Competitiveness indices of green chili produced in Mexico in the world market

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Abstract

Green chili is considered one of the most important vegetables in Mexico due to the area harvested, the volume and value of the production contributed, and the foreign exchange generated by exports. Likewise, Mexico is an important producer and exporter since it ranks second worldwide in the production of green chili with 3 238 245 t in 2019. The research aimed to analyze the main competitiveness indices of the green chili trade in the 1994-2019 period, with the calculation of the indicators of apparent national consumption, trade balance, relative trade balance, export coefficient, tradability index, degree of openness index, and the trade dependence coefficient. The results reflect that the green chili produced in Mexico has a competitive advantage since the apparent national consumption was lower (2 173 018 t) than the production (3 238 245 t), the trade balance was positive, the relative trade balance was close to one, and the export and export specialization coefficients were positive; this indicates that the fresh chili industry in Mexico is competitive in the production and export of green chili, satisfies domestic demand, and contributes surpluses to the world market.

Keywords:

Capsicum annuum spp., exports, export coefficient, production, trade balance.

Chili (*Capsicum annuum* spp.) is an important part of the history and food culture of pre-Hispanic Mexico. The consumption of this product is fresh, dried, powdered, pickled, in pastes, sauces, salads, moles, fillings, sweets, and others (Rodríguez *et al.*, 2002). Chili is also used in traditional medicine as a remedy for respiratory diseases and gastrointestinal diseases, as an analgesic, laxative, and gastrointestinal digestive (Casas, 2002). Chili is deeply rooted in Mexican cuisine and food culture (García, 2019).

The cultivation of chili dates back to 7 000 years BC. (Laborde and Pozo, 1984; Sader, 2023). There is archaeological evidence that has allowed us to estimate that this product was cultivated from 7 000 to 2 555 BC. in the regions of Tehuacán, Puebla and Ocampo, Tamaulipas (Aguirre and Muñoz, 2015).

Chili (*Capsicum* spp.) has five cultivated species (*C. annuum*, *C. chinense*, *C. pubescens*, *C. frutescens*, and *C. baccatum*) and about 25 wild and semi-cultivated species (Hernández *et al.*, 1999). Due to the area cultivated and the economic value that production represents, *C. annuum* is one of the most important species in Mexico and in the world, rich in antioxidants and vitamin C (Vázquez *et al.*, 2020). The types of chili widely known and consumed in Mexico are jalapeño, ancho, guajillo, pasilla, serrano, manzano, habanero, de árbol, and piquín. The diversity of chili crops is better known and used at the regional and local levels (Aguilar *et al.*, 2010).

The largest green chili producing countries are Mainland China with 18 978 027 t, 50% of world production, Mexico with 3 238 245 t (8%), Turkey with 2 625 669 t (7%), Indonesia with 2 588 633 t (7%), Spain with 1 402 380 t (4%), Egypt with 764 292 t (2%), Nigeria with 753 116 t (2%), Algeria with 675 168 t (2%), the United States of America with 624 982 t (1%), and the rest of the countries with 6 376 652 t (17%), which generate more than 80% of the world's production (FAOSTAT, 2021).

The main green chili producing states in Mexico are Chihuahua with 663 179.4 t (25%) of national production, Sinaloa with 648 222.15 t (24%) and Sonora with 223 431.53 t (8%), which generate more than 55% of national production (SIACON, 2021). Competitiveness is considered as the dynamic capacity of an agri-food chain to maintain, expand and improve its participation in markets, both domestic and foreign, in a continuous and sustained manner through the production, distribution, and sale of goods and services at the time, place, and manner requested by consumers, always seeking the benefit of society (Rojas and Sepúlveda, 1999).

Likewise, competitiveness reflects the extent to which a nation, in a system of free trade and equitable market conditions, can produce goods and services that stand the test of international markets while maintaining and increasing the real income of its population in the long run (Hatzichronoglou, 1996). The research aimed to analyze the competitiveness indicators of the trade of green chili produced in Mexico in the world market during the period from 1994 to 2019 in order to obtain an overview of the competitiveness of green chili production and trade in Mexico.

The working hypothesis was that the coefficients of the export competitiveness indicators are positive and reflect the competitiveness of green chili production and trade in Mexico. Apparent national consumption (ANC) expresses the amount of product that a country consumes in a given period of time and is calculated based on domestic production plus the trade balance and inventory consumption (MADR, 2005). It is estimated with the formula:

$$ANC = Y + M - X$$

. Where: ANC= apparent national consumption; Y= national production; M= imports and X= exports.

The trade balance (TB) is the record of a country's imports and exports over a period of time. The trade balance is the difference between the volume or value of a country's exports and imports (Benavides *et al.*, 2017). TB is calculated with the formula:

$$TB = X - M$$

Where: TB= trade balance; X= exports and M= imports.

The relative trade balance (RTB) relates the trade balance and the total trade of a product (Brito, 2010). It is calculated with the formula:

$$RTBij=\frac{Xij-Mij}{Xij-Mij}$$

Where: Xij= exports of product i by country j to the world market; Mij= imports of a product i by a country j to the world market or a specific market.

The export coefficient (EC) relates the value of exports (X) and the value of production (VP) over a period of time (Velín and Medina, 2011). Algebraically, the relationship is expressed as:

$$ECij=\frac{Xij}{VPij}$$

Where: ECij= export coefficient of product i of country j; Xij= exports of product i of country j; VPij= volume of production of product i of country j.

The degree of export openness (DEO) shows the share of exports of a product over apparent consumption (Ramírez et al., 2016). The calculation procedure is as follows:

$$DE=\frac{Xij}{Qij+Mij-Xij}$$

Where: Xij= exports of product i of country j; Mij= imports of product i of country j; Qij= domestic production of product i of country j; and Qij + Mij-Xij= apparent consumption of good i in country j in a given period.

The tradability indicator (TI) is the relationship between the trade balance and apparent consumption (Campos et al., 2018). The TI is calculated with the formula:

$$Tij=\frac{Xij-Mij}{Qij+Mij-Xij}$$

Where: Tij= TI of product i of country j; Xij= exports of product i by country j to the world market; Mij= imports of a product i by a country j of the world market; (Xij-Mij)= total trade balance of product i of country j; and Qij= production of product i of country j.

The trade dependence coefficient (TDC) expresses the percentage of imports in domestic demand (Ramírez et al., 2016). The calculation method is:
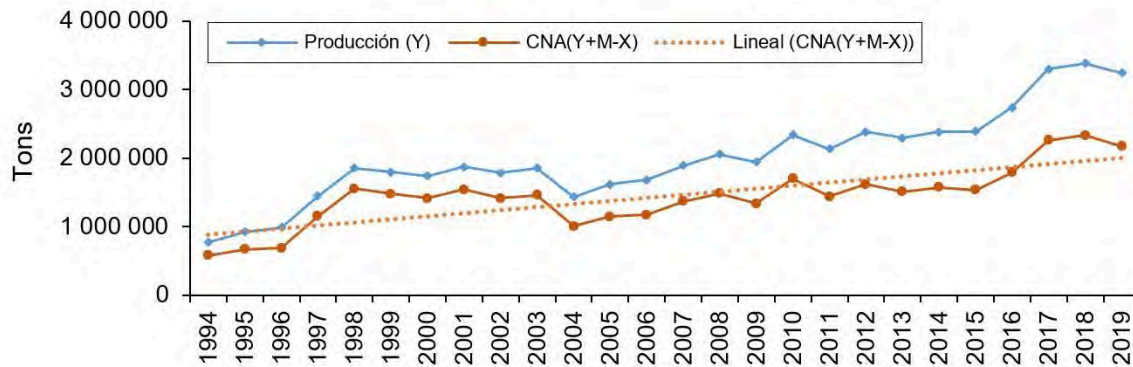
$$GIij=\frac{Mij}{Qij+Mij-Xij}$$

Where: Mij= imports of product i by country j; Xij= exports of product i by country j; and Qij= domestic production of product i of country j.

The characterization of competitiveness requires variables and indicators of production and trade. The variables are production, imports, exports, total trade, apparent national consumption, and trade balance, and the competitiveness indicators are relative trade balance, export coefficient, degree of export openness, tradability index, and trade dependence coefficient (Ramírez et al., 2016).

Apparent consumption. The variables of production, import and export, which together make up apparent consumption, have had an increasing trend in the period studied from 1994 to 2019, showing that Mexico has a greater availability of green chili for consumption. Production and apparent national consumption have a positive correlation; in 1994, green chili production was 766 715 t and apparent national consumption was 574 540 t, while in 2019, production was 3 238 245
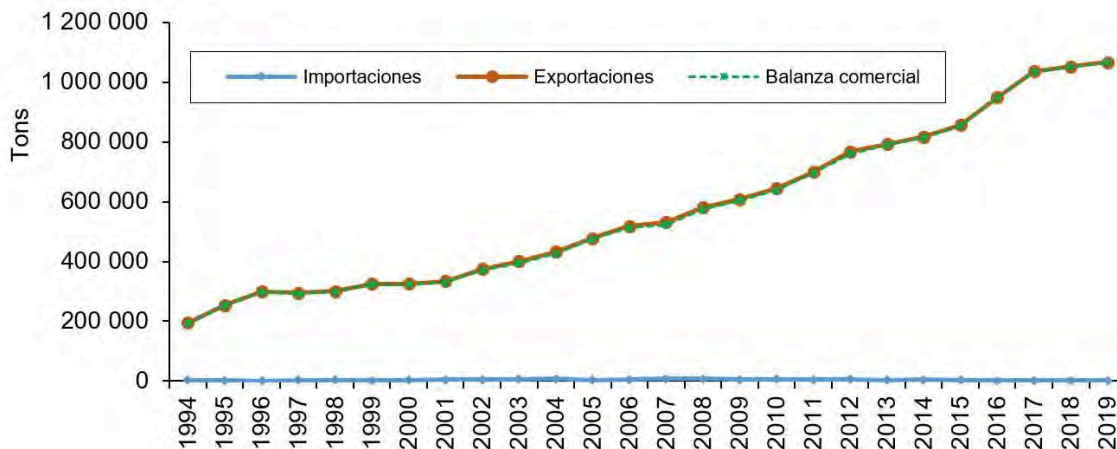
t and apparent national consumption was 2 173 018 t (FAOSTAT, 2021), with a growth rate of 422.35% in production and 378.21% in apparent national consumption during the period analyzed (Figure 1). Production values were higher than apparent national consumption values, reflecting the existence of exportable production surpluses (Rojas and Sepúlveda, 1999).

Figure 1. Production and apparent consumption of green chili (t) from 1994 to 2019 (FAOSTAT, 2021).

Trade balance. The trade balance of green chili produced in Mexico had a positive trend in the period studied; it has had a positive trade balance in all years, with a difference of 873 052 t in the period; the trade balance has increased 554.3% (FAOSTAT, 2021). The behavior of the trade balance and exports of green chili during the period from 1994 to 2019 has shown a positive trend, with a growth rate of 548.06% in exports and imports showed a lower growth rate, of 77.58% (Figure 2).
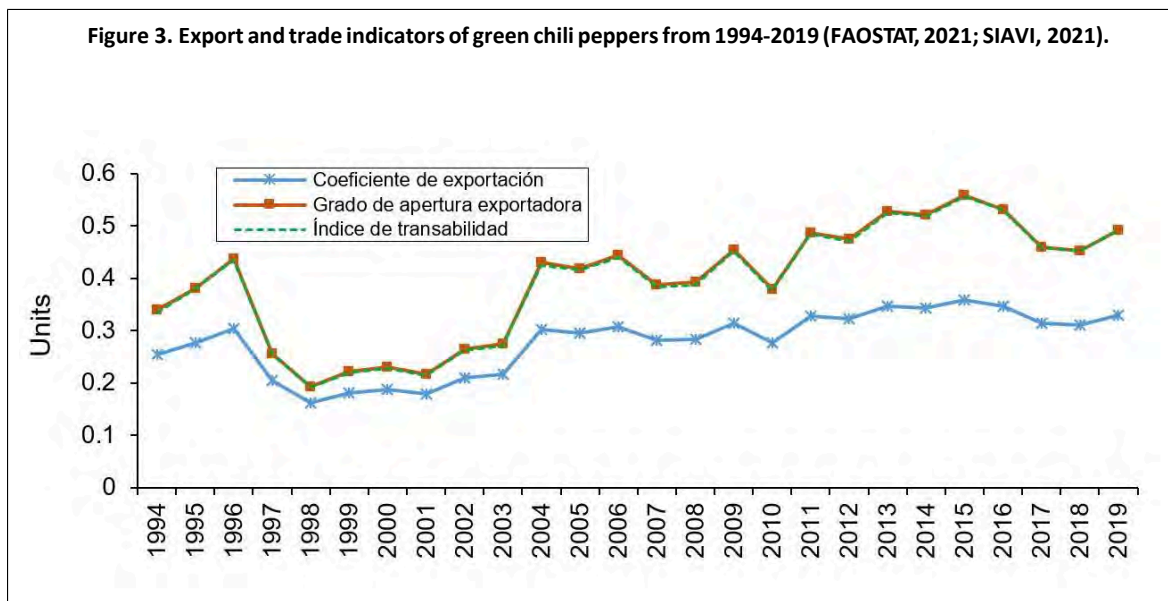
Figure 2. Trade balance of green chili in Mexico (t) from 1994 to 2019 (FAOSTAT, 2021; SIAVI, 2021).

Relative trade balance. The relative trade balance of green chili presents values close to one, which indicate the importance of exports in relation to imports. The index reflects that Mexico is a net exporter of green chili in the period analyzed as it reaches a relative trade balance of around one, indicating low imports and high competitiveness of green chili (FAOSTAT, 2021).

Export coefficient. The export coefficient for the period from 1994 to 2019 showed positive values above zero, which means that the competitiveness of green chili is high (Figure 3). The tradability index during the period analyzed was positive in all years, greater than zero, which means that the

sector is considered a net exporter because there is an excess of supply, which indicates exportable surpluses (FAOSTAT, 2021). The export coefficient curve is below the export openness index curve because the first index shows the percentage of green chili production that is exported, while the other index reflects the share of exports in consumption, which is higher, confirming a high degree of export specialization (Ramírez *et al.*, 2016).

Figure 3. Export and trade indicators of green chili peppers from 1994-2019 (FAOSTAT, 2021; SIAVI, 2021).

Commercial dependence coefficient. The commercial dependence coefficient of green chili from 1994 to 2019 showed a downward trend with ups and downs and peaks in 2004 and 2008, with 0.0069 and 0.0048, respectively (FAOSTAT, 2021). The indicator is close to zero, which means that the competitiveness of the sector is high, imports of green chili are small, indicating that domestic demand is satisfied with national production and part of the production can be destined for export, reflecting competitiveness (Ramírez *et al.*, 2016).

Conclusions

The production and apparent national consumption of green chili in the period from 1994 to 2019, as well as the trade balance of the same period, showed an increasing trend, which generated a trade surplus in the green chili sector, both variables have a positive growth rate. The relative trade balance showed values close to one, reflecting that the product is competitive.

The export coefficient showed values above zero; the tradability index had values greater than zero throughout the period studied; the index of degree of export openness was above zero; this indicates that Mexico produces enough to cover the domestic demand for green chili and generates surpluses for the foreign market, which makes this sector competitive. The trade dependence coefficient showed values close to zero, which means that the competitiveness of the sector is high. The competitiveness indices of the green chili trade analyzed have shown that Mexico is competitive in this product and shows an increasing trend.

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