EFFECTS OF DROUGHT ON THE MEXICAN BEAN MARKET

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SUMMARY

Bean is one of the most drought-affected crops in México. This situation has an influence on the legume's behavior in the national market. The objective of this work was to quantify the effects exerted by drought on the Mexican bean market and on the social welfare of the Mexican population. To measure these effects, a spatial equilibrium model with average data of three annual cycles was validated. The results indicated that, when faced with drought, and with no import restrictions, Mexican bean supply would drop by 15.4%, consumption would decrease by 0.3%, and imports would rise by 104.2%. In a scenario with drought plus one restriction where imports could only increase 33%, the country would only import 198 thousand tons, and bean surplus for both producer and consumer would drop by 14.4% and 7.6% respectively; furthermore, the price for the legume producer would increase by 15%. In conclusion, drought causes a decrease in bean national production, a significant increase in imports, and consumption remains stable. Bean producers sustain the heaviest economic loss.

Introduction

Drought is an unpredictable, natural phenomenon that occurs when the precipitation recorded during a period in a specific region is below average. Drought, depending on the impact it generates, can be classified as meteorological, hydrological, agricultural, and socioeconomic (Dominguez, 2016; Alahacoon and Edirisinghe, 2022). The effects brought about by this phenomenon can be severe, and negatively affect a region's productive and economic sectors, and even alter social development, human activity, and environment (Ortega-Gaucin, 2013). Mexico is vulnerable to drought as 52% of its territory is classified as arid and semi-arid (Salinas, Lluch, Hernandez and Lluch, 1998). According to Esparza (2014), fourteen states in the country present arid and semi-arid regions that are more susceptible to drought as a result of low rainfall throughout the year (there is a one-month period of rainfall in

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arid zones and a one-to-three-month period of rainfall in semi-arid zones). However, it is the northern and central regions in Mexico that are more vulnerable to the effects of this phenomenon (Ortega-Gaucin, 2013; Perez-Aguilar *et al*., 2021).

One of the most drought-stricken economic and productive activities is agriculture. Authors like Magaña and Neri (2012) affirm that the agricultural sector is a priority when faced with drought as both climate variability costs and agricultural dependence on imports have become increasingly higher.

Bean is one of the most affected crops production-wise because of drought (Lapiz-Culqui *et al*., 2021). The effect can be explained by the fact that an average of 1.58 million hectares sown (data from 2017-2019) produced an average of 1.08 million tons; of the total production, 63% is obtained from these states: Zacatecas (33.2%), Sinaloa (14.2 %), Durango (8.8%), and Chihuahua (7.3%), all of which are located in the northern region of the country. Furthermore, 96% of bean production in the Zacatecas-Durango-Chihuahua region is carried out under rain-fed conditions, with an average yield of 570 kg·ha^{-1}.

According to Acosta-Díaz *et al*. (2011), agroclimatic conditions of the main bean producing regions (except Sinaloa) have an effect on production because the crop in these states is grown into shallow, low organic matter content soils with a low water holding capacity where intermittent drought causes a low grain yield. This, in turn, has a direct impact on the legume's national production and lowers the product's availability in the national market.

Bean is, in Mexico, one of the most important grains to provide food for the population. So much so that a per capita consumption of 9.2kg was recorded in the 2017-2019 period by Secretaría de Economía (SE, 2019) and Instituto Nacional de Estadística y Geografía (INEGI, 2019); nevertheless, bean consumption per capita may reach 13kg in lower income households (Magaña and Neri, 2012). According to data from the Servicio de Información Agroalimentaria y Pesquera (SIAP, 2019a), during the 2017-2019 period, a 1.18-million-ton apparent consumption of bean was recorded for Mexico between 2017-2019, of which 12.5% was covered by imports (SIAP, 2019a and SE, 2019). Bean consumption is higher than the it's national production, which generates food dependency. According to De Los Santos-Ramos *et al*. (2017), dependency on bean has increased in the last three decades. Moreover, climatic factors such as drought help boost this condition. Take 2012 as an example where, after the 2011 agricultural year's drought, Mexican bean availability dropped by 51% (SIAP, 2019a) and imports reported a maximum level of 235 thousand tons, which represented an increase of 124.7% with respect to 2011's imports (FAOSTAT, 2021).

The effects of drought in the bean national market are not only manifested in the form of a higher food dependency; they are also felt in the welfare of producers and consumers. Nonetheless, Ding *et al*. (2011) points out that the economic impact and the loss distribution after drought depend on market structures and on the product's supply-demand interaction.

Thus, by considering the argument above, these questions arose: What is the economic impact of drought on the bean market? And how much does this affect the social welfare? The answer them, the main objective of this research was to quantify the effects of drought on the Mexican bean market and on the social welfare of Mexican population.

Materials and Methods

A spatial equilibrium model was used to analyze the effects of drought in the Mexican bean market. The model was based on Takayama and Judge (1971), García-Salazar and Williams (2004), and García-Salazar *et al*., (2011). Assuming i (i= 1,2...I= 14) bean-producing regions in Mexico and j (j= 1,2...J= 14) bean-consuming regions, m (m= 1,2… M= 4) border entry points of imported bean and e (e= 1, 2,...M= 3) ports and borders of exported bean, the programming model can be stated as shown in Eq.1.

$$\begin{aligned} \mathrm{MaxNSP} = {} & \textstyle\sum_{j=1}^{J}\left[\lambda_j y_j + \frac{1}{2}\omega_j y_j^2\right] - \sum_{i=1}^{I}\left[\nu_i x_i + \delta_i pr_i + \frac{1}{2}\eta_i x_i^2\right] + \sum_{e=1}^{E}[p_e x_e] - \\ & \textstyle\sum_{m=1}^{M}[p_m x_m] - \sum_{i=1}^{I}\sum_{j=1}^{J}[p_{ij}^c x_{ij}^c] - \sum_{i=1}^{I}\sum_{j=1}^{J}[p_{ij}^f x_{ij}^f] - \sum_{i=1}^{I}\sum_{e=1}^{E}[p_{ie}^c x_{ie}^c] - \\ & \textstyle\sum_{i=1}^{I}\sum_{e=1}^{E}[p_{ie}^f x_{ie}^f] - \sum_{m=1}^{M}\sum_{j=1}^{J}[p_{mj}^c x_{mj}^c] - \sum_{m=1}^{M}\sum_{j=1}^{J}[p_{mj}^f x_{mj}^f] \end{aligned} \qquad (1)$$

Where, λ_j is the intercept of the bean demand function in region j; ω_j is the slope of the bean demand function in region j; y_j is the bean consumption in region j; ν_i is the intercept of the bean supply function in region i; δ_i is the coefficient relating the price to bean producer and the rainfall in region i; pr_i is the rainfall in region i; η_i is the slope of the bean supply function in region i; x_i is the quantity of bean offered in region i; p_m is the international bean import price through border m; x_m is the quantity of bean imported through border m; p_e is the bean export price sent through border e; x_e is the quantity of bean exported through border e; p^c_{ij} and x^c_{ij} are shipping cost and bean quantity sent by truck from i to j; p^f_{ij} and x^f_{ij} are shipping cost and bean quantity sent by rail from i to j; p^c_{mj} and x^c_{mj} are shipping cost and bean quantity sent by truck from m to j; p^f_{mj} and x^f_{mj} are shipping cost and bean quantity sent by rail from m to j; p^c_{ie} and x^c_{ie} are shipping cost and bean quantity sent by truck from i to e; p^f_{ie} y x^f_{ie} are shipping cost and bean quantity sent by rail from i to e.

The target function is subject to the constraints shown by Eqs. 2 to 7:

$$x_i \geq \sum_{j=1}^{J}[x_{ij}^c] + \sum_{j=1}^{J}[x_{ij}^f] \qquad (2)$$

$$x_m \geq \sum_{j=1}^{J}[x_{mj}^c] + \sum_{j=1}^{J}[x_{mj}^f] \qquad (3)$$

$$\sum_{i=1}^{I}[x_{ij}^c] + \sum_{i=1}^{I}[x_{ij}^f] + \sum_{m=1}^{M}[x_{mj}^c] + \sum_{m=1}^{M}[x_{mj}^f] \geq y_j \qquad (4)$$

$$\sum_{i=1}^{I}[x_{ie}^c] + \sum_{i=1}^{I}[x_{ie}^f] \geq x_e \qquad (5)$$

$$\sum_{i=1}^{I}[x_i] + \sum_{m=1}^{M}[x_m] = \sum_{j=1}^{J}[y_j] + \sum_{e=1}^{E}[y_e] \qquad (6)$$

$$y_j, x_i, x_m, \dots\dots\dots\dots. x_{mj}^f \geq 0 \qquad (7)$$

The programming model is made of the seven equations (1 to 7). A description of each is shown in Table I.

The model included 14 bean producing and consuming regions: Zacatecas, Durango, Sinaloa, Chihuahua, Nayarit, Northeastern (which includes the states of Coahuila, Nuevo León, and Tamaulipas); Northwestern (Baja California, Baja California Sur, and Sonora); the San Luis Potosí region (Guanajuato, Querétaro, and San Luis Potosí); Western (Aguascalientes, Colima, and Jalisco); Michoacán (Guerrero and Michoacán); Central (Mexico City, Estado de México, Hidalgo, Morelos, Puebla, and Tlaxcala); Gulf (Tabasco and Veracruz) Southern (Chiapas and Oaxaca); and Peninsula (comprising Campeche, Quintana Roo, and Yucatán). Four import entry borders were considered: El Paso, Laredo, Nogales, and San Diego.

To determine the effects of drought on the bean market, the model was first validated using the average data of three annual cycles: from October 2016 to September 2019, called "average year 2019". The procedure used to validate the base model consisted in comparing the values of bean production and consumption observed in the 2019 average year with those obtained from the solution to the model. It was determined that the base model had been validated when the majority of differences between values were lower than 10%.

The base model represented a scenario where drought does

TABLE I
STRUCTURE OF THE SPATIAL INTERTEMPORAL EQUILIBRIUM MODEL OF BEAN

Equation	Title	Description
1	Target function	The model's target function maximizes the Net Social Payoff (NSP), which is equal to the sum of the areas below the demand curves minus the areas below the supply curves, plus the value of exports, minus the value of imports, minus shipping and storage costs. The supply function assumes that the quantity offered depends on the price of bean and on rainfall.
2	Constraint	It indicates the way in which bean production is distributed to local consumer markets.
3	Constraint	It indicates the way in which bean imports to local consumption markets are distributed
4	Constraint	It establishes the way in which bean consumption is supplied in local consumption zones with produce from national producing regions and import ports.
5	Constraint	It indicates the way in which bean is supplied in each of the export exit points with beans from national producing zones.
6	Constraint	It establishes a balance indicating that the available quantity of bean (production plus imports) is equal to the total use (consumption plus exports)
7	Constraint	It establishes the non-negativity conditions of the model.

Source: Own work prepared based on the spatial equilibrium model.

not exist. Once the model was validated, another two scenarios were proposed. The first one considered a rainfall decrease compared to the level observed in 2011, a period with the lowest annual rainfall recorded in 20 years. There were no constraints imposed to imports in this scenario. The second scenario considered the rainfall level observed in 2011, but in order to measure the price increase that occurs with bean shortage, imports were constrained. In this scenario, imports can only increase by a third; that is to say, they can be up to 33% higher than the ones observed in the base model.

To determine the effects of the drought on the bean market, the model was first estimated and validated using average data from three annual cycles, from October 2016 to September 2019, defined as the average year 2019. Variables considered in the model are shown in Table II and are classified as endogenous and exogenous. The value of endogenous variables is determined by solving the model and the value of exogenous variables is introduced to the model as a parameter, which corresponds to the value observed during the year of the analysis.

Consumer and producer surplus were calculated by using supply, demand, prices, and quantities offered. The supply and demand functions were calculated by using quantities of bean produced and consumed, the prices offered to producer and consumer, the price elasticity of supply and demand, and the elasticities that measure the production-fertilizer price ratio.

The price elasticity of demand was taken from Guzmán-Soria *et al*. (2019). The national price elasticity of demand was used in the model for all regions and time periods. The bean price elasticity of supply and the elasticity that relates rainfall with bean production were also taken from Guzmán-Soria *et al*. (2019), who reported nationwide coefficients. The bean production in Mexico by region was obtained from Servicio de Información Agroalimentaria y Pesquera (SIAP, 2019a) and the rainfall data was taken from Comisión Nacional del Agua (CONAGUA, 2020).

The monthly regional consumption was obtained by calculating first the national apparent consumption (NAC), which considers national production data gathered by the SIAP (2019a), plus the imports, minus the exports (SE, 2019). The NAC was then divided by total population of the country, which resulted in the bean per capita consumption during the average year. In order to calculate the regional consumption, data on the population by state (INEGI, 2019) were multiplied by the per capita consumption. State totals were subsequently grouped to obtain the regional total.

Regional prices paid by consumers and received by producers were calculated as follows: a) the consumer price was obtained by adding the price to the wholesale (Sistema Nacional de Información e Integración de Mercados (SNIIM), 2020), plus the bean retailer markup reported by SIAP (2019b); b) the monthly producer price by region was calculated by subtracting the wholesale price from the wholesale markup (SIAP, 2019b). Bean international prices at Mexican borders and the monthly import quantity by entry points were offered by United States International Trade Commission (USITC, 2019).

Rail shipping costs considered rates charged in 2018 and were obtained from Agencia Reguladora del

TABLE II
VARIABLES CONSIDERED IN THE MODEL

Variable	Type	Region, entry and exit points, potential routes
Production	Endogenous	14 bean producing regions
Consumption	Endogenous	14 bean consuming regions
Imports	Endogenous	4 international import borders
Exports	Exogenous	3 international exit ports
Bean quantity shipped by rail from bean producing zones	Endogenous	196 potential routes
Bean quantity shipped by truck from bean producing zones	Endogenous	196 potential routes
Bean quantity shipped by rail from entry points	Endogenous	56 potential routes
Bean quantity shipped by truck from entry points	Endogenous	56 potential routes
Bean quantity shipped by rail to exit points	Endogenous	42 states
Bean quantity shipped by truck to exit points	Endogenous	42 ports

Source: Own work prepared based on the spatial equilibrium model.

Transporte Ferroviario (ARTF, 2019). The average rate was multiplied by a railroad distance matrix. Cities considered for reference were Zacatecas, Durango, Culiacán, Chihuahua, Tepic, Monterrey, Mexicali, San Luis Potosí, Guadalajara, Morelia, Ciudad de México, Jalapa, Tapachula, Mérida, Nuevo Laredo, Nogales, and Tijuana.

Truck shipping costs were obtained by multiplying the average annual rate by the distance of bean producing regions and import entry points to consumption centers. Data was obtained from telephone consultations to agricultural transportation companies located in Zacatecas, Durango, Sinaloa, and Jalisco. The cities of reference were the same used for rail shipping costs.

The base model and the scenarios where the decrease in precipitation observed in 2011 was considered, with and without import restrictions, were obtained using the MINOS procedure, written in GAMS (General Algebraic Modeling Systems).

Results and Discussion

To analyze the effects of drought on the bean Mexican market, the spatial equilibrium model was first validated by comparing expected values with observed valued during the 2019 average year. Said results are shown in Table III. The comparison of both consumption and production values denote that, on a national scale, the model overrates bean production by 1.9%, and consumption is overrated by 2.8%. On a regional level, the model overrates bean production in the Northern and Central regions by 3.4% and 3.3%, respectively, whereas the Peninsula Region underrates bean production by -0.6%. Similarly, the model overrates bean consumption in all regions in a range from 0.2% to 5.7%.

Total bean consumption and production in 2019 amounted to 1.01 and 1.09 million tons, respectively. Furthermore, the model considered bean imports and exports, which added up to 137.5 thousand and 52.0 thousand tons, respectively (Table III). During the analyzed year, the main bean producing regions were Zacatecas (38.8% of the national production), Durango (11.7%), San Luis Potosí (11.7%), Chihuahua (9.0%), Southern (7.2%), Central (7.0%), and Sinaloa (6.2%). Consumption-wise, more than 30% of the demand was concentrated in the Central Region, followed by the Northeastern with 9.6%, S.L. Potosí with 8.9%, and Gulf with 8.8% (Table III).

TABLE III
BEAN MARKET VALIDATION (TONS)

Region	Observed value	Expected value	Change	Change (%)
		Production		
Zacatecas	391,215	401,173	9,958	2.5
Durango	118,480	120,234	1,754	1.5
Sinaloa	64,509	64,464	-45	-0.1
Chihuahua	91,353	92,246	893	1
Nayarit	16,937	17,157	220	1.3
Northeastern	4,469	4,552	83	1.8
Northern	9,971	10,308	337	3.4
San Luis Potosí	118,773	119,388	615	0.5
Western	13,960	14,026	66	0.5
Michoacán	17,672	18,184	512	2.9
Central	68,736	71,021	2,285	3.3
Gulf	22,227	22,526	299	1.3
Southern	71,299	73,491	2,192	3.1
Peninsula	1,357	1,349	-8	-0.6
National	1,010,957	1,030,119	19,162	1.9
		Consumption		
Zacatecas	14,555	14,656	101	0.7
Durango	15,863	16,302	439	2.8
Sinaloa	26,520	27,979	1,459	5.5
Chihuahua	32,420	32,717	297	0.9
Nayarit	10,952	11,359	407	3.7
Northeastern	104,734	108,139	3,405	3.3
Northern	64,382	68,027	3,645	5.7
San Luis Potosí	98,075	98,313	238	0.2
Western	90,030	92,905	2,875	3.2
Michoacán	75,724	77,162	1,438	1.9
Central	341,348	348,375	7,027	2.1
Gulf	96,258	99,855	3,597	3.7
Southern	84,643	88,789	4,146	4.9
Peninsula	40,529	42,493	1,964	4.8
National	1,096,032	1,127,071	31,039	2.8
		Imports		
National	137,537	148,931	11,394	8.3

Source: Own work prepared based on the solution of spatial equilibrium model.

Table IV shows the results of the solution to the model in a drought scenario. If rainfall in the year 2019 had been similar to that of 2011, bean production would have decreased by 151.1 thousand tons, 15.4% lower that the production in the base year. The harshest effects caused by drought were seen in the northern states of the country. In Zacatecas, production would have dropped by 23%, in Durango by 30.4%, in Chihuahua by 28.0%, in Sinaloa by 18.7%, in the Northeastern region by 17.5%, and in the Northern region by 13.6%. In contrast, the southern part of the country would have recorded a 20.9% increase in bean production, the Gulf region a 16.2% increase, and the Peninsula would have raised its bean production by 3.7%.

Loss of welfare in a drought scenario was calculated based on producer and consumer surplus and on the changes to producer prices. Results are shown in Table V.

The results indicate a positive relationship between bean production and rainfall. The positive relationship between production and rainfall is similar to the findings of Guzmán-Soria *et al*. (2018), who reported an elasticity of 0.7005 between both variables. Prieto-Cornejo *et al*. (2019), on their part, conducted a study where they related drought with a decrease in yield. They concluded that drought can reduce yield up to 53 $kg \cdot ha^{-1}$, especially during the spring-summer agricultural cycle and under rain conditions.

TABLE IV
EFFECT OF DROUGHT ON BEAN PRODUCTION AND CONSUMPTION WITH NO IMPORT CONSTRAINTS (TONS)

Region	Base model value	Value with drought	Change	Change (%)
Production				
Zacatecas	401,173	308,933	-92,240	-23
Durango	120,234	83,670	-36,564	-30.4
Sinaloa	64,464	52,433	-12,031	-18.7
Chihuahua	92,246	66,372	-25,874	-28
Nayarit	17,157	16,394	-763	-4.4
Northeastern	4,552	3,756	-796	-17.5
Northern	10,308	8,911	-1,397	-13.6
San Luis Potosí	119,388	116,673	-2,715	-2.3
Western	14,026	14,227	201	1.4
Michoacán	18,184	17,728	-456	-2.5
Central	71,021	66,473	-4,548	-6.4
Gulf	22,526	26,168	3,642	16.2
Southern	73,491	88,834	15,343	20.9
Peninsula	1,349	1,399	50	3.7
National	1,030,119	871,971	-158,148	-15.4
Consumption				
Zacatecas	14,656	14,594	-62	-0.4
Durango	16,302	16,239	-63	-0.4
Sinaloa	27,979	27,883	-96	-0.3
Chihuahua	32,717	32,638	-79	-0.2
Nayarit	11,359	11,319	-40	-0.4
Northeastern	108,139	107,751	-388	-0.4
Northern	68,027	68,027	0	0
San Luis Potosí	98,313	97,896	-417	-0.4
Western	92,905	92,573	-332	-0.4
Michoacán	77,162	76,869	-293	-0.4
Central	348,375	347,098	-1,277	-0.4
Gulf	99,855	99,855	0	0
Southern	88,789	88,834	45	0.1
Peninsula	42,493	42,493	0	0
National	1,127,071	1,124,069	-3,002	-0.3
Imports				
National	148,931	304,075	155,144	104.2

Source: Own work prepared based on the solution of spatial equilibrium model.

In a drought scenario (Table IV), imports would increase by 155.1 thousand tons, which would represent a 104.2% raise. Given the fact that the missing bean production would be substituted with imports, consumption would not suffer a meaningful variation as it would only drop by 0.3%. The low decrease of bean demand could be explained based on research carried out by Rodríguez-Licea *et al*. (2010), who mention that bean availability in the market is a not a meaningful factor in its consumption as supply is diversified and consumers can easily acquire it. This implies that buying national or imported bean is not relevant to the consumer.

The data in Table V shows base model values compared to the results obtained in the scenario which considered drought and an import constraint. This scenario assumes that part of the missing bean production needed to supply the consumption level during the base year is not available in the international market and, consequently, imports can only increase by 32.9% to reach a total of 198 thousand tons.

In a drought scenario with a constraint imposed to imports (Table V), consumer and producer surplus nationwide would be less by 2.399 and 2.391 billion pesos, respectively, in relation to levels observed in the analyzed year. This scenario assumes expenditure to buy part of the bean to be consumed in the country. The sum of consumer and producer surplus means that, when faced with drought, social welfare would decrease by 4.79 billion pesos, situation that would affect both producers and consumers.

The low availability of bean in the local market caused by the drop in production would have a positive effect on producer price. On a national level, the producer price would increase by 15.3% and, on a regional level, there would be increases in a 7.6 to 17.5% range (Table V). These results are similar to those reported by Magaña *et al*., (2015), who point out an upward trend of national bean prices in the years 2011 and 2012 with prices paid to producers of 22.3% more than those reported in 2013. This was a consequence of the 2012 drought in Mexico, which is considered one of the most devastating disasters in northern and central states of Mexico, and one of the most important of the last seven decades (Dominguez, 2016). With the obtained results, it was observed that increases in producer prices were not enough to counteract losses and that bean producers were the most affected parties as they recorded the biggest loss in surplus (14.4%).

Conclusions

To determine the effects of drought on the Mexican bean market, a spatial equilibrium model was formulated. The decrease of rainfall observed in 2011 (the lowest rainfall year recorded in a 20-year period) would cause a drop in bean production and an increase in imports by more than 100%. Since the missing production would be substituted with imports, consumption would not suffer a meaningful change.

Drought would have negative effects on social welfare as producer and consumer surplus would decrease and would create a contraction in the economic surplus of over 4.7 billion pesos. Bean shortages produced by said contraction would have a positive effect on producer price, with an increase of more than 15%. Even when the bean producer price rises, the degree of affectation is higher in producers. Producers experience a bigger loss of economic surplus.

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TABLE V
EFFECT OF DROUGHT ON BEAN PRODUCER PRICE WITH AN IMPORT CONSTRAINT PER TON

Region	Base model value	Value with drought	Change	Change (%)
Producer Price				
Zacatecas	13,604	15,900	2,296	16.9
Durango	13,474	15,770	2,296	17.0
Sinaloa	13,095	15,391	2,296	17.5
Chihuahua	13,000	15,207	2,207	17.0
Nayarit	14,022	16,318	2,296	16.4
Northeastern	14,407	16,650	2,243	15.6
Northern	15,015	17,201	2,186	14.6
San Luis Potosí	13,953	16,249	2,296	16.5
Western	14,307	16,603	2,296	16.0
Michoacán	14,461	16,757	2,296	15.9
Central	14,878	17,174	2,296	15.4
Gulf	15,112	17,408	2,296	15.2
Southern	15,108	16,263	1,155	7.6
Peninsula	15,104	17,200	2,096	13.9
National	14,253	16,435	2,182	15.3
Imports				
National	148,931	198,000	49,069	32.9
Producer surplus (million pesos)				
National	16,713	14,314	-2,399	-14.4
Consumer surplus (million pesos)				
Nacional	31,487	29,096	-2,391	-7.6
Economic surplus (million pesos)				
National	48,200	43,410	-4,790	-9.9

Source: Own work prepared based on the solution of spatial equilibrium model.

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EFECTOS DE LA SEQUÍA SOBRE EL MERCADO MEXICANO DE FRIJOL

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RESUMEN

El frijol es uno de los cultivos más afectados por la sequía en México. Esta situación influye en el comportamiento de la leguminosa en el mercado nacional. El objetivo de este trabajo fue cuantificar los efectos de la sequía en el mercado mexicano del frijol y en el bienestar social de la población mexicana. Para medir estos efectos se validó un modelo de equilibrio espacial con datos promedio de tres ciclos anuales. Los resultados indicaron que frente a la sequía y sin restricciones a la importación, la oferta de frijol mexicano bajaría 15,4%, el consumo disminuiría 0,3% y las importaciones aumentarían 104,2%. En un escenario de sequía más una restricción donde las importaciones solo podrían aumentar 33%, el país solo importaría 198 mil toneladas y el excedente de frijol tanto para el productor como para el consumidor disminuiría en 14,4% y 7,6% respectivamente; además, el precio para el productor de leguminosas aumentaría en un 15%. En conclusión, la sequía provoca una disminución de la producción nacional de frijol, un aumento significativo de las importaciones y el consumo se mantiene estable. La mayor pérdida económica la sufren los productores de frijol.

EFEITOS DA SECA NO MERCADO MEXICANO DE FEIJÃO

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RESUMO

O feijão é uma das culturas mais afetadas pela seca no México. Essa situação influencia o comportamento da leguminosa no mercado nacional. O objetivo deste trabalho foi quantificar os efeitos da seca no mercado mexicano de feijão e no bem-estar social da população mexicana. Para medir esses efeitos, um modelo de equilíbrio espacial foi validado com dados médios de três ciclos anuais. Os resultados indicaram que diante da estiagem e sem restrições à importação, a oferta de feijão mexicano cairia 15,4%, o consumo cairia 0,3% e as importações aumentariam 104,2%. Em um cenário de estiagem mais restrição onde as importações poderiam aumentar apenas 33%, o país importaria apenas 198 mil toneladas e o excedente de feijão tanto para o produtor quanto para o consumidor cairia 14,4% e 7,6% respectivamente; Além disso, o preço para o produtor de leguminosas aumentaria 15%. Em conclusão, a estiagem provoca uma diminuição da produção nacional de feijão, um aumento significativo das importações e o consumo mantém-se estável. A maior perda econômica é sofrida pelos produtores de feijão.