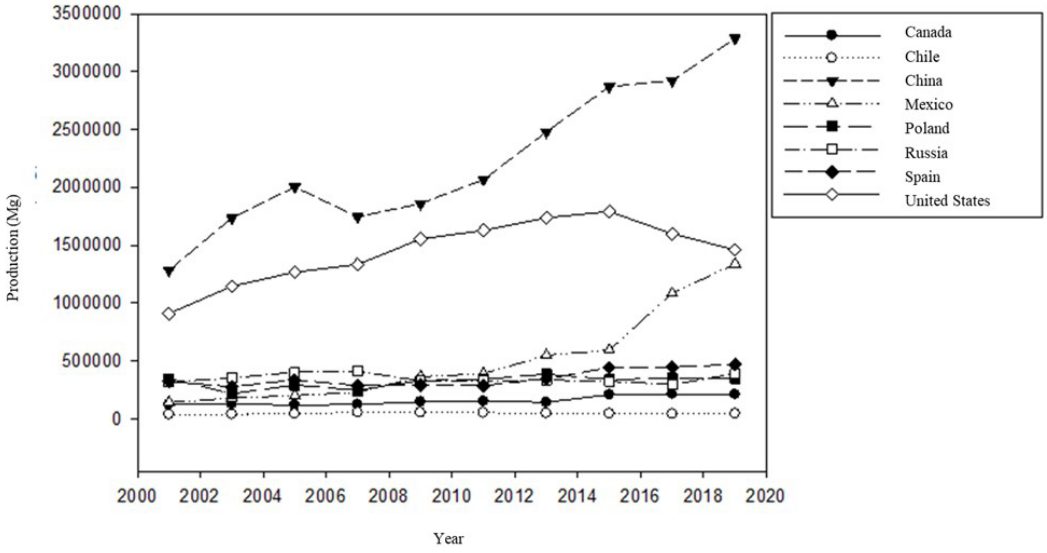

Figure 2. World production of berries (Own design with data from FAO, 2021).

and antioxidant properties that these fruits have (Beattie *et al*., 2005; Sangiovanni *et al*., 2017; Foito *et al*., 2018).

International trade

The value of world production of strawberries, raspberries, blueberries, and blackberries increased from $13 766,594 to $26 431,113 million USD between 2010 and 2020 (FAO, 2021), representing a 91 % growth in value, i.e., the value of berry production has doubled in 10 years. In Mexico, in 2020, 244 333 Mg of these products were exported, representing a value of $1 033.328 million USD, which placed it second in the world above the USA. In 2020, this value represented $823.470 million USD, and Spain ranked first with $1 186.370 million USD (INTRACEN, 2021) (Figure 3).

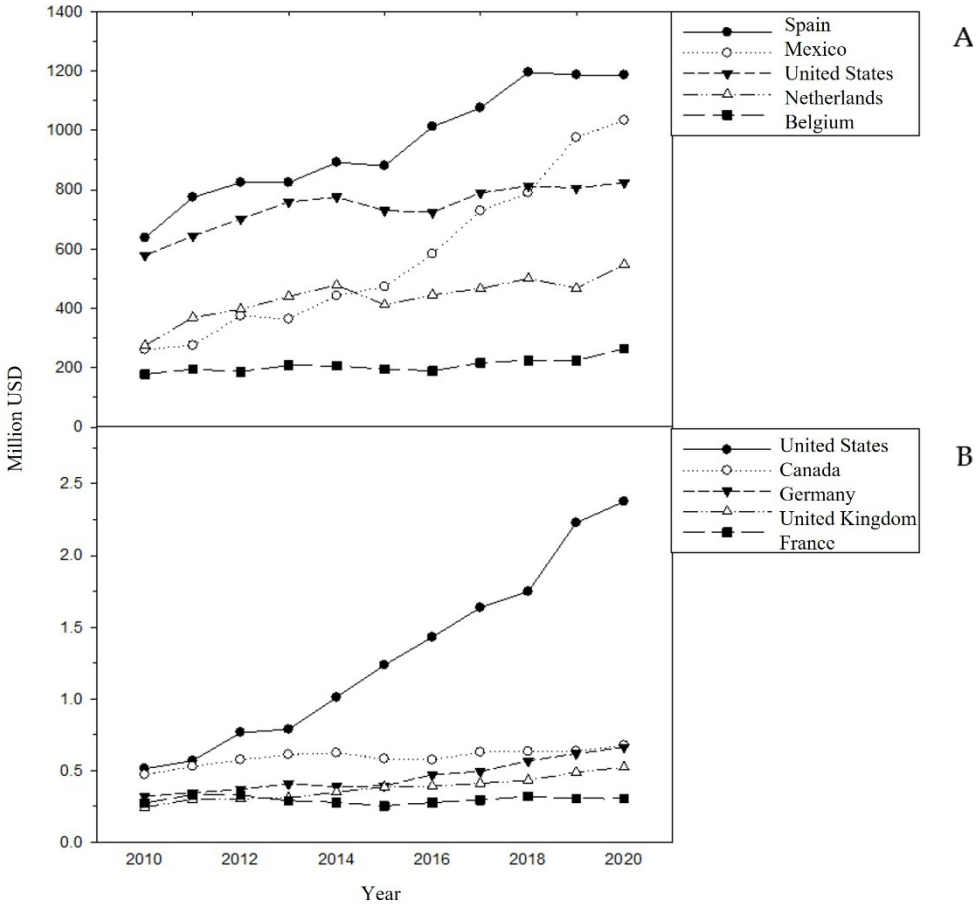

Figure 3. Evolution of exports and imports of raspberries (*Rubus idaeus* L.), strawberries (*Fragaria* spp.), blackberries (*Rubus ulmifolius* Schott), and blueberries (*Vaccinium* spp.) in the most commercialized countries. A: exports; B: imports (own design with data from FAO, 2021; INTRACEN, 2021).

Berries have a high export potential in the Mexican agricultural sector, being the third most exported agricultural product. Mexico exports 52.21 % of its strawberry production and 41 % of its raspberry, blackberry, and mulberry production to the international market. The main destination for strawberry exports is the USA (99 %), and for raspberry, blackberry, and mulberry, the main export destinations are the USA (91 %) and the United Kingdom (2.6 %) (SAGARPA, 2017; INTRACEN, 2021). Thus, Mexico has established itself as the most important supplier of fresh strawberries in the U.S. market (Suh *et al*., 2017; González-Razo *et al*., 2019).

The USA is the main importer of strawberries. In 2020, it reported $2 376 851 thousand USD as the value of these imports (Figure 3). Its main suppliers are Mexico, Peru, and Chile (INTRACEN, 2021). U.S. demand for strawberries increases in winter, which represents a great opportunity for Mexican exports (Wu *et al*., 2017).

Export Comparative Advantage (VCE)

From 2001 to 2019, the export comparative advantage index of the set of Mexican berries selected for the present study was greater than 1, suggesting that Mexico has a comparative export advantage for these products (Table 2). In addition, the trend of Mexican berry exports has continued to grow steadily.

Table 2. Mexico´s comparative export advantage (VCE) of berries from 2001 to 2019 (FAO, 2021; INTRACEN, 2021).

Year	Exports of berries in Mexico*	Agricultural exports in Mexico*	Exports of berries in the world*	World agricultural exports*	VCE
2001	64 815	3 649 880	760 905	115 293 122	0.99
2002	80 246	3 531 805	918 530	123 519 781	1.12
2003	102 805	4 231 334	1 106 503	143 027 998	1.14
2004	96 158	4 893 186	1 314 155	163 147 546	0.89
2005	164 996	5 228 115	1 429 805	175 081 050	1.35
2006	252 664	6 057 216	1 538 608	193 420 868	1.66
2007	299 538	6 870 670	1 833 168	247 661 878	1.77
2008	228 194	7 443 551	2 239 395	302 663 121	1.42
2009	191 617	7 283 816	2 142 532	268 114 459	1.19
2010	260 817	7 997 469	2 219 833	295 182 415	1.47
2011	275 639	9 356 848	2 626 766	363 041 498	1.40
2012	374 288	9 859 412	2 778 125	368 263 236	1.62
2013	363 946	10 847 073	2 932 859	389 915 095	1.50
2014	442 203	11 768 465	3 132 163	404 580 705	1.58
2015	472 588	12 640 450	3 031 399	384 203 452	1.56
2016	583 483	14 814 859	3 189 187	387 087 127	1.56
2017	728 795	15 990 551	3 504 567	415 835 025	1.69
2018	789 060	16 154 814	3 825 410	425 478 288	1.69
2019	977 780	17 155 888	3 904 307	428 264 646	1.83

*$ thousand USD.

Import Comparative Advantage (VCI)

The negative results of the import comparative advantage (Table 3) may indicate that Mexico does not have a comparative import advantage in terms of global berry imports, despite being primarily an exporting country.

Table 3. Mexico´s comparative import advantage (VCI) of berries from 2001 to 2019 (FAO, 2021; INTRACEN, 2021).

Year	Imports of berries in Mexico*	Agricultural imports in Mexico*	Berry imports in the world*	Agricultural imports in the world*	VCI
2001	13 226	3 119 941	851 261	131 439 019	-0.43
2002	14 628	3 331 799	1 052 757	138 549 528	-0.56
2003	14 535	3 435 060	1 228 356	162 158 796	-0.60
2004	14 543	3 675 526	1 468 558	186 686 531	-0.70
2005	18 290	3 579 455	1 662 144	197 959 165	-0.51
2006	24 909	4 596 848	1 894 445	221 330 701	-0.47
2007	26 838	5 463 952	2 248 298	276 726 540	-0.51
2008	31 218	7 221 735	2 618 551	340 709 314	-0.59
2009	14 029	5 361 899	2 583 969	297 418 449	-1.22
2010	11 520	5 669 366	2 855 112	321 406 063	-1.50
2011	14 395	8 301 154	3 309 295	388 589 936	-1.62
2012	20 677	8 851 433	3 707 792	397 854 095	-1.41
2013	29 437	7 499 647	3 907 775	427 639 365	-0.86
2014	31 188	7 437 976	4 225 176	435 262 097	-0.85
2015	34 179	7 304 893	4 377 137	420 456 580	-0.82
2016	38 413	7 483 860	4 711 699	418 746 425	-0.80
2017	42 963	7 979 745	5 300 539	454 117 061	-0.79
2018	46 853	8 844 358	5 799 712	465 960 825	-0.87
2019	42 567	8 836 065	6 389 588	467 319 059	-1.06

*$ thousand USD.

Revealed Comparative Advantage Index (VCR)

Once the above analyses were carried out, the index of revealed comparative advantage was obtained (Figure 4). The result is interpreted as follows: if the VCR is greater than one, it means that there is a revealed comparative advantage in the product; if it is less, the country has a comparative disadvantage. The higher the value of this index, the higher the country's degree of specialization in this product and, therefore, the greater the competitiveness (Arias-Segura and Segura-Ruiz, 2004).

According to the results obtained, the VCR was greater than zero in the period analyzed, indicating that Mexico presents an important competitive position in the global market of berries and that berry exports exceed imported volumes. One of the factors influencing the high production of Mexican strawberries is the advantage represented by the cost and supply of labor, which contributes to commodity growth (Wu *et al*., 2017).

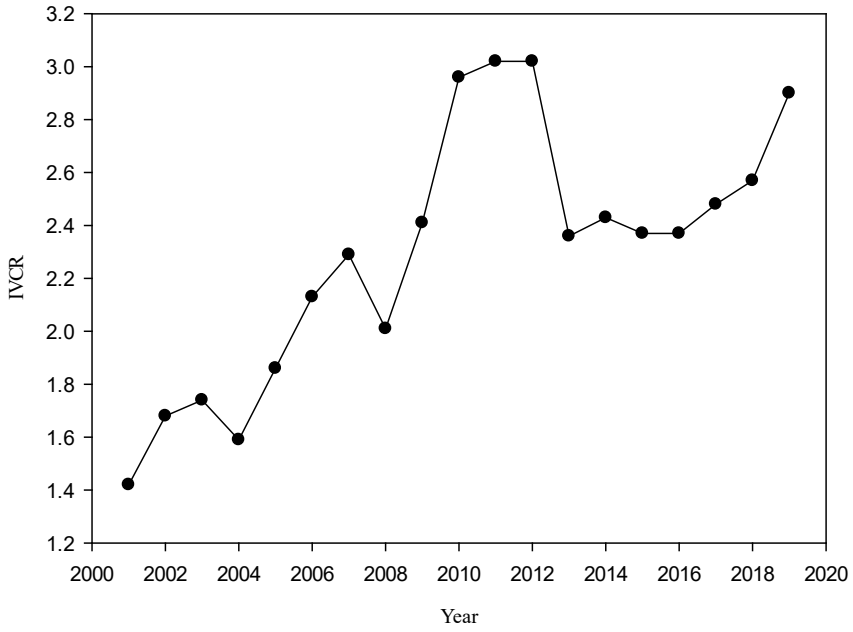

Figure 4. Mexico's revealed comparative advantage (VCR) index in the global berry market from 2001 to 2019.

The historical behavior of the VCR indicates that Mexico's revealed comparative advantage has increased. According to Arias-Segura and Segura-Ruiz (2004), this reflects a country's ability to compete in the international market. Therefore, it is assumed that Mexico exports those goods for which it has a comparative advantage, in this case berries, a situation that helps guide investment and trade decisions and take advantage of international demand and supply for the product in question.

Mexico's successful positioning in berry marketing is related to its proximity to the U.S. market, which represents its main export destination (González-Ramírez *et al.*, 2020; Ramírez-Padrón *et al*., 2020), and due consequently to the facilities provided by trade agreements (Ávila-Arce and González-Milán, 2012). In contrast, the positive impact represented by the increasing imports from Mexico by the USA, specifically in the strawberry industry, has generated greater challenges in the U.S. domestic market (Suh *et al*., 2017). Strawberry exports to the United States represent the highest value and volume relative to other export destinations (Bustamante-Lara *et al*., 2020).

Mexico has kept a comparative advantage in strawberry exports during the period analyzed, achieving specialization with a growing trend in the international market (Bustamante-Lara *et al*., 2020). It is necessary to maintain this trend so that Mexico can keep and improve this advantage over other countries. According to Wu *et al*. (2017), despite the imminent advantage that the U.S. market represents for Mexican strawberry exports, it will be necessary to consider a diversification of export destinations to make trade more sustainable for both countries and avoid possible damage to their respective industries.

Trade openness index

Trade openness is understood as a country's capacity to successfully insert itself into the international market. It acts simultaneously with competitiveness through the measurement of trade flows, that is, a country's participation in the international market, which is established through indicators such as the index of revealed comparative advantage (Quintero-Ramírez *et al*., 2020). The index of trade openness of the Mexican agricultural sector has been increasing during the study period (2001–2019), which possibly represents a potential development market abroad (Figure 5).

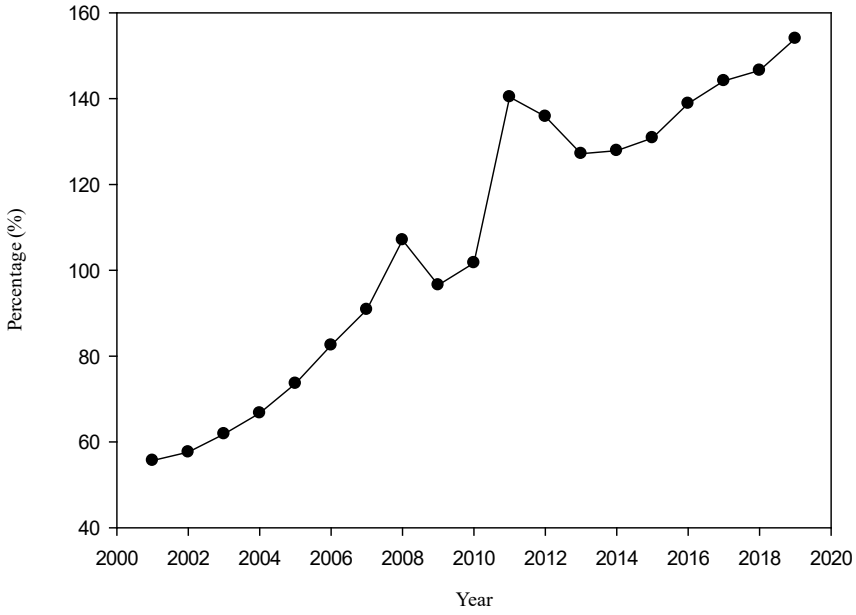

Figure 5. Index of trade openness of berries in Mexico from 2001 to 2019 (in $ thousand USD).

The values obtained in this research indicate that Mexico's productive capacity allows it to meet the needs of domestic demand for berries and be competitive in the international market (Ramírez-Padrón *et al*., 2016). There is a positive trade balance derived from a higher value of exports compared to agricultural imports, which in turn has generated an increase compared to agricultural GDP. According to Ayala-Garay *et al*. (2012), Mexico's trade openness is growing at an accelerated pace due to the trade increase with the rest of the world. On the other hand, Bustamante-Lara *et al*. (2020) indicate that trade liberalization has allowed the levels of specialization and competitiveness of strawberries to increase since international trade has an impact on the specialization of production, which is why diversification of export destinations should be considered.

CONCLUSIONS

Berries represent products that have gained worldwide relevance in the last two decades, related to their commercial value and health benefits. Mexico's climatic characteristics and geographic location have positioned it as one of the most important countries in the production and marketing of these products, among which strawberries and raspberries stand out and strengthen the competitiveness of the Mexican agricultural sector.

The growing demand for berries strengthens Mexico's competitive advantage in domestic and international markets. This is reflected in a positive and growing comparative advantage, which makes it highly competitive with the leading countries in the production and export of these products. Within the group of berries analyzed, strawberries represent Mexico's largest volume export. The USA is the main destination for Mexican exports.

REFERENCES

Aksoy MA. 2005. Global agricultural trade policies. *In* Aksoy MA, Beghin JC. (eds.), Global Agricultural Trade and Developing Countries. World Bank: Washington, DC, USA, pp: 37–53. https://doi.org/10.1596/0-8213-5863-4

Arias-Segura J, Segura-Ruiz O. 2004. Índice de ventaja comparativa revelada: un indicador del desempeño y de la competitividad productivo-comercial de un país. InterCambio, Área de Comercio y Agronegocios 4: 1–10.

Ávila-Arce A, González-Milán D de J. 2012. La competitividad de las fresas (*Fragaria* spp.) mexicanas en el mercado nacional, regional y de Estados Unidos. Agricultura, Sociedad y Desarrollo 9 (1): 17–27.

Ayala-Garay AV, Schwentesius-Rindermann R, Carrera-Chávez B. 2012. Vegetables in Mexico: From U.S. competitiveness and opportunities for development. Journal of Globalization, Competitiveness, and Governability 6 (3): 70–88. https://doi.org/10.3232/gcg.2012.v6.n3.04

Ayvar-Campos FJ, Navarro-Chávez JCL, Delfín-Ortega OV. 2018. Competitividad y productividad del sector agropecuario mexicano en APEC, 1980-2015. Portes, Revista Mexicana de Estudios sobre la Cuenca del Pacífico 12 (23): 7–30.

Beattie J, Crozier A, Duthie, G. 2005. Potential health benefits of berries. Current Nutrition and Food Science 1 (1): 71–86. https://doi.org/10.2174/1573401052953294

Bustamante-Lara TI, Vargas-Canales JM, Díaz-Sánchez F, Rosas-Vargas R. 2020. Especialización y competitividad en el sector agrícola mexicano: caso fresa. Agro productividad 13 (8): 31–37. https://doi.org/10.32854/agrop.vi.1697

Bustillos-Durán S. 2015. Competitividad del sector agropecuario en México: implicaciones y retos México. Nóesis - Revista de Ciencias Sociales y Humanidades 24 (48): 233–237. https://doi.org/10.20983/noesis.2015.2.10

Coronado-García MA, García-Porchas M, Santiago-Hernández VG, Córdova-Yañez A, Vásquez-Navarro RA. 2014. La zarzamora, un mercado potencial para los productores agropecuarios de la Sierra de Sonora. Revista Mexicana de Agronegocios 34: 784–794.

Cruz-Delgado D, Leos-Rodríguez JA, Altamirano-Cárdenas JR. 2013. México: factores explicativos de la producción de frutas y hortalizas ante la apertura comercial. Revista Chapingo Serie Horticultura 19 (3): 267–278

FAO (Food and Agriculture Organization). 2021. FAOSTAT. Food and agriculture data. Food and Agriculture Organization. Rome, Italy. https://www.fao.org/faostat/en/#home (Retrieved: October 2021).

Foito A, McDougall GJ, Stewart D. 2018. Evidence for health benefits of berries. Annual Plant Reviews 1: 1–43. https://doi.org/10.1002/9781119312994.apr0600

González-de Mejía E, Johnson MH. 2017. Anthocyanins from berries: Chemistry and roles in inflammation and diabetes. *In* Jayaprakasha GK, Bhimanagouda SP. (eds.), Nuctraceuticals and Functional Foods. United Nations Educational, Scientific and Cultural Organization: Singapore. 354 p.

González-Ramírez MG, Santoyo-Cortés VH, Arana-Coronado JJ, Muñoz-Rodríguez M. 2020. The insertion of Mexico into the global value chain of berries. World Development Perspectives 20: 100240. https://doi.org/10.1016/j.wdp.2020.100240

González-Razo F de J, Rebollar-Rebollar S, Hernández-Martínez J, Morales-Hernández JL, Ramírez-Abarca O. 2019. Situación actual y perspectivas de la producción de berries en México. Revista Mexicana de Agronegocios 44: 260–272.

Housni FE, Lares-Michel M, Aguilera-Cervantes VG, Guízar-Mateos I, Bracamontes-del Toro H, Michel-Nava RM. 2018. Impacto de la producción de berries sobre el comportamiento alimentario en una población de Jalisco, México. Revista Mexicana de Trastornos Alimentarios 9 (1): 11–23. https://doi.org/10.22201/fesi.20071523e.2018.1.463

INTRACEN (International Trade Center). 2021. Trade statistics for the international development of companies. International Trade Center. Geneva, Switzerland. https://www.trademap.org (Retrieved: November 2021).

Martínez-Borrego E. 2016. Agricultura, sustitución de cultivos y exportaciones en la zona metropolitana de León, Guanajuato, México. Carta Económica Regional 27 (116): 112–140.

Muratalla-Lúa A, Jaen-Contreras D, Arévalo-Galarza L. 2018. La producción de frambuesa y zarzamora en México. Agro Productividad 6 (5): 3–12.

Oszmiański J, Nowicka P, Teleszko M, Wojdyło A, Cebulak T, Oklejewicz K. 2015. Analysis of phenolic compounds and antioxidant activity in wild blackberry fruits. International Journal of Molecular Sciences 16 (12): 14540–14553. https://doi.org/10.3390/ijms160714540

Porter ME. 2011. ¿Qué es la estrategia? Harvard Business Review 89 (11): 100–117.

Quintero-Ramírez JM, Omaña-Silvestre JM, Ramírez-Padrón LC. 2020. Análisis de indicadores de ventajas comparativas reveladas: competitividad de las exportaciones de fresa (*Fragaria* spp.) mexicana. Revista de Desarrollo Económico 7 (24): 13–19. https://doi.org/10.35429/jed.2020.24.7.13.19

Ramírez-Padrón LC, Caamal-Cauich, I, Pat-Fernández VG, Martínez-Luis D. 2016. Índices de competitividad de la fresa (*Fragaria vesca* L.) de México en el mercado mundial. Agroproductividad 9 (5): 29–34.

Ramírez-Padrón LC, Caamal-Cauich I, Pat-Fernández VG, Martínez-Luis D. Pérez-Fernández A. 2020. Análisis de los indicadores de competitividad de las exportaciones de fresa mexicana. Revista Mexicana de Ciencias Agrícolas 11 (4): 815–827. https://doi.org/10.29312/remexca.v11i4.2049

SAGARPA (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación). 2017. Planeación agrícola nacional 2017-2030. Gobierno de México. Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación. Ciudad de México, México. https://www.gob.mx/agricultura/acciones-y-programas/planeacion-agricola-nacional-2017-2030-126813 (Retrieved: January 2022).

Sánchez-Rodríguez G. 2008. La red de valor de la zarzamora. El cluster de Los Reyes Michoacán, un ejemplo de reconversión competitiva. Sistema de Inteligencia de Mercados. Fundación Produce Michoacán A. C.: Morelia, México.

Sangiovanni E, Fumagalli M, dell'Agli M. 2017. Berries: Gastrointestinal protection against oxidative stress and inflammation. *In* Gracia-Sancho J, Salvadó J. (eds.), Gastrointestinal Tissue, Oxidative Stress and Dietary Antioxidants. Academic Press: Milan, Italy, pp: 243–258. https://doi.org/10.1016/b978-0-12-805377-5.00018-7

SIAP (Servicio de Información Agroalimentaria y Pesquera). 2020. Sistema de información agroalimentaria de consulta SIACON, versión 2020. Gobierno de México, Secretaría de Agricultura y Desarrollo Rural, Servicio de Información Agroalimentaria y Pesquera. Ciudad de México, México. https://www.gob.mx/siap/documentos/siacon-ng-161430 (Retrieved: September 2021).

SIAP (Servicio de Información Agroalimentaria y Pesquera). 2021. Producción agrícola. Gobierno de México, Servicio de Información Agroalimentaria y Pesquera. Ciudad de México, México. https://www.gob.mx/siap/acciones-y-programas/produccion-agricola-33119 (Retrieved: September 2021).

Souza AVD, Rodrigues RJ, Gomes EP, Gomes GP, Vieites RL. 2015. Bromatological characterization of blackberry fruits and jellies. Revista Brasileira de Fruticultura 37 (1): 13–19. https://doi.org/10.1590/0100-2945-037/14

Suh DH, Guan Z, Khachatryan H. 2017. The impact of Mexican competition on the U.S. strawberry industry. International Food and Agribusiness Management Review 20 (4): 591–604. https://doi.org/10.22434/ifamr2016.0075

Vollrath TL. 1991. A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage. Weltwirtschaftliches Archiv 127 (2): 265–280.

Wu F, Guan Z, Arana-Coronado JJ, García-Nazariega M. 2017. An overview of strawberry production in Mexico. UF/IFAS Food and Resource Economics: FE1014.