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# Factors affecting the profitability of wheat production in the states of Guanajuato and Nuevo Leon, Mexico

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## ABSTRACT

The objective of this research was the analysis of the main factors involved in the profitability of bread wheat in the states of Guanajuato and Nuevo León, Mexico. To obtain the information, semi-structured interviews were applied to key informants who indicated the context of the crop in their region. In order to estimate profitability, production performance and costs production were determined. The production cost information, for the two Mexican states, was obtained through the producer panels methodology in 2019. Producers were asked about the costs expended in land preparation, cultivation inputs, harvest and others such as water, electricity and financial rights. In addition, wheat yields and the price received per ton sold at the market. It was noticed that Nuevo León and Guanajuato have an agro-industrial infrastructure that demands Mexican wheat. In each state, the profitability of the crop depends on a number of factors such as the planting system and the production technology used; but in all the places studied, bread wheat had positive profitability. However, there are high production costs and a continuous deterioration of the real prices of the product. It is necessary to develop soft wheat varieties that adapt to rainfall conditions for agricultural regions where wheat cultivation is under those conditions. Although Mexico is self-sufficient in the production of flour, each year it is necessary to import an additional volume of bread-making wheat since Mexican industry is deficient facing the high demand for bread production.

**Keywords:** yield, production costs, profitability.

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## INTRODUCTION

During 2020, the national production of grain wheat reached three million tons. Among the main producing states, Sonora topped the list with 49% of production, followed by Guanajuato with 12%, Baja California with 10%, while Nuevo León, Tlaxcala and Chihuahua together contributed 8% of national production (SIAP, 2023). In Mexico, the milling industry acquires the entire harvest of bread-making wheat and around 720 thousand tons of crystalline wheat, for the production of semolina that is used in the manufacture of pasta (CANIMOLT, 2016).

Wheat production in Mexico shows a downward trend, in 2008 the production was 4 million 214 thousand tons, in contrast to the 2 million 943 thousand obtained in 2020; which represented 70% of what was produced in 2008. This trend tends to be accentuated, especially with bread-making varieties. This is attributable to the scenario of falling international prices and competition for the area available for planting with crops such as barley and oilseeds (CANIMOLT, 2016). Also, to the reduction in profitability, as producers have high production costs and a continuous deterioration in the real prices of the product.

Between 1980 and 2015, the input price index for wheat production grew at an average annual rate of 30.44%, while that of the producer price index decreased by 2.1% and yields barely grew 0.4%, implying a reduction in profitability. Despite the loss of profitability, coupled with the increase in import volumes and the deregulation of the market, there are no studies that accurately investigate the main problems involved in reducing the profitability and competitiveness of wheat cultivation. The objective of this research was to analyze the factors involved in the profitability of wheat in the states of Guanajuato and Nuevo Leon, Mexico.

## MATERIALS AND METHODS

The study was conducted in the municipalities Penjamo and Valle de Santiago, Guanajuato; and in the municipalities Los Ramones, Allende, and Valle de Salinas, in Nuevo León. The information was obtained by applying a semi-structured interview, directed to key informants. The first interview was with eight actors, from research institutions, such as INIFAP, the State Delegation of the Ministry of Agriculture and Rural Development (SADER) and the Secretariat of Rural Development in Guanajuato (SDR). A second interview was conducted with 40 farmers in the two states, from which data were obtained to identify problems, causes and solutions in the production and sale of wheat.

For the analysis of crop profitability and to identify actions to make a competitive production chain (Lundy *et al.*, 2004), production costs were obtained with the methodology of producer panels (Agroprospecta, 2010; Ireta-Paredes *et al.*, 2015, Ireta-Paredes *et al.*, 2018) with groups of producers, with similar characteristics of technological level and surface area under cultivation. Two producer panels were held in each locality, with small and large producers, each one was made up of four to six producers who were invited directly, the requirement was that they had grown wheat in 2019. After obtaining production costs, the complement to the profitability analysis was yield evaluation (Swenson and Haugen, 2013). Then, the following algebraic expressions, based on economic theory, were used to determine profitability (Krugman and Wells, 2006; Samuelson and Nordhaus, 2009).

Total cost was determined through this function

$$CT = PxX$$

where  $CT$ =total cost;  $Px$ =input or activity cost  $x$  and  $X$ =activity or input.

And the total income per hectare was obtained by multiplying the yield of the crop in tons (Megagrams, Mg) times its market price.

$$IT = PyY$$

where  $IT$  = total gain (MXN \$ ha<sup>-1</sup>),  $Py$  = sales price (MXN \$) at the market per Megagram of the crop (MXN \$ Mg<sup>-1</sup>);  $Y$  = crop yield in Megagrams per hectare (Mg ha<sup>-1</sup>).

Finally, profitability was calculated:

$$\textit{Profitability} = IT - TC$$

## RESULTS AND DISCUSSION

### Profitability analysis

The producing areas of Valle de Santiago and Penjamo, in Guanajuato recorded an average yield of 7.5 Mg ha<sup>-1</sup> and an average profit of MXN \$ 8201 per ha; in contrast, the municipalities of Allende, Los Ramones and Valle de Salinas in Nuevo Leon presented an average yield of 4 Mg ha<sup>-1</sup> with average profit of MXN \$ 2305 per ha. In Nuevo Leon, the municipality of Valle de Salinas has the highest investment compared to the rest of the production units evaluated, which is attributable to the high costs of irrigation and land leasing.

In Table 1, it can be seen that the municipality of Penjamo had the highest profitability with \$10 344 per ha, while in Valle de Santiago, it was MXN \$6059 pesos per hectare cultivated with soft wheat. The variation in profitability between Penjamo and Valle de Santiago, Guanajuato can be attributed to the fact that in the municipality of Penjamo the sale of wheat is carried out by the producer organization to which they belong, so they achieve consolidated sales and obtain a better price per ton.

In the case of Valle de Santiago, producers resort to contract farming with intermediaries for different mills, which is done individually and therefore their bargaining power is lower, their only advantage is that they will be able to place their harvest at a sale price previously agreed in the contract. If the guarantee prices in force since the 2019 agricultural cycle are considered, the profitability is almost the same in both municipalities. However, that of Valle de Santiago is still lower due to higher production costs. Despite those, Valle de Santiago reaches a profitability per hectare greater than MXN \$ 10 000.

The Mexican state of Guanajuato, where irrigated agriculture predominates, has the highest profits per hectare compared to wheat-producing regions in Nuevo Leon, where wheat crop is irrigated and rain-fed. Los Ramones municipality, in the Mexican state of Nuevo Leon, is the one with the highest profit obtained per hectare (MXN \$3720 ha<sup>-1</sup>), when real rural average price MXN \$4300 Mg<sup>-1</sup> is considered (without adding the warranty price). In this municipality, wheat is produced under irrigation system and mechanized labor (Table 1). Despite yield and income per hectare are higher in Valle de Salinas, their high production costs and a minor price paid to the producer, both affect profitability per ha. When profitability is calculated with the warranty price, income rises;

**Table 1.** Comparison of production costs and incomes per hectare of wheat in the states of Guanajuato and Nuevo Leon, Mexico with 2019 prices.

Concept	Guanajuato		Nuevo León		
	Penjamo	Valle de Santiago	Los Ramones	Allende	Valle de Salinas
Type of irrigation	Irrigated	Irrigated	Irrigated	Rainfed	Irrigated
Land preparation	6462	5917	5180	1500	5900
Agricultural labor	2000	1425	1500	1000	1425
Seeds	1740	1800	1740	1050	1740
Fertilizer	4249	4137	-	-	4500
Fungicide	340	233	400	401	400
Herbicides	1625	1313	520	120	1300
Irrigation	1240	2116	1200	-	3240
Harvest	2250	2250	940	700	1410
Production cost	19 906	19 191	11 480	4771	19 915
Land leasing	5000	7000	2000	2000	2000
Production cost plus land leasing (MXN \$ ha <sup>-1</sup> )	24 906	26 191	13 480	6771	21 915
Income					
Yield (Mg ha <sup>-1</sup> )	7.5	7.5	4	2	6
Price paid to producer (MXN \$ Mg <sup>-1</sup> )	4700	4300	4300	3700	4080
Income (MXN \$ ha <sup>-1</sup> )	35 250	32 250	17 200	7400	24 480
Profitability (MXN \$ ha <sup>-1</sup> )	10 344	6059	3720	629	2565
Profit per Megagram (MXN \$ Mg <sup>-1</sup> )	1379	808	930	315	428
Profitability (MXN \$ ha <sup>-1</sup> ) (with warranty prices set at MXN \$ 5790 per Mg)	18 519	17 234	9680	4809	12 825

Source: elaborated by the authors with field data obtained in 2019.

the municipality with the highest profitability is then Valle de Salinas (MXN \$ 12 825 ha<sup>-1</sup>), because it also has greater production per hectare.

### Factors Affecting Profitability in Wheat

These are government subsidies, credits, and other governmental grants in the wheat production process. The government grant received was from Pro Agroproductivo, which granted \$1300 per hectare of wheat cultivated until 2018. Starting in the 2019 agricultural year, Mexican Federal Government implemented the Basic Food Products Warranty Price Program, which included bread-making wheat that was paid with a warranty price of \$5790.00 MXN per Megagram, with a purchase limit of 100 tons per producer. The agency in charge of the operation of the Program, the Mexican Food Security Agency (SEGALMEX), paid the producer with the difference between the actual price obtained for the delivery of their crop to the industry and the established warranty price.

With SEGALMEX operating rules for the 2019-2020 Autumn-Winter cycle, the warranty price remained at MXN \$ 5790.00 per ton of bread-making wheat with the limit

of up to 100 tons per producer. The productivity incentive was added for tons 101 to 300, which received 50% of the support, and the competitiveness incentive for crystalline wheat, intended for the domestic milling industry, from 1 to 50 tons, with a support of 40% of the grant defined as the warranty price of bread wheat. This has been favorable for these producers, however, it should be applied in its entirety to all producers in Mexico.

Producers tend to resort to financing and in Guanajuato loans are higher than MXN \$100 000 with an interest rate of 1 to 13%, compared to Nuevo León, where producers request support for amounts higher than MXN \$500 000 with a 3 to 13% interest rate. Most of the loans are granted by financial institutions, or by the companies with which they sign contract farming, as it is the case of DC-TRIMA, in the municipality of Valle de Santiago, Guanajuato.

### **Exports and imports**

The production of bread-making wheat is insufficient to meet the demand of the national milling industry (SAGARPA, 2017). As for crystalline wheat, the domestic market for human consumption has surpluses, which are destined for export as a market of opportunity and to the livestock sector as a market that consumes surpluses (CANIMOLT, 2016). The main destination country for soft wheat and crystalline wheat is the United States, which accounted for 91% of Mexican exports (2009 to 2019) of soft wheat and 80% of crystalline wheat (SIAVI, 2019).

Imports in 2019 showed a decrease of 27.54% compared to those in 2018 (SIAVI, 2019). In the period 2009–2019, imports of soft wheat accounted for 97.1% of total imports, of which 61.5% came from the United States of America. In turn, Russia, Lebanon, Italy, and the United Kingdom have become the main suppliers of crystalline wheat (SIAVI, 2019).

### **Wheat prices in México**

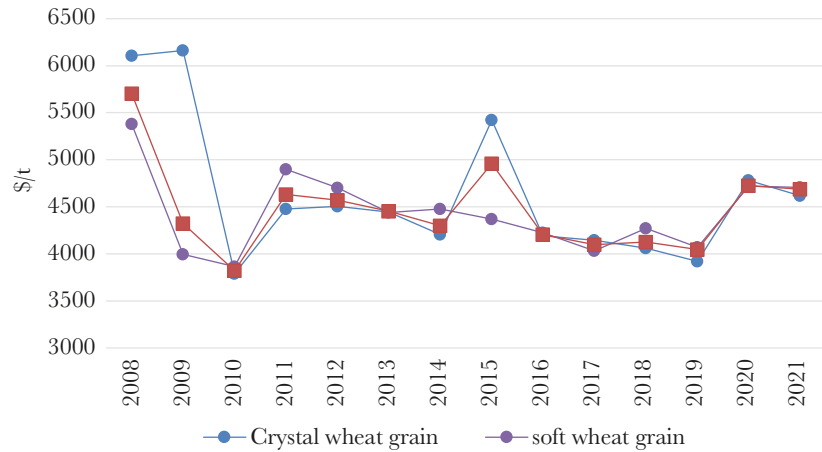
Figure 1 shows the dynamics of the real rural average price (RRAP) paid to the producer per type of wheat; which has an Average Annual Growth Rate (AAGR or TMAC) of  $-1.73$ ; composed of  $-1.05$  for soft wheat and  $-1.98$  for crystalline wheat (Figure 1).

When analyzing the wheat Producer Price Index (wPPI) for the period 2008-2021, an upward trend is observed in the prices of inputs used to grow wheat, whose AAGR showed a 4.12% increase, the fertilizer price index FPI grew at a 3.16% rate, and the wheat Rural Average Price Index decreased by 1.73% (Figure 2).

When analyzing the average rural price and the producer price index for the period from 2008 to 2022 and comparing the AAGRs, a loss of profitability for the producer is observed. Since the price of inputs shows a higher growth rate than that of the AAGR of the real price paid to the producer at the national scale.

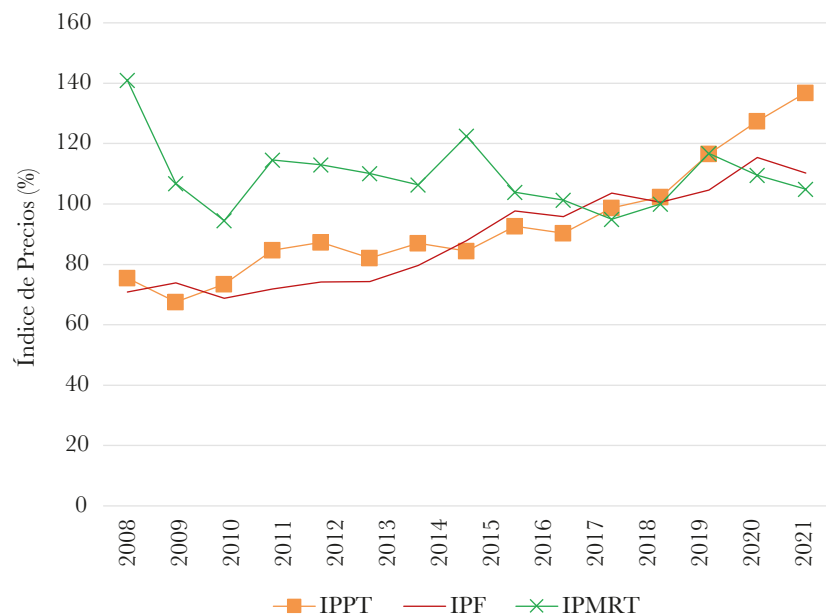
### **Wheat market**

The soft wheat market in Guanajuato has two main uses, the pasta making industry and the baking industry. According to the information obtained in the field, “Molinera de México”, which is part of the TRIMEX Group, acquires wheat for the industrial consumption of PepsiCo Mexico, while “Harinera Irapuato” acquires wheat for “Grupo



**Figure 1.** Real Rural Average Price (RRAP) paid per Megagram (ton) of wheat to the producer for the period 2008-2021.

Source: elaborated by the authors based on data from INEGI (2023) and SIAP (2023). RRAP-Real rural average price for wheat grain.



**Figure 2.** Price indices for the production and sale of wheat in Mexico (2008-2022).

Source: elaborated by the authors. wPPI - Producer Price Index for wheat; FPI - Fertilizers Price Index based on INEGI (2023) and wRAPI - Rural Average Price Index for wheat based on SIAP (2023).

BIMBO”. In the case of crystalline wheat, it is acquired by the “Los Pirineos” flour mill, located in the municipality of Salamanca, Guanajuato, for the company “Grupo La Moderna”, which makes pasta, and also by “Grupo MINSAs”, which transports the wheat to Jalisco. The “San Blas” flour mill belongs to “La Italiana” Industrial Group, which makes the past brand “Italpasta”, and mill consumption is also durum wheat, which are processed in the municipalities of Salamanca, where “La Italiana” produces flour, and Irapuato, where it elaborates pasta.



Another market for wheat is to sell it to bakery industries such as PepsiCo which pays on time, although the disadvantage is that this Company does not invest in storage facilities and asks to use the facilities that belong to the producer organizations. Another purchasing scheme of the bakery companies was that of “Grupo Bimbo”, which according to the percentage of protein that was present in the wheat grain, paid an economic stimulus over the price to the producer. More than 12% protein was required to reach the best stimulus over the price of wheat.

In Nuevo León, mills that produce wheat flour or semolina (or both) for pasta-making are the first buyers of wheat. They are followed by manufacturers of feed for cattle fattening (SAGARPA, 2017). Nuevo León is an eminent consumer of wheat, since what it exports are wheat products, mainly flour in its different presentations and qualities. Once this Mexican state satisfies its export target, it buys grain from other states or from USA and Canada to meet its domestic needs.

## CONCLUSIONS

Nuevo León and Guanajuato have an agro-industrial infrastructure that demands Mexican wheat, both from the center of the country and abroad. In each state, the profitability of the crop depends on a number of factors, such as the planting system and the production technology used. But in all the places studied, wheat had positive returns; despite the fact that there are high production costs and a continuous deterioration of the real prices of the product.

When considering the warranty prices, the profitability of the grain increases three-fold in Valle de Santiago, and five-fold in Valle de Salinas. Although Mexico is self-sufficient in the production of flours, in the North of the country producers prefer to import wheat flour, then process it to export pastries, cookies, and bread destined for USA and Canadian markets. Overall, Mexico is self-sufficient in the production of wheat flour, but each year it must import an additional volume of bread-making wheat, because it is deficient in bread production, due to the degree of national consumption.

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