



## ECONOMIC SITUATION OF RICE CROP IN THE CENTRAL AREA OF COLOMBIA

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Recepción Date: December 7, 2022

Recepción Date: March 20, 2023

### Abstract:

This article analyzes the current economic situation of rice crop in the central zone of the country based on updated official secondary sources of information, on recent agricultural economic analysis theories and through a Quasi-Experimental research method with longitudinal time. The main causes of the lower production, planted areas and yields per hectare are the low profit margins explained by high production costs, high volatility in real prices, high import volumes, informal financing, uncertainty in marketing among other structural circumstances such as land tenure.

**Keywords:** rice production; production yields; production costs; cost-benefit analysis

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## ECONOMIC SITUATION OF RICE CROP IN THE CENTRAL AREA OF COLOMBIA

### Resumen:

El presente artículo analiza la situación económica actual del cultivo de arroz en la zona centro del país en base a fuentes secundarias de información oficiales actualizadas, en teorías de análisis económico agrícola recientes y mediante un método de investigación Cuasi-Experimental con tiempo longitudinal. Como principales causas de la menor producción, áreas sembradas y rendimientos por hectárea se identifican los bajos márgenes de utilidad explicados por altos costos de producción, una alta volatilidad en los precios reales, altos volúmenes de importación, informalidad en la financiación, incertidumbre en la comercialización entre otras circunstancias estructurales como la tenencia de la tierra.

**Palabras clave:** arroz; producción arroceras; rendimientos de producción; costos de producción; análisis costes-beneficio

## SITUAÇÃO ECONÔMICA DO CULTIVO DE ARROZ NA ZONA CENTRAL DA COLÔMBIA

### Resumo:

Este artigo analisa a situação econômica atual do cultivo de arroz na zona centro do país com base em fontes oficiais de informação secundária atualizadas, em teorias recentes de análise econômica agrícola e através de um método de pesquisa quase-experimental com tempo longitudinal. As principais causas da menor produção, áreas plantadas e rendimentos por hectare são as baixas margens de lucro explicadas pelos altos custos de produção, alta volatilidade nos preços reais, altos volumes de importação, financiamento informal, incerteza na comercialização entre outras circunstâncias estruturais, como posse da terra.

**Palavras-chave:** arroz; produção de arroz; rendimentos de produção; custos de produção; análise de custo-benefício

## 1. INTRODUCTION:

In the Colombian rural area, 24% of the total population of the country lives, the agricultural sector represents the second most important sector in terms of employed population after commerce, where 16.81% of the total employed are located (DANE 2021), although the country has a high potential for agricultural production according to the FAO, it is the second world exporter of flowers and the third world exporter of coffee and bananas. The most serious indicators of poverty and extreme poverty occur in rural areas where 44.6% of the population living in this area is in a situation of poverty and 18.8% in a situation of extreme poverty (DANE 2022) that consumption of this food is crucial, added to the fact that in Latin America and the Caribbean the problem of hunger and malnutrition has worsened in recent years (FAO 2022).

This in the context of a situation of economic recovery after the Covid-19 pandemic characterized by high levels of inflation, mainly in food, war between Russia and Ukraine, a high exchange rate, disruption in global supply chains that have With expensive inputs and imported food, as well as prospects for low rates of economic growth in the coming years, it is essential to improve the food security situation in the context of climate change, as well as encourage the development of productive and export potential in the country (FAO 2022). In addition, the rural sector is the most affected by the problem of drug trafficking and violence, where Colombia showed a significant increase in the cultivation of illicit crops where the country continued to be the largest producer of coca leaf

with 204,000 hectares in the year . 2021, an increase of 43% compared to 2020 (United Nations Office on Drugs and Crime - UNODC 2022), this in the context of a policy change in the treatment of the forced eradication of illicit crops by the new government and the prioritization in the application of commitments based on a Comprehensive Rural Reform as a result of the peace agreement recently signed in the country.

The rice crop in Colombia has a significant relevance in the productive structure and the agricultural sector, since it represents 35% of the total area planted with short-cycle crops according to the Ministry of Agriculture and Rural Development, where in the central zone of the country, 32% of the total planted area is located between the years 2000 and 2020, being the department of Tolima the one that comprises 29% of the <sup>1</sup>National Rice Production Units -UPA-, the highest in Colombia, in addition to the fact that this region has the best agroclimatic conditions for the development of this crop (Federacion Nacional de Arroceros - Fedearroz, National Rice Fund. 2021) therefore, the need to analyze the current situation of the planted area, production, yield, foreign trade, prices, consumption and production costs in recent years due to the fact there are no recent studies that provide updated information in Colombia on the sector that serve as a basis for correct decision-making in national and territorial public and private policy, giving solutions to the current problem.

The results presented in this article seek to research the current panorama of the main causes of the decrease in production, planted areas and yield per ton of rice crop in the central zone of Colombia through a recent economic analysis,

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<sup>1</sup> A rice producing unit is understood to be any land used in the production of rice, with independent administration, regardless of size, tenure condition, production system or production destination."IV National Rice Census- DANE - FEDEARROZ. 2017.

where to respond to this question is considered as objectives in a first part to characterize the global and national panorama of production, exports and imports by country of destination and origin, in a second part to analyze the current evolution in the main municipalities of the area, focused on yields, planted areas and total production, followed by a third section whose objective examines the real prices in the last fifteen years and per capita consumption, disaggregating urban and rural areas, ending with the analysis of the production cost structure and cost-benefit indicator, all based on updated data available from reliable secondary sources such as Fedearroz, Ministry of Agriculture and Rural Development, National Administrative Department of Statistics (DANE), International Trade Center (ITC), Banco de la Republica, United Nations Division for Trade of Commodities (UNCOMTRADE). As well as the background of previous studies of the sector prepared by Fedearroz, the Ministry of Agriculture and Development and the National Rice Fund, Ediagro and the study of Parra, RI, Puyana, R. and Yepes, F. of Fedesarrollo of the year 2021 mainly .

## **2. THEORETICAL BACKGROUND:**

Agricultural economic analysis can be done in different ways based on the context of the Green Revolution and the monoculture approach where the main variables that affect crop production are explored, studying the structure of the milling industry, highlighting the main problems that influence demand and marketing; preparing an evaluation of the rice foreign trade policy to finally project a level of production and demand estimating the exportable surpluses of the product according to different alternatives (Gabriel Montes Ll., Ricardo Candelo C. & Ana Milena Muñoz de Gaviria 1980).

Likewise, in this analysis, the concepts that seek to provide a recent image of production in the area are important, analyzing a global and regional context of production; where it is referenced by including variables such as area, production and performance, as well as the immersion in the international trade of the product and relative consumption based on an inventory balance methodology. Inquiring about the territorial composition of the crop, predominant systems according to the area, seasonality, change in quantities and productivity of the region or country.

According to Ocampo, J. (2014) an economic diagnosis focused on a competitiveness strategy can be shown, with the purpose of describing in the form of selected evidence how the agricultural sector is at a given moment, in addition to the situation of access to credit. and to public goods. To this end, a summary of the behavior of the sector in recent years can be made, prioritizing the analysis of a regional focus of indicators and the most important causes in factors such as marketing, foreign trade and financing, among others, emphasizing innovation variables and productivity. Thus, the transformation in foreign trade can be examined, mainly in trade policy, exchange rate, trade agreements and diversification in exports of agricultural products. To the above is added the detail of the main indicators of the sector according to product at the national and zone level where the planted area is related, productivity exposed on a semi-annual and annual basis. Incorporating results referring to the type of sowing and the irrigation system, published through maps according to specific characteristics.

Finally, for Rafael Isidro Parra-Peña S., Santiago Flórez G. & Daniel Rodríguez published in (2022) the analysis must be carried out according to the characterization of the value chain by product in the country according to recent years, analyzing the most relevant obstacles to the chain and formulating conclusions in order to provide a solution, in addition to offer data on the value chain of the crop from planting and harvesting to the

purchase of the product. Surveys of farmers can also be carried out in order to analyze the effects of services on productivity, costs and the level of satisfaction. In addition, optionally, an econometric model can be used that analyzes production yields and costs and a partial equilibrium model that details the trade policy and the consequences of a full opening in this market in later years.

### **3. METHODOLOGY:**

The present study used a Quasi-Experimental research method with longitudinal time (Menard, S. 1991), characterized by the separation of the parts of a whole in order to understand them individually, achieving a process of analysis and rational union. of scattered elements; with the purpose of understanding the behavior of variables such as production, yields, foreign trade, consumption, prices, production costs among others, in a previously preconceived structure of the problem; For this, in the first part and based on statistical data, it starts from a global and national context of the production and foreign trade of the product according to the country of origin and destination based on the most recent data published by the National Rice Fund, Fedearroz, International Trade Center and UNCOMTRADE, subsequently an economic characterization of the most relevant municipalities according to their production is carried out, through secondary information obtained from the Municipal Agricultural Evaluations carried out by the Ministry of Agriculture and Rural Development between the years 2007 to 2021, together with what is exposed in the Municipal Development Plans. Additionally, the most recent information processed through spreadsheets and displayed in tables and graphs on production in tons, yield and planted areas of the main crops by municipalities is shown, in order to analyze their evolution over time and to know the importance of rice cultivation in the area.

Subsequently, the historical real prices of the last fifteen years are analyzed, for which information was collected from Fedearroz and the Banco de la República, focusing on the green Paddy variety, with said information a historical record of prices was made that allowed through own calculations obtain harmonized data at present value. Likewise, the evolution of per capita consumption is shown according to urban and rural areas in the last fifteen years based on data from the Economic Research Division of Fedearroz and the National Survey of Quality of Life- ECV of DANE. Regarding the characterization of the marketing and financing process, it was prepared based on information from studies, bulletins and current reports with data from producers, unions, key players, mills, dismantlers, commercial houses and other institutions related to the crop and sector.

Finally, the Evaluations of Production Costs and Cost Benefit ratio analysis, it was carried out based on representative information from various sources such as the Monthly Bulletin of Input Components, internal and external price indicators, specific information from producers, key marketers of DANE area and specialized data from Fedearroz, among others of the area, which were reviewed, organized, calculated, supplemented, updated and analyzed in detail.

#### 4. RESULTS:

##### Global and national context

World rice production in 2020 was concentrated mainly in Asian and Southeast Asian countries, with countries such as China, India, Bangladesh and Vietnam contributing 74% of world production (544 million tons), where China and India concentrate 52% of the production volume and 42% of the harvested area worldwide.

Among 83 different countries worldwide, which reported information for the year 2020 and organized into five groups according to their level of production, China and India, with productions of more than 150 million tons/year are in a second group. There are Indonesia and Bangladesh that report 14% of the world harvest with productions close to 50 million tons per year.

In a third group are those countries that obtained a production between ten to 50 million tons in the year 2020 and that represent 21% of the total world production (19.4 million tons) among them are Vietnam, Thailand, Myanmar, Philippines, Japan, United States, Pakistan and Brazil. While in a fourth group there are countries that achieved a production between two and ten million tons of production, Colombia is in this group together with countries like Peru that obtained 2.9 and 3.2 million tons of production respectively, this group represents 9% of total world production. Finally, in a fifth group there are 54 countries with productions of less than two million tons, which represent 3% of the total world production. (National Rice Fund 2021)

In general aggregate terms by region, it can be stated that the Asian continent and the Asia-Pacific subregion concentrate 90% of the world production of this cereal in 2020, while the African continent represents 5% and the American countries the 4.8% of world production. This is mainly explained by aspects of geographical extension, population mass and internal

consumption of the product. (Goswani, R. Chatterjee, S. & Prasad, B. 2014).

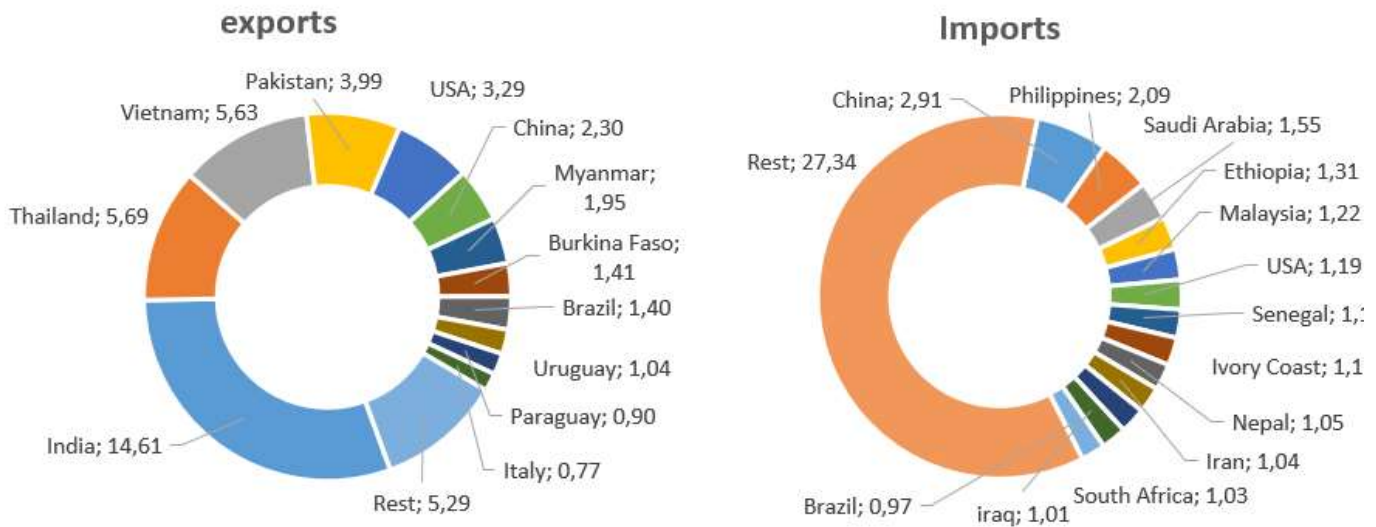
Regarding productivity measured in yield per hectare, Australia stands out (with 10.4 tons per hectare) as the country with the highest world yields. While China (7.04 tons per hectare) and India (4.13 tons per hectare), despite having the highest productions worldwide, are located in more relegated positions in terms of performance (China in position 8 and India in the position 40 out of 83 countries).

In the case of Colombia, its national average production reported in 2020 was 4.78 tons per hectare, ranking 21st worldwide, establishing the country at higher levels in this indicator, which according to the registered values is in the fourth top of productivity internationally. (Rural Agricultural Planning Unit - UPRA. 2020)

In terms of international trade worldwide, it is evident that for the year 2020 rice imports were 75.3 million tons compared to global exports that reached 48.6 million tons, that imports are greater than exports is mainly explained by the release of inventories from the large exporting countries such as India, Thailand, Pakistan, the United States and China.

It is interesting to analyze the case of India and China since the first country is defined as a net exporter of the product with around 14.6 million tons, while China exports around 2.3 million tons and imports 2.9 million tons, as evidenced in Figure 1; reflecting this as a dynamic market of high production and trade, but also as a market defined by the size of the population, greater purchasing power and high per capita consumption of this good. (Fan, S. & Pardey, P.G. 1997)

World Exports and Imports of Rice in million tons per country



Source : Own calculations based on ITC and UNCOMTRADE. (2022).

For the specific case of Colombia, it is evident that the country is a net importer of rice since its imports are considerably higher than its exports, where for the year 2020 these were 279.048 and 1.990 tons respectively. Its main trading partners as origin of imports were the United States with 186.990 tons and Ecuador with a total of 44.064 tons imported in 2020. These two countries account for 82% of Colombian imports of this product, as evidenced in the Table 1. This situation has occurred despite the strong devaluation of the Colombian peso against the US dollar in recent years, which has been 34.3% in 2020 compared to 2017. In addition, factors such as the Free Trade Agreement and smuggling could partly influence these high import figures for the product. (Parra, RI, Puyana, R. and Yepes, F. 2021).

While Colombian rice exports are minimal, with 1.274 tons exported in 2020, mainly to countries like Venezuela (934 tons) and Cuba (300 tons). It should also be noted that in the American continent some countries of Central America and the Caribbean import between four and seven times their national production, being potential export opportunities and market benchmarks for Colombia; For this, the unit production costs per hectare must be reduced, as well as their yield and productivity improved through the implementation of more and better technology in the crop areas . (Fedearroz & National Rice Fund. 2021. )

**Table n° 1**

*Rice imports by Colombia according to country of origin. (2017 to 2020)*

No.	Countries	2017	2018	2019	2020
1	World	127,082	164,869	208.491	279.048
2	Ecuador	268	30.597	28.977	44.064
3	United States	126.389	132.912	145.488	186,990
4	Peru	0	0	33.496	47.631
5	Thailand	195	207	276	117
6	Italy	141	130	138	146
7	India	64	4	79	59

Source : Own calculations based on ITC and UNCOMTRADE. (2022).

### Context Central Zone.

Analyzing the cultivation of rice in the Central Zone that includes the departments of Tolima, Valle del Cauca, Caquetá, Huila, Cauca and Nariño measured in Rice Production Unit (UPA), as presented in Table 2, 74.5% of these belong to areas smaller than ten hectares, that is, small and medium producers; and that 59% of them are leased units in terms of land tenure. (Fedearroz. 2017).

**Table 2 Producers and Rice Production Units by region. Year 2016.**

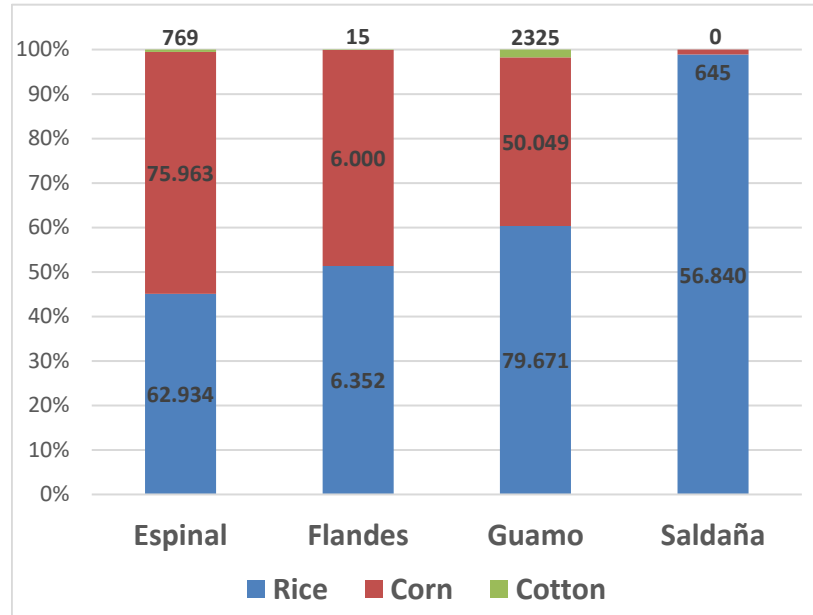
Region	Producers	UPA*
<b>Colombia</b>	16.378	25.256
<b>Central area</b>	5.232	10.111
<b>Tolima</b>	3.350	7.235
<b>Selected municipalities</b>	1.710	3.797

Focusing the analysis on the municipalities of El Espinal, Saldaña, Flandes and Guamo as the areas with the highest historical production and performance at the national level, and according to information provided by the Development Plans of these municipalities, it is highlighted that the main economic activity of the territory It is found in the primary sector, represented by agricultural activities, followed by the tertiary sector in the tourism, social, community and personal services, transport services, restaurants and hotels sectors. In the primary sector, the main crops are transitory like rice, corn and cotton, as shown in Figure 2, although the growth of fruit crops such as mango in recent years stands out.



Figure N° 2

*Production of main crops by Municipality in tons in 2021.*



Source : Own elaboration based on Municipal Agricultural Evaluations - Ministry of Agriculture and Rural Development. (2022).

Transient crops have a greater participation in economic activity in the municipality of El Espinal, since together they represent close to 80% of the production in tons for the year 2021. In their order, the cultivation of corn stands out with a participation of 54% and the cultivation of rice with a participation of 45% over the total production in tons for the year 2021.

In the case of this municipality, the advantage of having the irrigation district of the Coello river stands out since it has allowed the expansion of the agricultural frontier in the municipality since 1953, has facilitated the association of small producers and agro-industrial development through value-added processes to final agricultural goods; In addition, to facilitate workshops and warehouses where elements for the sector are manufactured. (Government of Tolima. 2014)

It should be noted that these municipalities are located on main national roads that connect important population centers such as Bogotá, Neiva, Ibagué, Girardot and Melgar mainly, in addition to having a secondary and tertiary road network that interconnects the agricultural productive sectors with the main markets, distribution and consumption of the different products, although the government points out the importance of restoring and expanding the network due to its normal deterioration. (Municipal Council of El Espinal. 2017)

Likewise, the municipality of Saldaña has rice cultivation as its main agricultural activity, where it presents great challenges such as climate change that causes increases in dry periods that, although it has the irrigation district administered by USOSALDAÑA, there is a need to expand your

coverage with new technologies such as laser technology pools. The livestock sector is also significant in the territory where alternatives such as silvo-pastoral and agroforestry production systems are proposed, as well as crop rotation. (Castro-Llanos, F., Hyman, G., Rubiano, J., Ramírez-Villegas, J. & Achicanoy, H. 2019)

In this municipality there is little diversification of the productive offer and therefore a high dependence on the productive system of rice monoculture specifically; For this, the municipal government proposes to improve the quality of life of the producers through the use of the Guarantee Fund of the Agrarian Bank, agro-industrial fairs and business roundtables. (Municipal Council of Saldaña. 2020)

It is observed that according to the production in tons, the municipality of El Guamo is the most productive in the zone in the rice crop, being 60.33%, followed by the cultivation of corn with a total of 37.9% and by the cultivation of cotton with a total of 1.76% in the year 2021.

During the last fifteen years, the planted area data show a significant reduction for all municipalities, highlighting the municipality of El Espinal, which in 2007 had 12.285 planted hectares while in 2021 these were 8.135. Regarding production indicators, in 2021 it is highlighted that the municipality of El Guamo (with 79.670 tons) is the most productive, followed by the municipalities of Espinal, Saldaña and Flandes, as evidenced in Table 3.

**Table 3**

*Planted area (ha), production (ton) and yield (ton/ha) for rice cultivation by municipality. Years 2007, 2011, 2016 and 2021*

Year	Criterion	Espinal	Flandes	Guamo	Saldaña
2007	Sown area	12.285	1.622	13.620	10.472
	Production	75.678	16.115	95.763	67.860
	Performance	8.3	8.0	7.6	7.5
2011	Sown area	12.300	2.652	11.881	9.400
	Production	80.615	18.564	92.575	41.675
	Performance	6.2	7.0	7.0	6.6
2016	Sown area	12.043	1.696	12.638	9.984
	Production	91.362	12.320	98.114	67.359
	Performance	7.5	7.2	7.7	6.7
2021	Sown area	8.135	771	10.300	9.200
	Production	62.934	6.352	79.670	56.840
	Performance	7.81	8.13	7.7	6.2

Source : Own elaboration based on Municipal Agricultural Evaluations. Ministry of Agriculture and Rural Development. IV National Rice Census 2016 - DANE – FEDEARROZ. (2022).

### Historical real prices and per capita consumption.

The analysis of real prices highlights a trend of high volatility during the last fifteen years with significant variations close to 56% in periods of approximately three years, for example in the

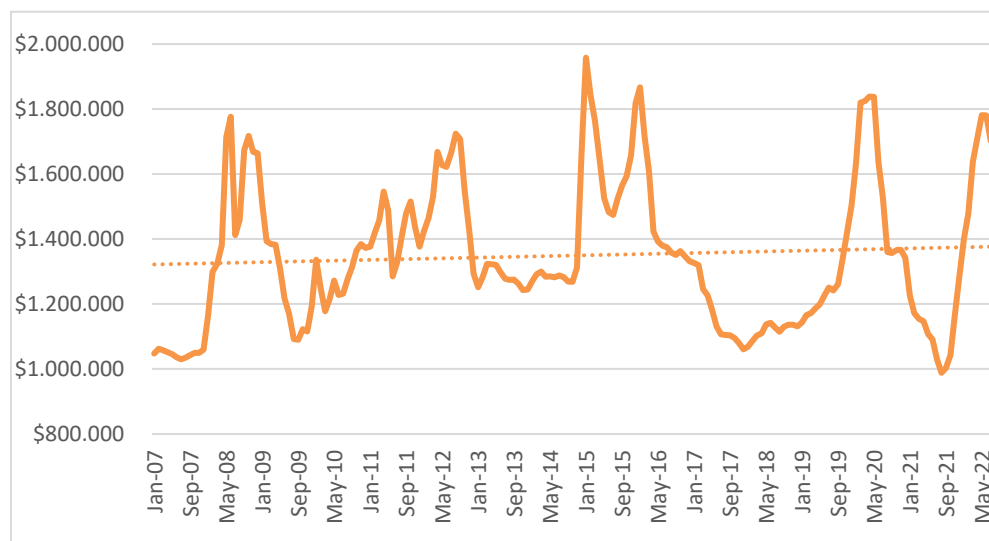
month of October 2007 it starts at a low price for that date of \$904.956 per ton. to later rise to \$1.557.618 in July 2008 and drop again to \$1.107.876 per ton in June 2009. After this, continuous growth can be observed until reaching \$1.403.170 per ton in August 2012, mainly due to the phytosanitary crisis that caused crop vanishing<sup>2</sup> and a considerable reduction in production for that date (Castro. F.. Hyman. G.. Rubiano. J.. Ramírez-Villegas. J. & Achicanoy. H. 2019), then the price dropped to \$1.070.075 per ton in August 2013.

The yield is obtained by dividing the production by the harvested area, a figure that is sometimes different from the planted area data due to registered harvests from previous periods. In the case of rice cultivation in the central zone, the yields in 2007 vary between 7.5 and 8.3 tons per hectare while in 2021 these vary between 6.2 and 8.1, evidencing a slight reduction in general terms.

Finally, it is highlighted that for the year 2021 the municipality of Flandes has the highest yields with 8.1 tons per hectare, while the municipality of Saldaña presents the lowest yields with 6.2 tons per hectare. It is evident in the last ten years that although the yield has increased in all municipalities, production has decreased during this period.

**Figure N° 3**

*Real prices at present value per ton of green paddy rice. 2007-2022.*



Source : Own calculations based on Fedearroz. (2022)

<sup>2</sup>Phytosanitary disease characterized by a deficient load of grains in the ears of rice, also affecting their quality. (Fedearroz 2017).

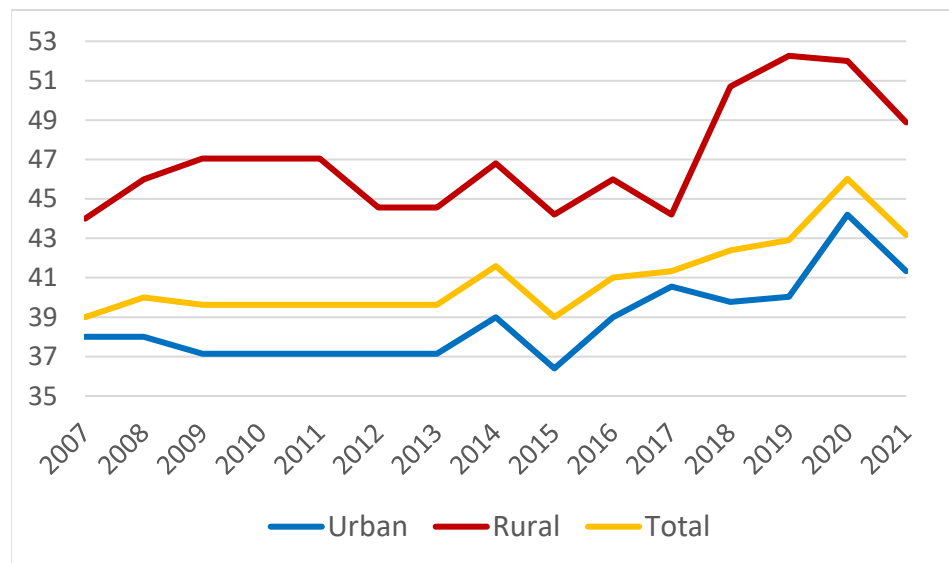
Subsequently, and for recent years the price per ton becomes even more volatile since it continues in a process of growth in real prices until reaching its maximum for the month of February 2016 of \$1.535.412, explained among other aspects by a climate change phenomenon translated mainly into droughts, which caused a reduction in production and an increase in price (Fedearroz 2021); where subsequently the reference price falls to \$896.073 in September 2017, registering a reduction rate of 71.34% for a year and a half, as shown in Figure 3.

It is highlighted that despite having evolved with a positive trend, real prices were in December 2017 and September 2021 at historical lows similar to those paid in August 2007. showing high volatility that generates few incentives to the producer at the time of investing since he considers this activity as unsafe in the long term, casting doubt on future investment decisions in the sector.

Finally, in the acute period of the Covid-19 pandemic between April 2019 and September 2021, the real price per ton decreased by 84.57%. registering the minimum historical real price in the last fifteen years, which was \$988.406.05. a price that it was below the production costs for the date, to later grow again in the economic recovery period between October 2021 and August 2022 by 72.14% remaining at \$1.747.257 l.

Another additional factor that causes price volatility and excess production in the economic system of rice cultivation is the low added value of the final products in general as a conversion alternative to the finished goods that exist today. (General Comptroller of the Republic. 2020)

**Figure 4.** Consumption of white rice in kilograms per person yearly. Colombia 2007-2022



Consumption of white rice in kilograms per person yearly. Colombia 2007-2022

The per capita consumption of white rice has increased in the last fifteen years as shown in Figure 4, going from 39 in 2007 to 43.16 kilograms per person in 2021, being higher in rural than urban areas in all periods. It is highlighted that during 2007 to 2016 the total average consumption remained relatively the same close to 40 kilograms, where from 2017 to 2020 it grew significantly at a rate of 18% total, reducing again between 2020 and 2021 at a rate of 6.8 %. a situation that becomes more evident in the rural sector from 2019 to 2021. mainly due to the economic crisis caused by the Covid-19 pandemic. (DANE and Fedearroz 2021)

### **Marketing and Financing.**

The current situation that Colombia is experiencing occurs in a context where a production of 3.3 million tons of white rice was obtained by 2021 in around 544.635 planted hectares (5.365 hectares less compared to 2016) at the national level and it is expected that to end the year 2022 and 2023. equal or higher figures are achieved in this regard; However. this has not been entirely positive for producers due to the fact that there is overproduction added to high costs, where it is expected that the maximum prices of 2015 will not be reached again; In addition. according to the Ministry of Agriculture and Rural Development, there are about 652 thousand tons stored as of December 2020 which makes the context more complex. (Parra-Peña. R.. Flórez. S. & Rodríguez. D. 2022).

The marketing process for rice cultivation in the area is relatively more organized and formal compared to the other two transitory crops that are produced (corn and cotton) and which has more options for the farmer when negotiating its production. In these municipalities there are four large mills in charge of the commercialization. processing and storage of the production such as; Diana Agrícola SAS., Molinos Roa SA., Molinos Florhuila S.A., and Molinos Caribe SAS., however, Molino Diana Agrícola SAS is the largest in terms of processing and storage capacity in the area and

traditionally plays a relevant role in terms of marketing, financing and pricing to producers in the studied area. (Ediagro. 2005).

The lower production, yield and profits of the crop in the area is reflected in a low demand for the additional services provided by the mills such as financing, technical assistance and sale of inputs, where the portfolio of delinquent debtors has grown significantly and the beneficiaries of new credits have been clearly reduced. This financing service focuses on the loan of a credit of approximately \$1.200.000 per hectare at the moment in which the crop is in development, where everything possible is done so that this resource is used in the lease payment; This is done by the financing entity, verifying through technical assistance in the field compliance with the requested requirements, in addition to other requirements such as having a contract in the case of tenants. (DANE and Fedearroz 2021)

Faced with this situation, the strategy of the mills in the area is to invest in mainly imported machinery and technology for drying, threshing and packaging as a national policy of modernization in each and every one of the plants in order to be more productive. Competitive, efficient and with this achieve higher profits in the market, as well as contribute to future opportunities with a view to exporting the product. (Parra-Peña. R.. Flórez. S. & Rodríguez. D. 2022).

The mills paid \$170.000 for the 125 kilograms load in 2021 with the producer paying for the transportation that is included in the canceled price, where there is a price band that allowed the mill to pay a target price at producer. Hence, there was a certain level of uncertainty due to the scale of collection, production and distribution where a reconversion is observed in the producing areas since a large part of the planted zone in the central area has moved to the eastern plains region where the rent of the land is cheaper, although some costs such as transportation to collection and transformation centers are higher; In addition. the limited access to water resources has been one of the key factors preventing the agricultural frontier

in this area from being able to expand, which will transform the economic. Political, social and environmental panorama of the area. (Fedearroz 2021)

Regarding financing and credit, it is highlighted that the costs of the credit study established by Banco Agrario based on which it defines the amount of the loan are the same for small and medium-sized producers where the requirements, amounts and mainly interest rates. On average, the credit that Finagro lends through Banco Agrario is around \$4.500.000 in total for eight months in the case of rice planting. It should be noted that there are other financing lines to which the Bank carries out, such as land adaptation, purchase of machinery (which has a term of five years), this mainly depends on the price of the machinery while the land adaptation credit it is linked to the needs of the client in what he intends to invest, where in the case of machinery this does not exceed 80% of the price for medium-sized producers and 100% of the price for small producers.

Regarding the interest rates that Banco Agrario establishes in the line of transitory crops, as well as for the other lines of credit for small producers in September 2022, it is the Reference Banking Indicator (IBR) +6.7% Annual Cash (EA), (15.7% EA) and for the medium producer it is IBR +7.85% EA (16.85% EA), where many times there are no quotas of this type since they depend on the amount assigned by the national government.

It is also highlighted that there are several commercial houses that. in addition to selling inputs are key players in financing, which charge rates close to and higher than usury. this type of practice is popular since in these places they do not request too many requirements and disburse immediately with the products purchased. (Rebolledo. Mc. Ramírez-Villegas. J. Graterol. E. Hernández-Varela. C. Rodríguez-Espinoza. J. Petro-Páez. E. Pinzón. S. Heinemann. A. Rodríguez-Baide. J. Van Den Berg . M. 2018).

At present it can be noted that the active portfolio of Banco Agrario in the area is approximately 25.600 loans placed for agricultural banking, specifically for working capital in rice crops, these are mostly eight-month term loans that are assigned to about 200 clients.

Finally, it is highlighted that the land ownership certificate is a difficult requirement for most farmers to meet when obtaining a loan, since a large proportion of the producers are tenants (44% according to the IV National Rice Census 2016 ) (Fedearroz 2017) and not having this document prevents them from benefiting from the loan. It is also difficult to comply with the leasing contract requirement because having such a high price, the vast majority of producers do not agree to terms of more than six months where the agreed times generally do not match the new credit requested because Banco Agrario takes into account the start date of the contract.

#### **Evaluation of production costs and cost-benefit ratio.**

The situation of rice crop in the central zone of the department of Tolima is relatively complex, due to the fact that it faces high production costs, mainly due to high land rental costs as evidenced in Table 4, a significant increase in prices of inputs which mostly come from imported components and have been affected by the high revaluation of the dollar against the peso in recent years, increases in the billing of volumetric and fixed rates of the irrigation service by the districts that operate in the zone and high costs in the seeds; This has reduced profitability as a farming business in the region which has caused a considerable impact on new investments in this activity. leading many producers to move them to other regions such as the Eastern Plains, where rental costs are much lower although with higher transportation and marketing costs. (Parra. Rl. Puyana. R. and Yepes. F. 2021)

**Table N° 4.** Evaluation of production costs for small and medium producers of rice crop. Central area of Colombia year 2021.

<b>Heading</b>	<b>Full Value</b>	<b>%</b>
<b>DIRECT COSTS</b>		
Land preparation	\$523.106	6.50%
Sowing	\$903.229	11.23%
Weed control	\$558.076	6.94%
Control of pests and diseases	\$410.930	5.11%
Fertilization	\$1.871.582	23.27%
Irrigation	\$716.633	8.91%
Taken from the Lot	\$356.741	4.44%
Subtotal Direct Costs	\$5.340.308	66.40%
Subtotal Indirect Costs	\$2.702.657	33.60%
<b>TOTAL PRODUCTION COSTS</b>	<b>\$8.042.965</b>	<b>100%</b>

Source : Own elaboration based on Fedearroz. (2022).

It is evidenced according to the results of the evaluation of unit production costs for small and medium producers taking into account information from previous studies prepared by Fedearroz and based on multiple sources of information (Álvarez. C. Sánchez Z. 1998) that these are distributed mainly in sowing with a considerable representation in the cost of the seeds, followed by the fertilization item which represents 23% of the total production costs for the crop, where the fertilization item becomes the most important within the direct cost pool. (Hargadon. J. and Múnera C. 1994).

It is also observed that although the irrigation item corresponds to 8.91% this is remarkable considering that the volumetric and fixed rates during the last years have increased their value in the different irrigation districts of the country.

Finally, indirect costs show an important relative weight within the general structure since they represent 34% of total costs; mainly explained by land leasing (25.59%) which has increased significantly in recent years due in part to speculation caused by recent overproduction. (DANE 2020)

Elaborating the Benefit-Cost ratio analysis according to the data obtained, it can be affirmed that for a period of approximately four months of duration of the crop with average yields of 7.46 tons per hectare and with the data previously exposed. \$9'150.034 are generated as income. per hectare which discounting the respective production costs results in a profit of \$1.107.070.4 and a Cost-Benefit ratio of 1.13, that is for each peso invested in the project, 0.13 pesos are obtained as a profit, it's a relatively low value compared to previous years since in 2011 and 2016 it was 0.26 and 0.24 respectively; This relationship is even slightly above the opportunity cost measured by the 90 day Fixed-rate certificate

of deposit (CD) of that date (3.08%), which tells us that the investment is profitable to carry out as a project productive compared to a fixed-term deposit option surpassing by 9.92% the profitability offered by an option with very low risk. (Gitman. L. and Madura. J. 2000).

## **5. CONCLUSIONS:**

The world production of rice in the year 2020 is concentrated mainly in countries of Asia and Southeast Asia (90%) where China, India, Bangladesh and Vietnam contribute 74% of the world production explained especially by terms of geographical extension, population mass and internal consumption of this product.

Colombia obtained 2.9 and 3.3 million tons of production in 2020 and 2021, ranking in the group that represents 9% of the total world production; while its national average production reported in 2020 was 4.78 tons per hectare standing at levels of the top fourth in this regard.

Colombia is a net importer of rice because in 2020 these were 279.048 and exports were 1.990 tons. The origin of imports is the United States with 186.990 and Ecuador with a total of 44.064 tons mainly. The country shows a high export potential to Central American and Caribbean countries especially where the conditions of competitiveness of the sector must be improved to allow diversification in products and markets as well as an increase in added value.

The four municipalities studied in the Central Zone base their economy on the primary and tertiary sector, that is the agricultural, commerce and services sectors; as the main product of the primary sector is in its order rice, corn and cotton. It is worth noting that in the cultivation of rice in general, both the planted areas, production and yields per hectare have been reduced in the last fifteen years in most of these areas.

Significant volatility in real historical prices has been observed in the last fifteen years throughout

the period which generates uncertainty in decisions about long-term investment in the crop.

Private free market and informal forms of marketing and financing of crops in the area predominate, leaving producers at the expense of the requirements, prices and provisions of individual marketers. It is observed that there is little financing from Public and Commercial Banks, which has been replaced by alternatives with private agents at high costs.

The production costs and the cost-benefit ratio are \$8.042.965 and 1.13 per hectare respectively, that is to say that for each peso invested in the project 0.13 pesos are obtained as a profit, highlighting the items of land rental, seeds, fertilizers and irrigation; such as those that represent the highest percentage of the total, while the profit per hectare for small and medium producers is approximately \$1.107.070.4 during the four months of the productive cycle.

The main causes that hinder the expansion and development of the crop in the central zone of the Colombian inter-Andean valleys are: low profit margins explained by high production costs, high import volumes, low export levels and capacity, high volatility in real prices in the market, high costs and informality in financing, uncertainty in marketing among other structural circumstances such as land tenure mainly which has caused displacement of planted areas to other areas of the country such as the Eastern Plains.

This research establishes a point of reference for future studies to monitor the situation in the coming years to the aspects mentioned here with an economic analysis methodology applicable to any crop or agricultural or agro-industrial productive project in the country in addition to serving as a reference in public and private policy decision-making in the sector.



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