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ANALYSIS OF THE SOCIAL AND ECONOMIC IMPACT OF SUGARCANE CULTIVATION IN THE STATE OF VERACRUZ

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Abstract: This article addresses the problem of analyzing the impact of sugarcane cultivation for producers in the state of Veracruz, Mexico; its environmental consequences and the water consumption demanded by the sugar industry. Also mentioned are the effects on the soil, rivers and groundwater due to the use of pesticides and the enormous water consumption required for sugarcane production. A documentary research was carried out to address the problem. Among the most important results of this research, a correlation was found between the increase in the price of sugarcane and the increase in the area used for its cultivation in the state of Veracruz, Mexico, which has caused a harmful environmental impact for this state in the southeast of Mexico.

Keywords: impact, production, sugarcane.

INTRODUCTION

Sugarcane production had its origins in Southeast Asia and western India. It was later introduced to Egypt around 647 A.D. and about a century later, to Spain around 755 A.D. (Cabrera, 2010). Since then, sugarcane production spread to almost all tropical regions. In Christopher Columbus' voyages to America, it was transferred to the Caribbean islands and from there to the tropical zone of the American continent.

Sugarcane production arrived in Mexico at the time of the conquest in approximately 1522, and the first sugarcane plantation was carried out in the state of Veracruz, and later the first sugar mills were installed in the warm parts of the country as part of the colonization. In 2015, Mexico ranked seventh in the world in sugarcane production, along with Brazil, India, China, Thailand, Pakistan, Colombia, Indonesia, the Philippines and the United States (FAO, 2015).

The sugar industry in Mexico is developed in 15 states in our country and generates a primary production value of around 30 billion pesos. Figure 1 shows the main sugarcane producing states.

IMPACT OF SUGAR CANE PRODUCTION

In the first stage of this project, the costs and benefits of sugarcane cultivation were identified from both perspectives: private and social evaluation. The private evaluation considered the opportunity costs of the land used to plant sugarcane, as well as the costs of fertilizers, irrigation, cutting and sale; while the income was calculated exclusively on the basis of the market price per ton of sugarcane, multiplied by the number of tons sold. In the social evaluation, the same costs considered in the private evaluation were considered, as well as the costs caused to the environment, specifically the pollution caused by the excessive use of fertilizers and the actual water consumption demanded by the sugar industry.

In the second stage of this project, the costs and benefits identified in the first stage were quantified by assigning a physical measure to these costs and benefits and, subsequently, a price was assigned to these physical measures.

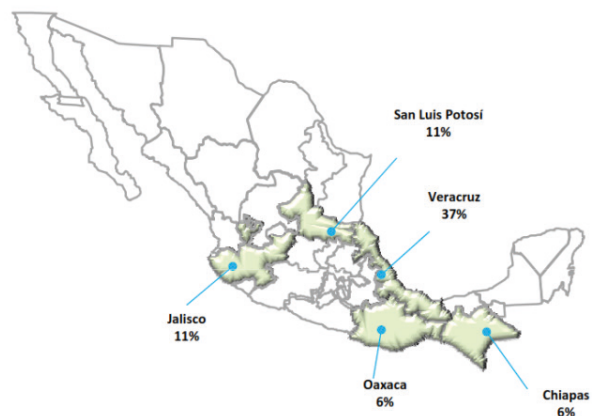


Figure 1. Sugarcane producing states.

The objective of this project is to analyze the economic impact for sugarcane producers

in the state of Veracruz, as well as its consequences for the environment, and the actual water consumption demanded by the sugar industry. To achieve this objective, a documentary research was carried out to evaluate sugarcane production in two ways: private and social. The private evaluation consists of determining the convenience of executing a project for its owner, while the social evaluation considers all the effects of the project on society (Meixueiro-Garmendia et al., 2008).

In the state of Veracruz, sugarcane cultivation participated in 2016 with an area of 323,650 hectares, representing 19.6% of the total harvested area; and by the value of its production of 9,356 million pesos, it was located as its main product, since it constituted 30.8% of the value of the state's agricultural production, consolidating itself as the most important product and of greater economic and social relevance in this entity (SAGARPA, 2015). For the extraction of sugar from sugarcane, 20 industries (sugar mills) have been operating in the state of Veracruz for the last five years, which have entered into supply contracts through producers' organizations.

A monoculture is a production model based on the artificialization and homogenization of production systems (Abbott et al., 2007). This model is characterized by the application of high energy cost technologies and is considered one of the most important achievements of mankind to face the problems of hunger and poverty.

When analyzing the socio-environmental impacts of monocultures after more than 40 years of application of this agricultural model, it was found that not only has it not solved the problems of poverty and hunger, but it has also generated an environmental and social crisis and has had negative impacts on food security and biodiversity (Olguín et al., 2011).

According to several reviewed studies, in recent years humans have transformed ecosystems faster than in any other period of time (Arellano, 2010; Colegio de Postgraduados, 2008 and 2009). This has generated a considerable and irreversible loss of the diversity of life on earth, for example, deforestation that endangers the conservation of water, soils, flora and fauna, etc. Monoculture agriculture has expanded due to globalization and with it, transnational corporations have expanded their influence and control in the market for agricultural inputs and seeds (Acosta, 2011; Ascanio, 2004; Cabrera, 2010).

The water footprint is an indicator of the water used in our daily lives, both that used to produce our food, as well as that used in industries, to produce energy and that polluted by these same processes (Arreguín et al., 2007). Specifically, the water footprint makes it possible to relate the actual consumption of water used to satisfy all human needs, with trade and the globalization of the world economy, because it makes it possible to visualize the way in which water consumption in one region has an impact on another region in the same country or even in another country. It is worth noting that to obtain 1 kg of refined sugar from sugarcane requires about 1,500 liters of water. Sugarcane consumes around 220 billion cubic meters of water per year, equivalent to 3.4% of the world's water consumption for agricultural production.

Many see monoculture agriculture as a strategy to satisfy the demand for food due to the increase in world population, but on the contrary it caused many negative impacts on ecosystems, some of these are (A.J. et. al., 2008):

- High rates of deforestation, elimination of vegetation cover, loss of soil fertility and erosion of large natural areas.

- The intensification of soil use led to a greater requirement of synthetic fertilizers of different types as a source of nutrients, causing problems in chemical fertility such as acidification and salinization of the soil and loss of its biological fertility.
- The homogenization of the production system meant the reduction of the productive components of the farm, generating the loss of biodiversity and genetic erosion.
- The technological use of conventional agriculture is the cause of soil, water and air pollution problems.
- With the expansion of monoculture agriculture, the use of agrochemicals has become widespread, leading to an increase in insect resistance to pesticides over the last 50 years.
- This model has become one of the primary causes of the imbalance of agro-ecosystems with high social and environmental costs.
- Nutrition and food security have been directly related to productive diversity and the expansion of monoculture.
- With monoculture, the economic stability of producers is vulnerable due to the instability of market prices and environmental risks.

In sugarcane cultivation the main impacts are soil erosion and compaction, the effects of pesticides on soils, rivers and groundwater, the damage that can be caused to the atmosphere and the population during its harvest by fire, and damage from soil fertilization (Garcia, 2009; Mishra et al., 2004; Olvera et al., 2013; Srivastava et al., 2012; Waclawowsky et al., 2010). In addition to the factors mentioned above, there is the problem with the residual biomass of sugarcane crops and also

the impoverishment of fauna and flora in general, due to the impacts on living beings that are involved with the expansion of sugarcane monoculture (Marín et al., 2013; Mora, 2011; Sangerman, 2012; Windle et al. 2005).

RESULTS

In the state of Veracruz, sugarcane cultivation participated in 2016 with an area of 323,650 hectares, representing 19.6% of the total harvested area; and by the value of its production of 9,356 million pesos, it was located as its main product, since it constituted 30.8% of the value of the state's agricultural production, consolidating itself as the most important product and of greater economic and social relevance in this entity. For the extraction of sugar from sugarcane, 20 industries (sugar mills) have been operating in the state of Veracruz for the last five years, which have been making supply contracts through producers' organizations (SAGARPA, 2015).

In the period from 2012 to 2016, there has been a growth trend in the harvested area from 273,575 to 323,650 hectares. In terms of yields, the trend has been variable, although in this period there has been a slight increase from 61.2 to 64.4 tons/ha of sugarcane. This is reflected in the volume that was industrialized for sugar production during this period, going from 16.7 to 20.8 million tons of processed sugarcane.

As for the average price to the producer, this was also favored from 2013 to 2016, going from \$441.65/ton. to \$687.21/ton. of sugarcane, respectively, improving the profitability of the crop, a factor that has motivated producers in the last two years to improve the care of their plots.

Although today the sugarcane fields in the state of Veracruz show positive profitability indicators, it is important to remember that crop management practices must be improved, since this increase is mainly due to

the improvement in the price of the product and, to a lesser extent, to the improvement of agricultural practices (FIRA, 2010).

Furthermore, taking into account that 60% of the area is cultivated under a rainfed regime with a considerable impact on the environment, and in the case of irrigated areas, production processes must be modernized, seeking greater efficiency in the use of water, agrochemicals and fertilizers, taking into account the negative effects that this has.

During the 2014-2015 harvest, CONADESUCA (National Committee for the Sustainable Development of Sugarcane) reported that the largest area harvested with sugarcane in the country was in Veracruz with 325,859.04 ha, representing 41.6% of the area occupied with this crop (CONADESUCA, 2015 and 2010). Although the state of Veracruz is an optimal place for sugarcane production, because its cultivation to be adequate requires sites with high relative humidity, good water supply and an approximate temperature of 30°C; to achieve that sugarcane production, fertilizers are used to increase crop yields. If the proportions applied are adequate, they are used by the plants; however, if they are excessive, they remain in the soil for some time and are then transported by water or wind (Mora, 2011; Ortiz et al., 2012).

Based on the results of the documentary research, in the private evaluation it was determined that between 2012 and 2016, there was a growth trend in the harvested area from 273,575 to 323,650 hectares, but in terms of yields, the trend was variable, although with a slight increase, going from 61.2 to 64.4 ton/ha. of sugarcane, which allowed increasing the volume that was industrialized for sugar production in that period, going from 16.7 to 20.8 million tons of processed sugarcane. As for the average price to the producer, this was also favored from 2013 to 2016, going from \$441.65/ton. to \$687.21/ton. of sugarcane,

respectively, improving the profitability of the crop, a factor that has motivated producers in the last two years to improve the care of their plots. However, on the 56% increase in the average producer price, an estimate was made of the increase in the opportunity costs of the land used to plant sugarcane, as well as the costs of fertilizers, irrigation, cutting and sale, caused by the increase of about 20% of the area planted, as well as the increase of fertilizers to improve the sugarcane yield per hectare, reaching the conclusion that the real benefit for the producer was an increase of 14% in their earnings per hectare, which evidences a favorable economic impact for the sugarcane producer, during the period from 2013 to 2016.

On the other hand, in the social evaluation, the impact on the environment was quite negative for two main reasons. First, in order to increase the yield of each hectare planted with sugarcane from 61.2 to 64.4 tons per hectare, an increase of approximately 5%, it was necessary to increase the use of fertilizers and pesticides, which are two of the main sources of soil, river and groundwater contamination. Additionally, in order to process each ton of sugarcane, it was necessary to use approximately one and a half million liters of water, but if we remember that the yield per hectare in 2016 was 64.4 tons, we can conclude that the amount of water used in the state of Veracruz, for sugarcane production, is not really being correctly quantified in the cost of production.

Therefore, it is necessary to induce an integrated participation of the agents of this value network (producers, industrialists, suppliers and government) to implement actions to increase productivity and reduce costs per unit of sugarcane produced, seeking to improve its competitiveness in order to face the adversities of the economic environment and climate change (Bravo et al., 2009; Enriquez, 2012).

FINAL COMMENTS

A problem that has gone unnoticed by most Mexicans accustomed to the *laissez-faire* imposed by a dozen corporations and a hundred large companies that keep the economy captured, is causing great damage to the country. In addition to the social cost paid by the farmers in the regions where sugar cane plantations are developed, its expansion in many cases causes the destruction of forests, land movements, pollution and many times the draining and drying up of swamps, lagoons and other water sources, in short, the partial or total elimination of ecosystems and the loss of biodiversity.

The social cost of the expansion of these plantations should not only be measured by the damage they are causing to peasant and family economies. It should also be measured by the environmental disaster caused by depriving future generations of water and fertile soils, that is to say, of minimum conditions of existence in a country with a millenary history and culture. How long will Mexicans, indifferent to social and environmental problems, tolerate the practices of landowners and businessmen who continue to manage the process of growing and harvesting sugar cane?

In this document a documentary research was presented to analyze the economic impact for sugarcane producers in the state of Veracruz, as well as its consequences for the environment, and the actual water consumption demanded by the sugar industry.

Based on the results of the documentary research, it was determined that, between 2012 and 2016, there was a growth trend in the harvested area from 273,575 to 323,650 hectares. Regarding yields, the trend was variable, although with a slight increase, going from 61.2 to 64.4 tons/ha. of sugarcane, which allowed increasing the volume that was industrialized for sugar production in that period, going from 16.7 to 20.8 million tons of processed sugarcane.

As for the average price to the producer, this was also favored from 2013 to 2016, going from \$441.65/ton. to \$687.21/ton. of sugarcane, respectively, improving the profitability of the crop, a factor that has motivated producers in the last two years to improve the care of their plots.

On the other hand, the impact on the environment was quite negative for two main reasons. First, in order to increase the yield of each hectare planted with sugarcane from 61.2 to 64.4 tons per hectare, that is, an increase of approximately 5%, it was necessary to increase the use of fertilizers and pesticides, which are two of the main sources of soil, river and groundwater contamination. Additionally, in order to process each ton of sugarcane, it was necessary to use approximately one and a half million liters of water, but if we remember that the yield per hectare in 2016 was 64.4 tons, we can conclude that the amount of water used in the state of Veracruz, for sugarcane production, is not really being correctly quantified in the cost of production.

Unfortunately, considering the above aspects, the impacts are not always objective, since one of the limitations we have is that much of the information does not reflect the different environmental, social and economic impacts, since for our research we do not have reliable sources of the real situations that exist in the Veracruz fields, but we will continue working on the collection of information in order to have a study more attached to the reality of our Mexican countryside.

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