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Impact of Colombia's trade agreements with the United States and the Andean Community of Nations on the sustainability of the Colombian corn industry between 2012 and 2016

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Dedication and acknowledgments

We thank our families for their unconditional support and those teachers who have patiently shown us a path full of opportunities throughout our academic years.

Summary

Trade agreements between countries, as a concept, represent a window for the development of the general well-being of nations, the transfer of technology and the exploitation of the comparative and competitive advantages of the actors. However, the political and business objectives blur the purpose of these tools, not only from the moment they are signed, but in the followed policy actions adopted to support the different sectors that could be violated. The maize agro-industrial chain represents a very important phase for the country's food security, since this is a fundamental input for thousands of products in different industries, and fundamentally in the production of food source of energy and protein for humans. This work constitutes a first step in understanding the importance of the maize agro-industrial chain and the effects of trade agreements that affect it the most, since they expose their actors to competition with the most efficient producers of this kind of grain throughout the world: United States of America, Argentina and Brazil.

Keywords: trade agreement, tariff preference, imports, tax

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Introduction

Pragmatism, added to others, is part of the characteristics of international negotiators. Pragmatism facing the reality and detailed entrepreneurship to overcome the challenges that changing contexts imposes. This is an investigative paper which the understanding of the challenges faced by the maize agro-industrial chain is approached in a simple way, which, stealthily, is the basis for human sustenance, since it is the main source of food for animals and humans.

Various theories can guide the paradigm of those involved in the study problem, however, this case makes evident the great challenges that those sectors devoid of technological infrastructure and union support have when they face producers from other latitudes where it is used intensive factors and therefore certain competitive advantages are obtained. In this way, the knowledge of some theories of international trade may clarify the vision of the problem for some readers.

Finally, the description of the actors involved in the maize agro-industrial chain and the socialization of figures related to production, consumption and foreign trade, will allow us to understand the practical effects that trade agreements signed with the United States and countries of Mercosur members bring to the sector and consumers, in addition to laying the foundations for detailed studies based on econometric models.

1. Project Formulation

1.1 State of the art

Colombian economic development has been characterized by phenomena that have caused slow development, unexpected and poor vision. The struggle between political parties, the armed conflict and drug trafficking have been some of the main factors in making the country's progress slowdown and leading the state to concentrate its resources on solving social problems, in addition to embracing a paternalistic policy and not defining strategies for the strengthening of the necessary infrastructure that allow the sustainable development of the different economic sectors, including agriculture.

In order to understand the effect of some international agreements on the maize agro-industrial chain, it is valuable to briefly know some general historical background of the agricultural sector in Colombia, to do that Kalmanovitz & Lopez Enciso in their book aspects of Colombian agriculture in the century XX (2005) make a detailed journey through deep characteristics such as the beginnings of land distribution and land uses; highlighting, among others, the importance of small and medium farmers in the consolidation of the coffee sector, which for the first decade of the century exported around 5.4 million dollars, but five decades later achieved external sales of 130 million dollars.

In addition, it tells the incidence of protectionist policies that favored the agricultural sector, but also the implications of trade openness and new assignation of resources by the state to sectors such as construction and oil. All these changes transformed the composition of the GDP, in which, agriculture went from representing 20% to 12% in 2010, meanwhile, sectors such as services represented 47.1% to date, accumulating an increase in his participation, eleven points. (Cardenas S, 2016, pág. 51). It is important to remember that the inadequate distribution of land was influenced by the armed conflict, which

generated around two and a half million displaced people, with this, the land tenancy became unbalanced and, in consequence of it, its use too (Comision de la verdad, 2019). For this reason, it is common that former centers of agricultural production, today are dedicated to livestock or recreation, given this, there is the great challenge of restoring productive calling of the regions.

The agricultural trade policy study, led by Fedesarrollo, ledded by Perfetti, and others, shows us the evolution of agricultural and agroindustrial imports and exports between 1990 and 2015. The joint trade balance continues to be negative, however, the text highlights that The imports that continue to be reported are due to products for which Colombia does not have a competitive advantage such as corn, sorghum and soybeans, although it has been competitive in the export of coffee and its derivatives, it is necessary to exploit a greater number of territories and focus them on an exportable offer less sensitive to international prices and in which the comparative advantages that the country has, can be exploited.

According to a study carried out by the superintendency of industry and commerce, approximately 200 thousand families live from growing corn, mostly doing it in areas of less than 5 hectares, managing to represent approximately 85% of production. (Superintendencia de industria y comercio , 2011). It is also found in studies carried out by FENALCE that the self-sufficiency of the sector has fallen drastically, from 99% in 1991 to only 26% in 2016. (CIAT , 2019). The above is a consequence of a significant increase in the consumption of animal protein (pork and chicken) and that production has not grown at the same speed, generating a significant imbalance that can only be adjusted through imports.

In general terms, the international agreements signed have transformed the structure of the corn value chain, with which they have allowed progress for certain actors such as the industrial one, dedicating to the production of balanced feed for animal consumption, but it has transformed the configuration of planting in some regions. It is clear that the benefits of the signed trade agreements do not benefit all actors the same extent, however, they have been fundamental in increasing corn consumption and allowing progress in terms of food security in the country.

1.2 Statement of the Problem

Since 2004, Colombian foreign policy has focused on the consolidation of different trade agreements, among them, the Free Trade Agreement with the United States, the European Union, and links with the Andean Community of Nations have been strengthened, through of the latter, with which the most representative mechanisms for the protection of rice and corn producers in the region have been established through the establishment of the Andean Price Band System. The foregoing has defined the trajectory of the sectors involved in corn production under two scenarios: one in which elements of protection have been given to the farmer, and another in which he has been exposed to a system of quotas without a tariff and with subsequent allocation of these. However, it is clear that the size of the cake has grown, which is reflected in the grain demand, which between 1991 and 2016, grew by 515%, going from less than 1 million tons to more than 6 million. Simultaneously, production has not grown at the same rate; According to the FAO, between 1960 and 2016, it increased by 76%(CIAT , 2019).

The foregoing makes it clear that all policies favor the actors involved to a different extent, which makes it important to recognize and envision the conditions that the signed trade agreements will generate in the medium term. To achieve this, it is important to answer the question ¿How have Colombia's trade agreements with the United States and the Andean Community of Nations affected the maize agro-industrial chain between 2012 and 2016?

1.3 Objectives

1.3.1 General Objetive

Recognize the impact of Colombia's trade agreements with the United States, Argentina and Brazil in the maize agro-industrial chain between 2012 and 2016.

1.3.2 Specific Objectives

- Describe the agroindustrial chain of corn in Colombia: corn at the local and global level, agricultural phase and transformation phase.
- Analyze agricultural policies that impact the agroindustrial chain of corn in Colombia.
- Recognize the influential aspects for the maize agro-industrial chain in the free trade agreement with the United States, Brazil and Argentina.

1.4 Project justification

This research aims to provide concrete contributions to studies on the impacts and implications of the different free trade agreements that Colombia has signed. Contribute to expanding the state of the art on the issue. Also, it seeks to serve as a base and starting point for future research on the subject.

From the business point of view, it is essential to recognize how the plans that the government has contemplated for a sector as sensitive as the corn industry have been. This research allows farmers and industrialists to direct their business strategies, capitalizing on the experience and looking at the scope of the commitments made by the government. Create tools for making important decisions such as defining the type of corn to plant, the area and the time; the location of a new plant for grain processing or defining whether to buy domestic or imported corn at a certain time is what motivates this research.

This research will allow to approach concepts such as the new theories of international trade, to the development that is evidenced from the trade agreements in question, allowing the understanding of the current reality from the theoretical foundations, which allows to give strengthenes to the position on decisions that are daily taken and give a sense of reality to the analysis made of the implications of trade agreements in the development of the corn value chain, passing from passionate and nationalistic arguments to others supported by history and economic science.

From a personal point of view, this research contributes a vision that integrates the background and current development of an increasingly determining sector in food security, which, in professional practice, as part of the corn value chain, will allow strategic decision making with the best knowledge of the opportunities and threats that are evident in the effects that the trade agreements described have had up to now.

1.5 Frame of Reference

The research will be conducted via the following bases; With these, the aim is to identify the key aspects that make up the essence of the country's trade policy development and provide tools to understand the effects of the trade agreements in question, as well as to review the behavior of the value chain of corn in the context described.

1.5.1 Theoretical Framework

It is essential to guide the solution of questions based on theoretical knowledge as a basis to enrich the perspective on the subject in question. In this case, it will be important to recognize the international trade theories that have guided the economic development of countries since the beginning of the 20th century, since these have been the basis from which governments guide their foreign policy, towards economic development.

The neoclassical theory of the international economy proposes that countries with abundant labor and scarce monetary resources should dedicate themselves to the production of food and primary goods, while those with scarce labor, but better disposition of economic resources, to the manufacture of specialized manufactures and products, thus taking advantage of comparative advantages. The basic premise of this theory is perfect competition, in which technology is equally available to everyone, knowledge development is not required in areas that do not correspond to comparative advantage, trade barriers are not required and the costs associated with international trade, such as transportation, are not relevant when comes to competing. In short, this theory does not contemplate market failures or the role of the state as a regulator. Today's trade does have major flaws, and some of them, have arisen naturally, which imposes challenges that states are

not in the capacity to handle. An example of this is seen in the technology sector, whose oligopolistic structure has been conceived naturally as the pioneering companies in the first instance protected knowledge, exploited it to massify their products, achieving great economic advantage over future competitors. which has implied a limited spectrum of growth for new companies in this sector.

Another important theory is Adam Smith's comparative advantage, which indicates that countries must produce what they have an absolute advantage in and import those in which they have an absolute disadvantage. The absolute advantage is generated by the more efficient production of a certain product compared to another country. (González Blanco , 2011). Giving solution to the gaps that this theory generates against the assumption in which a country does not have an absolute advantage, the theory of David Ricardo, exposes the law of comparative advantage, stating that that country should then produce what it does have comparative advantage. Under this concept, certain countries could exploit their comparative advantages, while others focus on exploiting their absolute advantages, allowing countries integrate into international trade efficiently; however, this concept also does not recognize the imperfection of the markets and ultimately does not contemplate the marginal costs that are incurred by ceasing to produce alternative goods. It is important to recognize that there is currently no evidence of full specialization of a country.

Solving the gaps generated by the mentioned theories, G. Haberler's opportunity cost theory provides a concept with greater validity in the economic field: increasing marginal costs, which show how, when an industry expands under the The premise of full specialization must renounce increasing quantities of other products, for which the opportunity prices illustrated by the concept of the production possibilities frontier show the different alternatives that a country has to produce, fully utilizing its resources with the better technology and identifying the points at which the country should export and import a certain good (González Blanco , 2011)

Heckscher and Ohlin's theory shows that the difference between relative prices and the different proportion of productive factors generates international trade in goods; Based on that, it was argued that countries will export those goods in which they make intensive use of abundant factors, while importing those goods that use intensively the scarce factor. (González Blanco , 2011).

After these theories, new patterns of international trade were developed, with the impulse of the new world order. For example, the conformation of the European Union evidenced flaws in the premises of the aforementioned theories, which have been exposed by the new theories of international trade which consider aspects such as inter-industrial and intra-industrial trade:

Inter-industrial trade is the one which countries exchange goods from different industries, which makes the country a net importer in a specific sector. Intra-industrial is the one which countries exchange goods from the same industry, sometimes complementary, as in the case of the automotive sector, in which some countries export spare parts and import vehicles.

1.5.2 Conceptual Framework

The understanding of the research problem will be developed under the recognition of aspects of the actor's development of different phases of the maize agro-industrial chain, which have evolved from their productive structure amid the accelerated increase in the consumption of their products. Knowing this development is of great interest, among other things, because it reflects how the availability of natural resources and productive factors, added to business and government decisions, have stimulated certain activities and relegated others. Obviously, these decisions have been made supported by the ideological trends that have been adopted over time. The foregoing allows us to observe the effects of foreign policy on decisions applied to the agricultural sector in general, which include decisions that favor different actors in different ways.

It is clear that today, the international division of labor for countries is a reflection of neoclassical theories; Countries with greater availability of labor and natural resources continue to dedicate themselves to the production of primary goods. However, the costs associated to trade development are relevant and the availability of technology and information is not the same for all countries, which makes competition imperfect, understanding this term as the situation which at least one of the parts (companies) have greater market power. Based on that, it is considered that one of the essential characteristics of today's markets, among others, are: its imperfect nature, serving economies of scale and the generation of positive or negative externalities (Steinberg, 2004), For this reason, it is common for countries' trade policies to encourage the relocation of the world's large factories, which, under the premise of generating employment and investment in developing countries, strongly influence the trade policies of those countries where are located, ensuring a safe environment in legal, tax and commercial terms, a concept that is reflected in Colombia today and that will bear in mind in the vision of the research problem.

This complexity makes it necessary to integrate the neoclassical theories of international trade, which important aspects are still evident today, with the most recent concepts, such as Bernarnd and Scott´s, which include in their foundations, the current reality, the countries interact as companies develop sectors in terms of productivity and well-being.

To finish up, it is important to define that the agro-industrial chain of corn is understood as the productive chain where farmers, marketers and grain consuming industries participate.

1.6 Methodological Framework

1.6.1 Research Method

The understanding of the research problem will be developed starting from the description of the maize agro-industrial chain, the analysis of the main agricultural

policies that have impacted it, and the fundamental aspects recognition that have influenced the maize agro-industrial chain, that are included in the corn value chain trade agreements between Colombia and the United States and the Andean Community of Nations between 2012 and 2016.

1.6.2 Research approach

The method under which the research is carried out is, to a greater extent, of a qualitative type, oriented, from the understanding of international trade theories and the historical background of Colombian foreign trade, to the recognition of the agro-industrial chain characteristics of corn in its different phases, recognition of the agricultural policies of greatest influence for the actors in the chain and the understanding of what is related to the sector embodied in the trade agreements signed with the United States, Brazil and Argentina and then conclude what is the effect they consider the mix of factors. For this, the trade agreements regarding the agricultural sector will be described and statistics associated with the corn value chain will be reviewed.

1.6.3 Type of study

This research is an applied type, since it is based on the recognition of theories applied to international trade, which, being related to the description of the history of trade policy applied to the agricultural sector and the exploration of statistics on production, consumption and imports, help us to recognize the incidence of the mentioned agreements in the corn value chain. At the same time, its depth level is medium, since it focuses on the recognition of key concepts for the research problem understanding.

1.7 Research methodology

Giving continuity to what was set in the method, previously identified the topics to be considered, the books and essays consultation on the international trade theories, acts, decrees and final texts of trade agreements, reports, statistics

associated with the agricultural sector and projects of various institutions associated with the corn value chain.

Applying the documental technique for information collect, the instruments were the search in the specialized databases, reports from non-governmental institutions such as FAO, which shows important data on the food security sustainability in the region and the determining crops behavior, where corn can be found.

Important information on historical antecedents was also found in the Banco de la Republica de Colombia essays on economy, which show in detail, the history and development of the agricultural sector, considering the influence of foreign and commercial policy throughout the XX century.

Studies from Fedesarrollo and the EAFIT university were reviewed, which contribute to agricultural trade policy, and delve into costs and effects that liberalization and protectionism decisions have had in various lines of the agricultural sector.

The International Center for Tropical Agriculture (CIAT), in association with the International Center for the Improvement of Wheat and Maize (CIMMYT) and the National Federation of Cereal and Legume Growers (FENALCE), in their report "Maize for Colombia 2030" make a detailed description of the progress of the corn value chain, the effects of the new commercial and production patterns, as well as the proposal of a strategic plan for the corn value chain development, where the conditions that currently influence, are integrated in the demand and supply of grain.

All sources used for the research development have a scientific nature, located in repositories of the aforementioned universities and institutions.

1.8 Project scopes

This research will acknowledge the impact of Colombia's trade agreements with the United States, Brazil and Argentina on the sustainability of the Colombian corn sector between 2012 and 2016, a period where the actual today's trade agreements have been strengthened. Building on the knowledge of the most outstanding foreign policy decisions, the description of the aforementioned agreements with regard to the agricultural sector and, finally, the relationship of corn imports under these agreements, with aspects such as crop growth and the grain consuming industry development.

2. Research Development

The corn agro-industrial chain brings together farmers and processors from the front to the same window of challenges and benefits that the signed trade agreements bring with them. As will be appreciated, although each one has developed in a particular way and has been able to take advantage of the circumstances to a different extent.

In conversation with Mr. Fernando Ramos, President of the National Federation of Cerealists - FENALCE, it is detailed that the agricultural phase actors of the chain are increasingly exposed to more unequal conditions of competition, so it is essential to analyze the sector´s panorama integrating the trade agreements elements signed with United States, Brazil and Argentina (the largest producers of corn) and the elements of agricultural policy with which the government has protected the sustainability of planting, highlighting three fundamentals pillars: Price protection, financing and crop insurance. This is the subject of the widest discussion each year, when the consumption of the "zero tariff" contingent on corn from the United States begins or the door is opened to those originating in the southern cone, which are highly desired by the processing industry for their ideal properties for vitreous content extraction, which is necessary in the food manufacture for human consumption.

Next, there will be a recognition of the maize agro-industrial chain, specific figures will be shown to allow us understand the contribution of this chain in the basic family basket products, recognize how agricultural policy elements of greatest importance to the union work, and contextualize the essence of the agreements applied to the product under study.

Finally, it will be shown that the agreements essential effect: the imports increase can not be categorized as absolutely positive or negative, since the effects are different for the actors in the agro-industrial chain, but in the end they have been positive for final consumers, who benefit from increased availability at stable prices of protein and energy basic sources.

2.1 Description of the maize agro-industrial chain in Colombia: maize at the local and global level, agricultural and transformation phase

Corn has established itself as one of the oldest known foods, and due to its great benefits and variety of uses, it has become a very important crop among cereals worldwide, with what its production has overcome that of wheat and rice; It is a human and animal basic food support and a source of a large number of industrial products. This cereal has also been one of the first to undergo quick technological changes in its form of cultivation, which includes the production of hybrids and transgenics. This success has stimulated an agricultural revolution as production has intensified and integrated with new production models where technological advances such as precision agriculture is involved. This product represents a supremely versatile alternative for animal and human nutrition since it can be used in various ways in any of its vegetative states; this is how its fruit is consumed in the form of baby cob when the flowering stage has just started, the green cob is consumed in culinary preparations, whether roasted, boiled or preserved, and the stems and leaves are used as forage for feeding ruminants (cattle and goats).

The description of the maize agro-industrial chain will be addressed by reviewing data on two specific aspects: production of the primary process (cultivation) and industrial transformation.

Regarding world corn production, it is highlighted that the highest yields per hectare are obtained in countries with subtropical and temperate climates, with mild temperatures and greater luminosity, cultivated in flat places and in large areas that allow efficient mechanization by applying agriculture precision technology, controlled storage systems and high mechanization of sowing and harvesting processes; for the year 2010 the highest yields expressed in tons per hectare (ton / ha) were in the United States with 10.6, followed by Canada with 9.1 and in third place Egypt with 8.5. Since then, corn production increased at accelerated rates due to several factors, among which are the growth of the biofuel

industry and the progressive increase in the consumption of animal proteins such as meat and milk in the Asian continent, which require large quantities of basic raw materials. The figures show how corn has become the most important cereal in the world economy and how its production has been growing in recent years at an annual rate of 2.5% reaching 864,376,440 tons in the 2010-2011 season of which 92% belongs to yellow corn and 8% to white corn. (Agrosavia, SF)
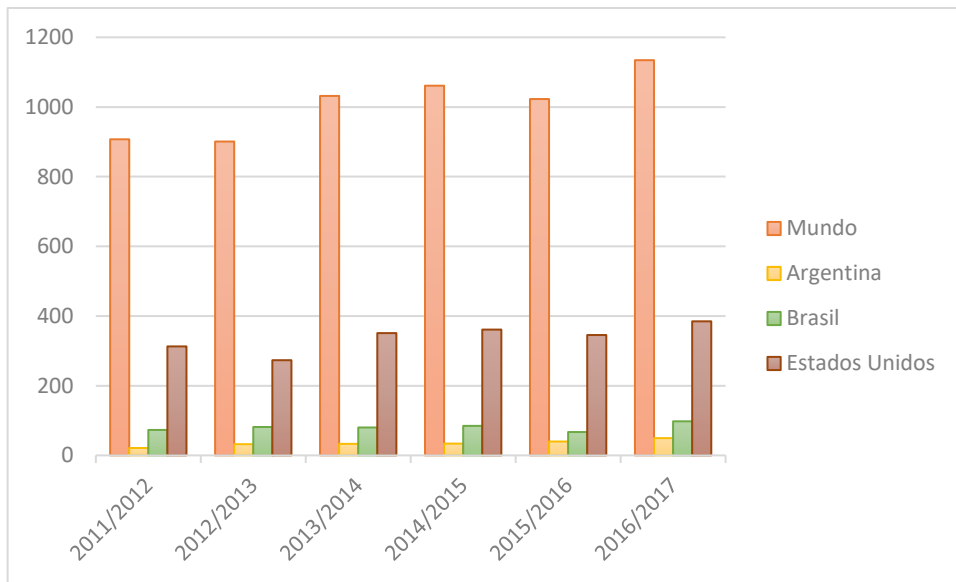
Source. International Grain Council, 2020

A fundamental aspect of grain supply in both quality and quantity has been the growing demand for grain for the production of ethanol, a biofuel that is produced to a greater extent, from sugar cane and corn (20% and 15% respectively) and that is expected to grow by 14% between 2016 and 2026. The general production of biofuels has been driven by public policies that have encouraged its production and use, mainly in the United States, the European Union and Brazil, this being the second major producer worldwide which is expected to contribute 60% of the

Figure 1. World Corn production, Argentina, Brazil and the United States, 2011 to 2016 period

projected growth. To this have been two the fundamental motivators: greater energy security and reduction of greenhouse gases. (OCDE/FAO, 2017)
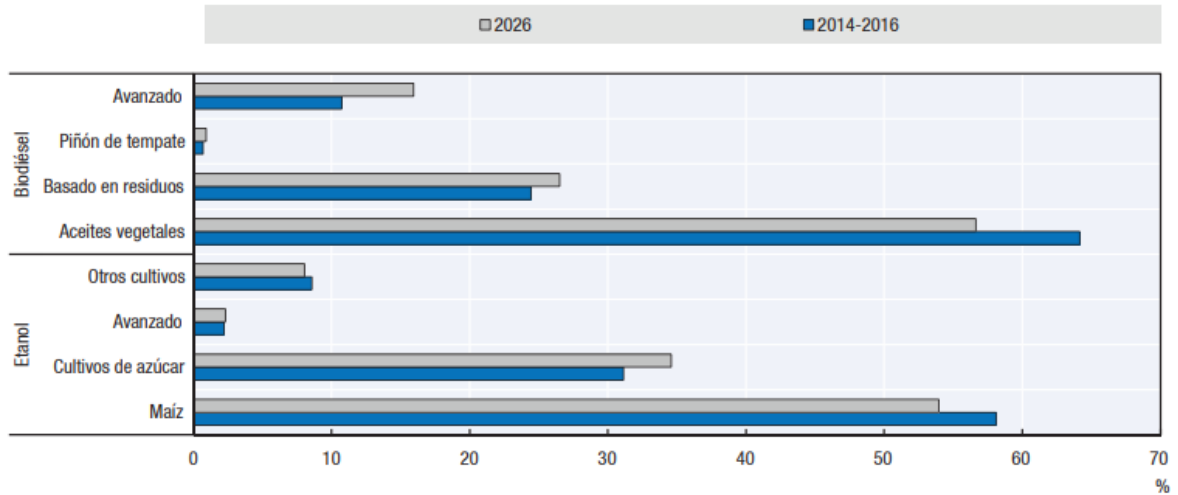

Figure 2. Global demand for raw materials for biofuel production in 2016-2026
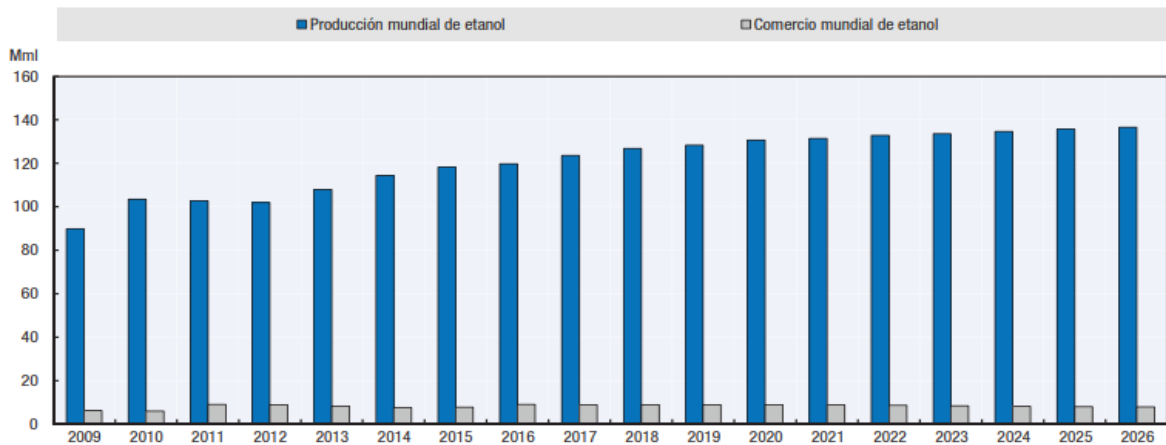
Source. OCDE/FAO, 2017

Figure 3. World production and trade of ethanol 2009-2026

Source. OCDE/FAO, 2017

The policies of the United States government on the addition of more ethanol as a total part of the fuel supply allow us to project that by 2020 the production of this country will reach 61.6 billion liters (OCDE/FAO, 2017)). This has been reflected in the permanent growth of corn production in this country: 312.8 million tons in 2012 and 384.8 million tons in 2016. (International Grain Council, 2020).

The production of this cereal in Colombia has also grown in recent years, however, not at the rates that global supply and local demand do. Two forms of cultivation are identified: the technified and the traditional.

The technified corn production system is characterized by more than 5 monocultores hectares, in some cases with the availability of water for irrigation and the use of technologies that are based on mechanization for soil preparation, use of improved seeds, fertilizers and pesticides. This system represents for Colombia 48% of the area that is destined for the production of corn with an average yield of 5.4 tons. (CIAT, 2019).

The traditional corn production system is characterized by areas smaller than 5 hectares. This cultivation is based on the use of native varieties and the non-use of hybrids due to the economic difficulties to access, in this way the hoe and tillage hoe are used for planting. Although this represents 52% of production, it is produced less than in the technified system, reaching only 2 tons. (CIAT, 2019)

Corn cultivation in Colombia represents 13% of the agricultural area, of these 60% are small producers with up to 10 hectares, 30% are medium-sized producers with up to 30 hectares and 10% are considered large producers; what allows to understand that it is a cultivation of small producers in its majority. The cultivation of corn generates 126,000 direct jobs and it can be estimated that 390,000 families plant corn. (AgroinsumosSA, 2018)

In Colombia, two types of corn are planted: white and yellow, where white is used for human consumption and yellow in greater proportion for animal and industrial consumption, yellow corn production grows by an average of 12.74% and white

corn At a rate of 4.63%, for the year 2010 the general production of corn was 786,045 tons in yellow corn and 482,719 tons in white corn. (Agrosavia, SF)

In figure 2 it can be seen that in the study period the production did not reach two million tons, on the contrary, contraction periods are observed. This situation means that the agro-industrial chain does not develop in a balanced way, therefore, actors in the transformation phase are forced to import.
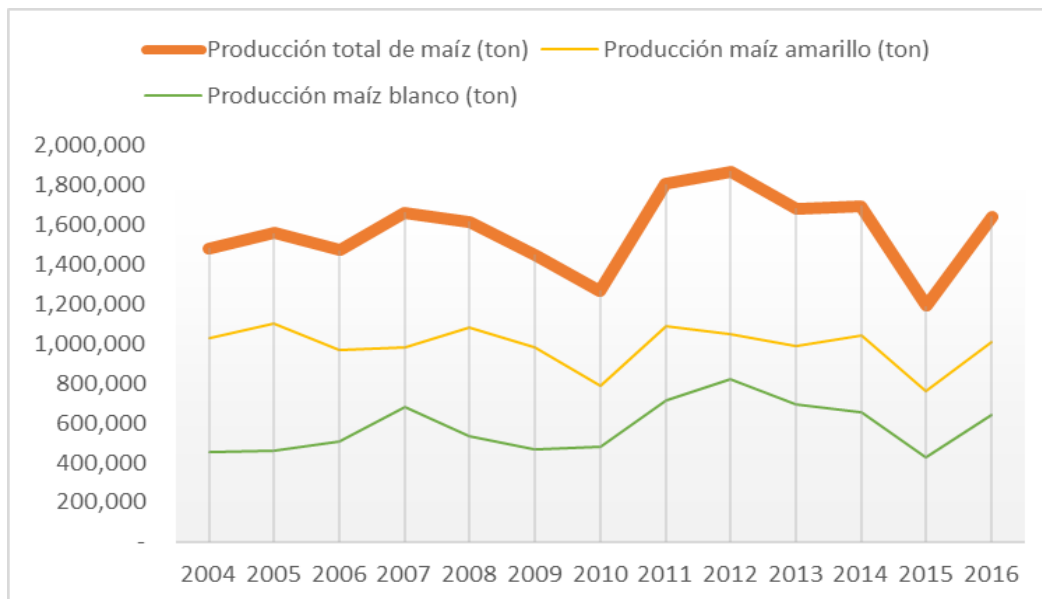
Figure 4. Corn production trend, 2004 to 2016 period.

Source. Own elaboration from FENALCE 2020 data.

Figure 3 shows the composition of corn production during the study period. As will be seen in the next chapter, corn farmers continue to plant the type of corn that is most imported, thus, opportunities represented by consumption incrise of food derived from white corn for human consumption are not exploided.
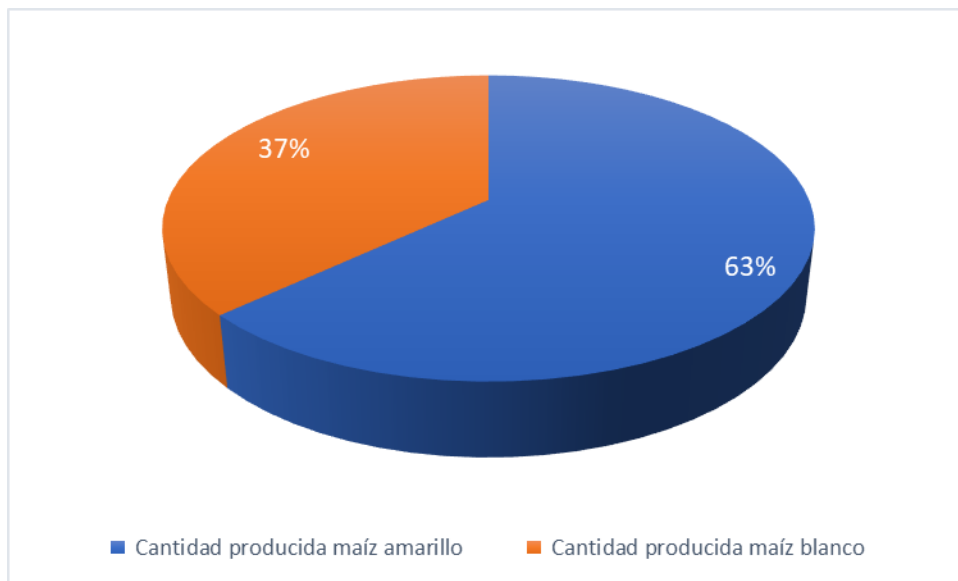
Source. Own elaboration from FENALCE 2020 deata.

Corn production compared to consumption in the 1990s was stable, but currently the rate of consumption is much higher, largely due to the increased demand for poultry products and pork consumption in the Colombian diets, which has generated more pressure for farmers, who do not have the infrastructure to supply this demand. (CIAT, 2019). This decrease in the self-sufficiency of corn production in Colombia causes an increase in imports, which have traditionally been made from Argentina, Brazil and the United States, the last one being the most important

Figure 5. Composition of corn production, 2004 to 2016 period.

supplier of grain from 2012 with the entry into force of the free trade agreement (CIAT, 2019).

The effects on the formation of prices after the signing of this agreement have allowed the industry to obtain the product at prices considerably lower than those offered in the national market, which has been the main problem for the sustainability of farmers. This increase has been sustained as evidenced by

statistics from 2016, when Colombia positioned itself as the largest corn importer in South America. The greatest pressure since then has been received by small producers, who cannot sell a kilogram of their harvest for less than $ 700, while the kilogram of corn imported in port can be purchased for less than $ 690. (EL TIEMPO, 2018)

The constant long-term search for strategies that allow progress on issues such as productivity, cost reduction and future competitiveness for local producers has forced the joining of efforts and programs implementation led by FENALCE, the International Center for Maize and wheat Improvement -CIMMYT, and AGROSAVIA, which have proposed programs such as "Maíz Para Colombia (MPCO)" which seeks to increase the national maize productivity by 2030 through new technologies, best sustainable practices and the improvement of seeds looking for, in addition to integration of small and large producers, to reduce the effects of imports and satisfy the national market.

The following take part in the maize agro-industrial chain: preparation industry of prepared animal feed industry (ISIC Rev 3, 1543) and the processing industry of grain mill products (ISIC Rev 3, 1541) and starches and products derived from starch (ISIC Rev, 1542). The processing done by these industries is carried out through two technologically different processes: dry milling and wet milling, the first one is where the parts that make up the corn kernels (endosperm and germ) are separated, and according to the grain characteristics they can obtain different products among them, products for the elaboration of doughs, raw flours and semolina, which are fundamental for the production of beers and snacks. The second form of transformation, called wet milling, is carried out by subjecting it to soaking and maceration with sulfurized water, thereby facilitating the separation of four basic components of the grain: starch, corn oil and gluten; Some products derived from this process are cornstarch, which is starch in its purest form, corn syrup made up of fructose and glucose, corn oil that comes out of a process of refining the germ and of great value for cooking or as dressing for salads, gluten

for its digestibility and as a high value protein and fiber source is used in the concentrates formulation for animal consumption.

The National Statistics Department-DANE, in its report on the satellite accounts of the corn, soy and sorghum agro-industry, shows that in 2005, the production of corn in its agricultural stage (harvest) represented $ 803,000 million, growing already at important levels in 2012, contributing $ 1,387,544. (Departamento Nacional de Estadística, 2012)

Tipos de cultivo	2005	2006	2007	2008	2009	2010	2011	2012[P]
Total	959.054	968.439	1.179.128	1.246.726	1.152.103	1.108.963	1.495.510	1.532.823
Maíz	803.008	833.511	1.059.635	1.139.803	1.056.185	1.021.077	1.378.053	1.387.544
Sorgo	98.528	81.420	68.207	41.403	36.658	27.536	29.407	41.189
Soya	57.518	53.508	51.286	65.520	59.260	60.350	88.050	104.090

Millones de pesos

Fuente: Ministerio de Agricultura y Desarrollo Rural - Cadenas Productivas.

Cálculos: DANE.

[P]: Provisional.

Figure 6. Cereal chain production to 2012

Source. MADR, 2012

Corn consuming industries

Corn consumption occurs mainly by two types of industries: the balanced feed industry for animal consumption and the food industry for human consumption.

The balanced feed industry for animal consumption is the agro-industrial link that is responsible for turning raw materials of agricultural origin, (mainly cereals such as corn, soy and sorghum), into food for the production of chicken and pork meat, milk, eggs, cheeses and other dairy products (animal origin proteins). Locally, this industry has experienced significant growth due the increase per capita consumption of chicken and pork meat, productive lines that have been

successfully managed commercially and politically, led by the National Federation of Poultry Farmers-FENAVI and the National Pig Industry- PORKCOLOMBIA fund. In the specific case of poultry sector, the consumption of chicken and eggs has increased the demand for yellow corn to the point where 85% of the corn used by the balanced food industry has been destined for this purpose; In the following table you can see what is the consumption of balanced food to obtain 1 kg of standing chicken meat and the percentage it represents in corn. (DANE, 2013)

Conceptos	2005	2006	2007	2008	2009
Pollo en pie (Kilogramos)	866.712.054	965.508.802	1.047.892.937	1.148.230.189	1.158.688.216
Cantidad de Alimento Balanceado para Animales (ABA) para obtener 1 kg de carne de pollo en pie (Coeficiente de conversión)	1,70	1,70	1,70	1,70	1,70
Alimento Balanceado para Animales (ABA) – Toneladas	1.473.410	1.641.365	1.781.418	1.951.991	1.969.770
% de maíz	60%	60%	60%	60%	60%
Maíz amarillo (Toneladas)	884.046	984.819	1.068.851	1.171.195	1.181.862

. Source: Agrosavia, 2013

This trend continues to grow, supported by the figures for egg consumption for 2016 of 7.7%, placing Colombia as the third country with highest consumption of this protein source after Mexico and Brazil. The continuous increase in egg consumption managed to locate it in 2017 as the third most consumed protein by Colombians after chicken and beef. (La República, 2018).

It is evident that these events have significantly increased the need for corn as a

Figure 7. Production and consumption of balanced feed, poultry industry, period 2005

raw material for the production of concentrates, pressing the growth of grain imports in a forced way; Statistics on the total production of balanced feed for animal consumption show that for several years this sector has gone from 1.8% between 2008 and 2009 to 6.9% between 2013 and 2014 (ANLA, SF). According to data from the National Association of Industrialists-ANDI, the production of balanced food for animal consumption in 2016 was concentrated in six sectors: birds with 64.3%, pigs with 15.5%, cattle with 11% and food for dogs, cats, fish, horses, rabbits and special preparations that represent 9.2% (LEGISCOMEX, 2016)

Although not to the same extent, the production of human consumption food based on corn has also expanded. One of the most representative cases is found in corn flour, used for preparation of typical dishes such as arepas and empanadas. The demand for this type of products in Colombia experiences a significant growth derived from the increase in Venezuelan immigrants since this population consumes up to 40 times more arepas than Colombians (SICEX, 2019)

Today Colombia has a large number of grain and cereal milling companies and most of them are located in consumption centers such as Bogotá, Medellín, Barranquilla and Cali.

According to statistic sales associated with corn products, it can be classified into two types of products: Products based on grinding or primary treatment and value-added products.

In 2011 we found that base products such as starch and precooked corn flour were the ones that were most commercialized with productions of 99,198,948 kg and 82,024,529 kg respectively, and sales for starch of 93,357,109 kg and precooked corn flour 80,402,530 kg which in sales means $ 142,630,915 million pesos for starch and $ 147,698,811 million pesos for precooked corn flour. (Agrosavia, 2013)

For value-added products those that manage to lead the sale are the precooked corn arepas with $ 25,513,641 and a value of $ 54,690,947, the corn flour arepas with a sale of 13,696,758Kg and a value of $ 112,382 .365,00 thousand pesos.

(Agrosavia, 2013). More than 70% of Colombians eat arepa at breakfast, cities like Medellín, Pereira, Cali, Bogotá and Manizales are places where people spend more money to buy arepas. Since 2013, the annual direct consumption per capita of this cereal nationwide has remained at 30 kilos. (EL TIEMPO, 2018)

Followed by the precooked corn arepas and the corn flour arepas are the corn flakes that represented sales of 9,499 kilos at $ 105,499,939.00 thousand pesos, corn bread with a sale of 10,464,848Kg equivalent to $ 56,672 .219.00 thousand pesos. Other products of importance in consumption are corn oils, packaged corn, and corn grits. (Agrosavia, 2013).

Regarding sales generated abroad, the products with the highest marketing values are precooked corn flour with $ 22,194,040, corn flakes with a value of $ 9,128,149 and precooked corn arepas with $ 2,076,365 (Agrosavia, 2013)

Among the main flour exporting companies in Colombia are Alimentos la Polar COL S.A.S, Harinera del Valle S.A, Precocidos del Oriente S.A y Rafael del Castillo y CIA S.A. (SICEX, 2019) and the main destination countries for flour exports are Peru, Chile, Ecuador, Costa Rica and Trinidad and Tobago. (SICEX, 2019)

It is evident that the production industries of animal feed are the ones that exert the greatest force on consumption and therefore on the guidelines for the chain in general. Analyzing information on imports from the DATER statistical system, 89 companies regularly import corn into the national territory, of which 50 belong to this kind of industry, entering at least 79% of the foreign product. (DATER, 2020).
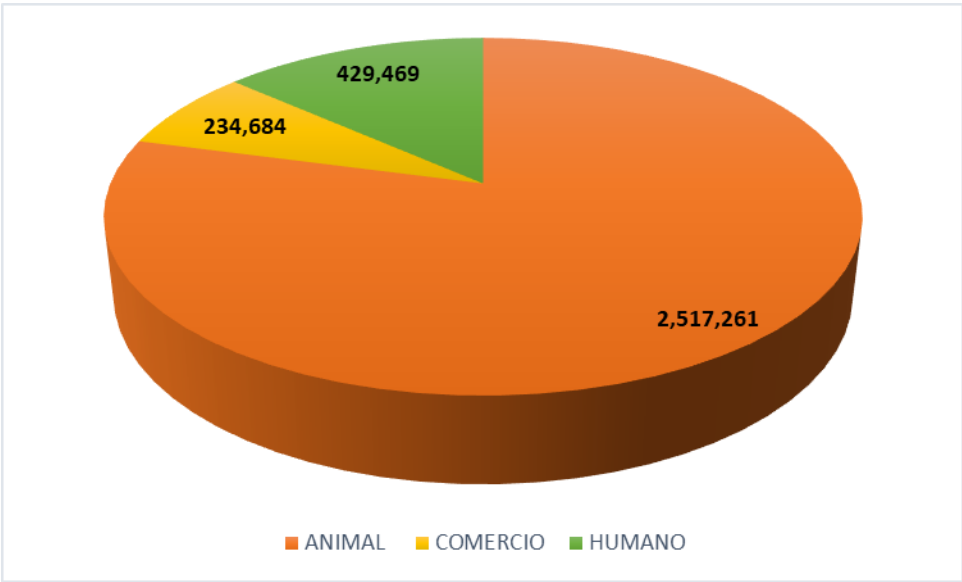
Figure 8. Corn imports by destination (million tons) 2012

Source. Own Elaboration from DATER 2020 data.

2.2 Impact of Colombian agricultural policy on the corn production chain.

In order to recognize the effects on the corn sector, it is important to know the fundamental aspects that influence it as part of the agricultural sector, in this way, the main policy instruments applied to the sector in general, will be detailed, highlighting the particular aspects that have corresponded to the corn production chain.

Through agricultural policy, the government fosters access to resources, improves productivity, and guarantees food security and social well-being for the rural population. In recent years, as the study carried out by the OECD on these policies in 2015 lists, the Colombian government has focused on the following actions:

Price interventions:

Contingent Administration Mechanism (until 2011) and mainly the application of the Andean Price Band System and the tariff reduction program under the FTA with the United States.

Interest rate subsidy:

Through Finagro, resources are allocated to banks such as Banco Agrario and private banks in general, with the aim of improving interest rates, allowing the refinancing of debts and establishing mechanisms that facilitate access to resources for work capital, investment in machinery, equipment and infrastructure.

Insurance:

These should be seen as anything that provides guarantees to producers in the face of potential economic losses, whether due to force majeure, or price caps. On coverage policies against the risk of crop losses by climate or biological factors, the government has subsidized up to 80% of the premiums of these insurances, this being one of the aspects that the producers have most claimed.

This is the case of Mr. Fernando Ramos, a farmer from the Córdoba region, whom had the opportunity to know the benefits of having had his harvest secured, having suffered the ravages of tropical storms, whose effects were felt in the Atlantic region in 2019. Another kind of coverage offered by the government is through the adoption of the Andean Price Strip System, with which producers mitigate the effects of corn entry from the continent's Southern Cone with low tariffs.

Production-based Payments:

For coffee, rice, cocoa and dairy chains.

Variable inputs payments:

Subsidy to the purchase of seeds and inputs, plantations renovation, irrigation systems, productive alliance programs

Tax Concessions:

Agricultural products for human consumption are exempt from VAT, as are the purchase of land for planting and investments such as the establishment of irrigation systems.

General services at service of the agricultural sector:

The government makes available integrated programmes between different ministries such as Agriculture and Rural Development -MADR, Environment and Sustainable Development, the Ministry of Mines and Energy and transport. The above should put at the service of the sector the generation of knowledge, inspection and control, construction of infrastructure, support for commercial promotion sided by PROCOLOMBIA, which has support offices in 21 countries and offices in different country regions, thus the government includes the sector as a key piece for the diversification and strengthening of the basket of non-mining exportable products.

Inspection services:

At the head of the MADR is the Colombian Agricultural Institute, which is responsible for controlling and inspecting agricultural production in phytosanitary terms; while the Ministry of Health, through the National Institute of Drug and Food Surveillance (INVIMA) is responsible for ensuring the safety of agri-food products. Through their regulations, hese entities, regulate the entry of foreign products.

Land restitution programs:

They have focused more on land restitution for the armed conflict victims, regularizing land tenure, establishing peasant reserve areas, productive projects for the use of territorial resources and developing productive projects.

Of the previous policy programmes, the most relevant for producers of the maize chain are price intervention, the implementation of agricultural insurance and financing tools.

Price intervention

In the 1990s, IDEMA held a maize imports and domestic supply monopoly, regulating prices, however, after the demise of this entity and in the face of economic opening, the government allowed private intervention in the aforementioned processes, as well as setting trade policies that favored related industries such as poultry (Federación Nacional de Cerealistas, 2012). At that time, the Investment Measures related to Trade in Goods-MIC were in force, which included the government's absorption of domestic production and impots high tariffs on imports.

Starting in 2004, fulfilling the commitments acquired with the World Trade Organization, the government is involved in the marketing and pricing of maize through the Public Contingent-MAC Mechanism with which it could be imported with low tariffs, to the extent that importers absorbed a greater proportion of the

domestic crop. (Universidad Javeriana, 2005). This gave rise to the Basic Index of the Agricultural Auction, whose beneficiaries according to the type of maize they wished to import, had to guarantee different conditions; yellow maize, had to guarantee the purchase of yellow maize, sorghum and cassava, while those of the white, only had to buy the same, but from local origin. (National Federation of Cerealists, 2012). Absorption quotas were administered by the National Agricultural Exchange (BNA, now the Colombian Mercantile Stock Exchange). In addition, the direct transfer of funds subsidy mechanism, called the Tariff Preference Effect (EPA), was constituted, with which the importer was required to transmit a portion of the revenue from the tariff discount with the national grower.

Maíz Amarillo. Subastas de Contingentes Agropecuarios- MAC (toneladas)				
Año	Contingente subastado	Contingente asignado	Producción disponible	Producción demandada
2.004	1.902.508	1.737.954	447.600	408.882
2.005	1.921.846	1.714.842	505.800	445.162
2.006	1.802.704	1.802.704	396.127	396.127
2.007	1.717.000	1.717.000	310.000	310.000
2.008	3.086.925	2.612.131	438.500	386.610
2.009	2.408.750	1.959.275	416.500	347.350
2.010	1.956.126	1.719.448	294.950	263.393
2.011	1.536.000	1.044.040	234.000	163.720

Figure 9. Agricultural contingent auctions, MAC, 2004 – 2011 period.

Source. FENALCE, 2012

By safeguarding the balance in agricultural prices, the government implements price regulation based on the application of the Andean Price Strip System and the FTA with the United States. The first being the one that has traditionally worried

farmers the most, such as corn farmers, since the product quality arriving from Brazil and Argentina represents a very good alternative for the replacement of the domestic product in industrial processes. In this way, it is worth delving into the knowledge of its operation.

The Andean Price Strip System is a mechanism established on November 26th/ 1994 to regulate the import cost of a special group of agricultural products, characterized with marked volatility in international prices and classified into marker and linked products. Markers are those products whose international prices are used for the calculation of price bands and among these are: white rice, beer barley USA No.2, yellow maize No. 2. Linked products are those derived, obtained by processing or mixing marker products or substitutes of these; these products are bear in mind in order to avoid deviations in trade.

FRANJA	PRODUCTO MARCADOR	MERCADO DE REFERENCIA	FUENTE
Arroz	Arroz blanco	Arroz blanco con 10% de granos partidos, FOB Bangkok, cotizaciones semanales correspondientes a "trader".	Reuter
Cebada	Cebada cervecera USA N°2	FOB Portland, con base en cotizaciones diarias reportadas por USDA.	Reuter
Maíz amarillo	Maíz amarillo Nº 2	FOB Golfo, con base en Bolsa de Chicago. Cotizaciones diarias de cierre, primera posición. Fuente Reuter. Estas cotizaciones serán ajustadas por un factor de 1,21, el cual será actualizado anual¬mente con base en observaciones de los últimos 5 años. La Ju	Reuter
Maíz Blanco	Maíz amarillo Nº 2	FOB Golfo, con base en Bolsa de Chicago. Cotizaciones diarias de cierre, primera posición. Fuente Reuter. Estas cotizaciones serán ajustadas por un factor de 1,21, el cual será actualizado anual¬mente con base en observaciones de los últimos 5 años. La Junta evaluará la pertinencia de modificar dicho factor de conversión con base en las fuentes de información que suministren los Países Miembros.	Reuter
Soya	Soya amarilla USA Nº 2	FOB Golfo, con base en cotizaciones diarias de cierre, primera posición, en la Bolsa de Chicago.	Reuter
Trigo	Trigo Hard Red Winter Nº 2	FOB Golfo, con base en cotizaciones diarias de cierre, primera posición, en la Bolsa de Kansas.	Reuter
Aceite crudo de soya	Aceite crudo de soya	FOB Argentina, con base en cotizaciones semanales.	Oil World
Aceite crudo de palma	Aceite crudo de palma	CIF Rotterdam, North West Europe, con base en cotizaciones semanales.	Oil World
Azúcar blanco	Azucar blanco refinado	Contrato Nº 5 de la Bolsa de Londres, cotizaciones diarias spot, FOB Londres.	Reuter
Azúcar crudo	Azúcar crudo	Contrato Nº 11 de la Bolsa de Nueva York, cotizaciones diarias de cierre, primera posición.	Reuter
Leche	Leche entera en polvo sin azucarar	Leche entera en polvo sin azucarar, precios promedio mensuales FOB Nueva Zelandia.	Statistics, New Zealand, cifras oficiales de exportaciones mensuales en volumen y valor. Los precios de referencia quincenales serán equivalentes al último promedio mensual disponible
Trozos de pollo	Carne de pollo	Mercado para precios históricos: Precios diarios Trucklot para pollos Grado A, 2 a 3,5 libras. Noreste de los Estados Unidos de América. Cotizaciones reportadas por Urner Barry Publications Inc., más fletes internos de 87 dólares por tonelada, actualizables anualmente. Mercado para precios de referencia: Precios diarios Trucklot para cuartos traseros (leg quarters) en el Noreste de los Estados Unidos de América. Cotizaciones reportadas por Urner Barry Publications Inc., más fletes internos de 87 dólares por tonelada, actualizables anualmente.	Cotizaciones reportadas por Urner Barry Publications Inc., más fletes internos de 87 dólares por tonelada, actualizables anualmente
Carne de cerdo	Carne de cerdo	Boston Butts, 4-8#, Central US FOB Omaha	USDA, más fletes internos de 110 dólares por tonelada, actualizables anualmente

Figure 10. SAFP marker products.

Source. Own elaboration from CAN, 2020 data.

The system consists of increasing the *ad-valorem* tariff when the international price is below the floor price set in the price ranges, and lowering the value of the tariff even to zero, when the price is above the ceiling. (Andean Community of Nations, 2020).

The floor and ceiling prices of each strip are established by the CAN´s General Secretariat before December 15th of each year, having annual validity and starting to govern on April 1st each year and are updated by adding to the historical series the last 12 months and excluding the first 12 months of the total series (60 months). Reference prices are bi-weekly, as they are calculated and published by the General Secretariat.

The following procedure is performed for the establishment of the price range:

Average price calculation.

The average CIF historical price is calculated taking into account 60 months until the month of October of each year, based on the following indicators:

1. The observed prices are the prices on the international stock market or the product FOB records; these prices should be converted into current dollars taking into account the index of U.S. urban consumer prices based on the last October;
2. Subsequently CIF prices are calculated considering freight of the marker product and adding 0.5% isurances.
3. The arithmetic average of the CIF price series is calculated in constant dollars.

Subsequently, the adjustment factor of the standard deviation is considered, which is set at 0.5% for the white maize price bands, soybeans, raw soybean oil, raw palm oil, rice, barley, wheat, chicken and pork chunks,the (minus) - 0.25% for the price range of yellow maize and (plus) +0.00% for white sugar, raw and whole milk.(Andean Community of Nations, 2020)

In addition, for price ranges elaboration, floor prices are fixed subtracting the adjustment factor of the typical deviation to historical CIF prices average.

The above data are the basis on which the government calculates and allocates tariff rebates or sets tariffs on products that are part of price ranges. It should be considered that marker products, reference markets and sources of information are established for calculations in the range of each reference product, which in maize case are the following:

In order to establish additional duties (tariffs) or tariff reductions, the calculations detailed in the following table are made, as the CAN General Secretariat provide it.

CONCEPTO	FORMULA
Nivel de precio de referencia (PR)	Promedio quincenal de cotizaciones en el mercado internacional
Sí el Precio de Referencia (PR) es superior al Precio Techo (PT), se calcula Rebaja Arancelaria (Reb)	(Precio de Referencia - Precio Techo) x (1+Arancel Externo Común)/Precio de Referencia
Dentro de la franja	No se realiza rebaja ni arancel adicional
Precio inferior al Precio Piso (PP), se calcula derecho adicional (Dva)	Precio Piso - Precio de referencia) x (1+Arancel Externo Común)/Precio de Referencia
*Arancel Externo Común (AEC): Es el establecido en la Comunidad Andina de Naciones (CAN)	

Figure 11. Rules for tariff calculation and tariff reductions under the SAFP.

Source: Own elaboretion from CAN, 2020 data.

| RELACIÓN ENTRE EL ARANCEL EXTERNO COMÚN DEL PRODUCTO MARCADOR Y EL ARANCEL EXTERNO COMÚN DEL PRODUCTO VINCULADO	FORMULA PARA EL DERECHO ADICIONAL DEL PRODUCTO VINCULADO (Dva)
Arancel Externo Común (del Prod. Vinculado) **igual que** Arancel Externo Común (del Prod. Marcador)	Derecho adicional (del Prod. Vinculado) **igual que** Derecho adicional (del Prod. Marcador)
Arancel Externo Común (del Prod. Vinculado) **mayor que** Arancel Externo Común (del Prod. Marcador)	Derecho adicional (del Prod. Vinculado) se calcula: **Máximo** entre Derecho adicional (del Prod. Marcador) x (Arancel Externo Común (del Prod. Marcador) / Aracenl externo común (del Prod. Vinculado) **y** Derecho adicional (del Prod. Marcador) - Arancel Externo Común (del Prod vinculado)-Arancel Externo Común (del Prod. marcador)
Arancel Externo Común (del Prod. Vinculado) **menor que** Arancel Externo Común (del Prod. Marcador)	Derecho adicional (Prod. Vinculado) se calcula: **Mínimo** entre Derecho adicional (del Prod. Marcador) x (Arancel Externo Común (del Prod. Marcador) / Aracenl externo común (Prod. Vinculado) y Derecho adicional (del Prod. Marcador) - Arancel Externo Común

Source: Own elaboretion from CAN, 2020 data.

On the OECD review of agricultural policies in Colombia (2015), a number of indicators were calculated on the support the government has provided to agricultural producers. There, the Nominal Protection Coefficient (NPC) was established, which measures the relationship between the average price received

Figure 12. Rules for calculating rights to related products SAFP.

by producers on farms and the border price for a specific product. This study found that maize is part of the group of products that, since 1991 until 2015, had received higher protection rates within the agricultural sector, thus reflecting the effects of protection measures such as the adoption of the Andean Price Strip System on domestic prices.

For maize, in this period the Actual Nominal Protection Rate average was 58%. It is important to realize the study compared this indicator between countries, such as Brazil, Mexico, Chile and Colombia, confirming the last one as the one with best granted protection.
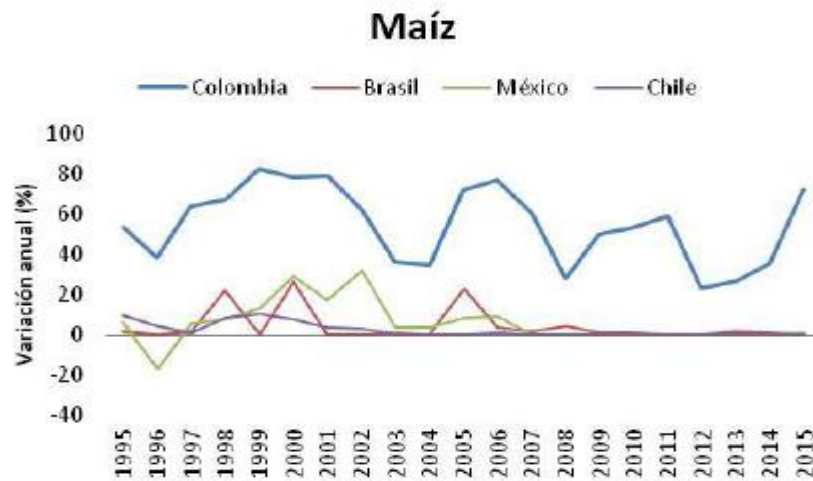
Source. OCDE, 2015

According to the OECD, the producer is most supported by the market price support component, with an average of 90% in the period 1992 to 2013. It is clear that the most efficient policy elements are those that support risk management, in this case farmers have given great importance to price protection systems, support for financing and the insurance of their crops.

Figure 13. Percentage of government support to the prices of the national producer.

Período		Antes de 1990	1990-1994	1994-2003	2004-2010
Mecanismo de protección	Nombre	Protección en frontera	Franja de precios en Colombia y SAFP	Vistos Buenos y Descuento Arancelario Específico Equivalente (DAEE)	Mecanismo de Absorción MAC
	Descripción	El IDEMA otorga licencias de importación	Mecanismo estabilizador de precios que define un Precio piso y un Precio techo. Cuando el precio CIF está entre la franja paga el AEC. Si es superior al P. techo, reduce arancel, y si es menor al P. piso, aumenta el arancel	[(p. Acordado cosecha-p. importación).Absorción/Toneladas importadas=descuento por tonelada.	PP.=precio Cif + arancel + transferencia al precio del agricultor por descuento arancelario
Forma de cobro		Arancel y licencia	Arancel	Arancel	Arancel
Objetivo del mecanismo Garantizar Seguridad Alimentaria		Evitar el ingreso de mercancías foráneas Subsidiadas		Garantizar la Absorción de la Cosecha Nacional.	Subsidiadas Cumplir los Requerimientos de la OMC y la Ronda de Uruguay. Garantizar la Absorción de la Cosecha Nacional y Lograr Mejores Precios a los Agricultores.
			Lograr mejores precios para los consumidores Nacionales		
Conceptos importantes		Permisos de importación del IDEMA	Precio piso precio techo, NANDINA, factor de ajuste.	Descuento arancelario Específico Equivalente DAEE / Convenios de Absorción de Cosecha	Cosecha Índice Básico de Subasta Agropecuaria (IBSA), Precio de Paridad, Efecto Preferencia (EPA).
Legislación de referencia		Decreto 371 de 1991 de la CAN	Decreto 672 de 1991 / Decreto 2524 de 1994	CONPES 2723 de 1994.	Decreto 430 de 2004.

Figure 14. Protective measures applied to corn production.

source. OCDE, 2015

Policy for agricultural risks and financing

Through the Financing and Agricultural Risks Department (DFRA), attached to the Vice-Ministry of Agricultural Affairs, are disigned and executed the policies that promote the financing of the sector and carry out the chaining with the entities through which resources such as the Financing of the Agricultural Sector fund, FINAGRO and banco Agrario de Colombia are channeled. For 2016, $271,991 million was earmarked for the implementation of the following instruments:

Agricultural Guarantee Fund (FAG):

Since 1985 it has offered guarantees to producers, supporting credits for working capital and investment, covering up to 80% of credit value, and up to 100% in the case of displaced population (Ministry of Agriculture and Rural Development, 2016). In 2016, this fund allocated guarantees worth 1.6 billion for the protection of loans worth 2.1 billion.

Credit instruments:

Starting in 2016, different lines of credit have been established under "Colombia Siembra" strategy, which the national government set out the goal of planting an additional one million hectares in the country between 2015 and 2018. To assist in the fulfilment of this objective, two supported funding segments were approved in the Special Credit Line (LEC) which offers a subsidized interest rate for the financing of short-cycle products that are related to the basic food basket (such as maize); for this program, in 2016 the government contributed $60,866 million in interest rate subsidy for loans worth $485,171 million.

In addition, incentive for rural capitalization (ICR), as a financing instrument, was implemented as a direct support through which farmers can access the purchase of seeds and inputs, plantation renovation, irrigation systems, develop productive partnership programmes and modernize productive infrastructure.

Through an applied credit capital incentive; in 2016, Finagro managed ICR worth $189,325 million for projects worth $757,382 million (Ministry of Agriculture and Rural Development, 2016).
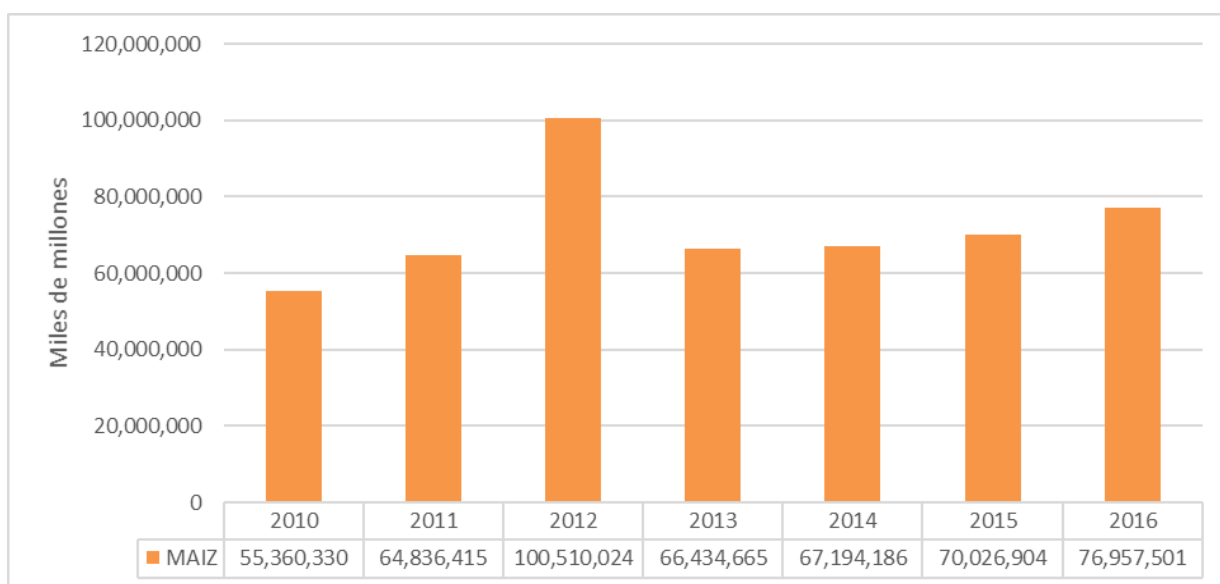
Figure 15.. Placement of credits by Finagr to the corn production chain, period 2010-2016, expressed in billions

Source. Own elaboration from Finagro 2016 data.

Insurance

The producer can protect through this mechanisms his investments against natural risks such as excess or deficit of rains, strong winds, floods, frost, hailstorms, landslides and avalanches, biological risks among others (Ministry of Agriculture and Rural Development, 2020).

On coverage policies for risk of crop losses by climate or biological factors, the government has subsidized up to 80% of the premiums of these insurances for those farmers who simultaneously are beneficiaries of fine-gro credit lines. The coverage of these insurances increased considerably, as reported by the MADR in its management report for 2016, from 42,800 hectares in 2010, to 177,906 in 2016; however, it is important to realize that this figure corresponds to only 3.4% of the total area cultivated in the country.
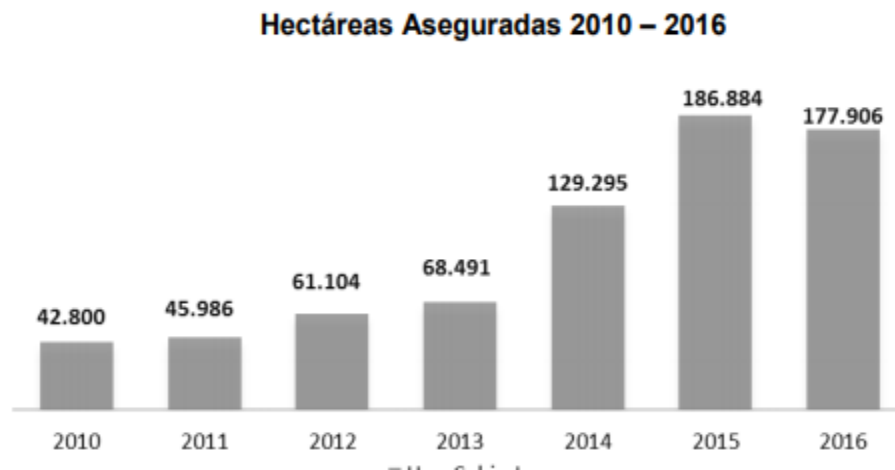
Figure 16. Insured cultivated hectares register between 2010 and 2016

Source. MADR, Management report, 2016

To date, the insured value amounted to more than $1,000,000,000, with $61,700,000 premium vouchers and government-subsidized securities about $43,000,000 of which 7.45% was for the Corn sector. (Ministry of Agriculture and Rural Development, 2016).
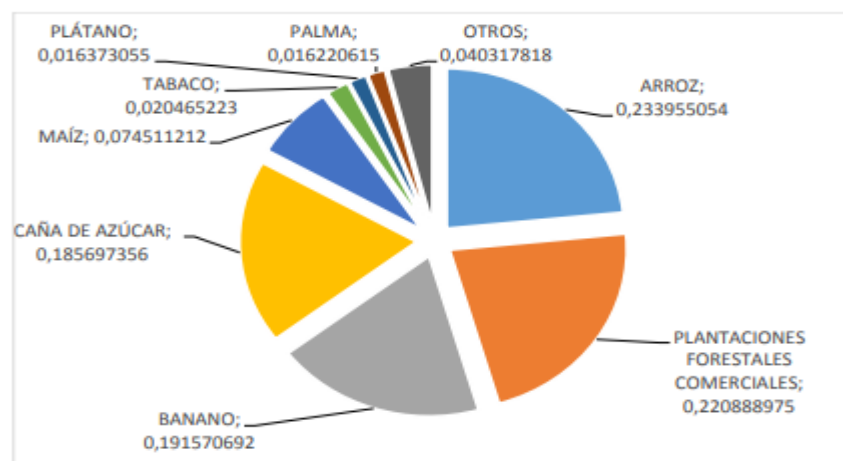

Figure 17. Substractors that acces agricultural insurance the most.

Source. Annual Management Report, Finagro,2016

2.3 Relating aspects to the maize agro-industrial chain in trade agreements with the United States, Argentina and Brazil.

Since the early 1990s, Colombia, like many Latin American countries, has embarked on paths to economic aperturism. This process of economic openness in the country has been one of the factors that has influenced the most the development shape of the maize agro-industrial chain as we know it today. This has been expressed, to a large extent in unilateral deregulation (first stage) and in the signing of different bilateral and multilateral trade agreements, the former being FTA with the United States, and the latter, the Economic Partnership Agreements with the European Union, the Pacific Alliance and the agreement with Mercosur(Montoya, Gonzalez, & Duarte, 2016). While the agreements impose significant challenges for actors in the agricultural phase of the chain, it can be seen that it benefits the actors of transformation.

The United States, Argentina and Brazil have been the three largest producers and exporters of maize worldwide. The first, has stood out as the largest producer and exporter, Brazil managed in the period 2012-2013 to surpass it and Argentina since 2012 has consolidated as a strong supplier of grain for countries in the Middle East (USDA, 2016). In competitiveness terms, this factor should be considered to be influenced by macroeconomic, agricultural and trade policies, transport infrastructure, storage and the soundness of trade-involved institutions in all countries. One of the most influential factors is the competitiveness of farmers derived from agricultural policy. It is identified that, in Argentina´s case, although the farmer pays export tariffs, meanwhile in Brazil and the United States, these actors are entitled to various subsidies including bonuses in the face of falling prices. (USDA, 2016).

The following will be the description of the aspects essentially related to the agro-industrial maize chain in the content of the trade agreements signed by Colombia with the United States, Argentina and Brazil as part of the countries of the

Southern Common Market (MERCOSUR) with which Colombia signed the economic complementation agreement number 72 (ACE No72).

2.3.1 Trade promotion agreement between the republic of Colombia and the United States of America.

Countries gain in international trade to the extent that trade agreements are achieved where complementarity is generated between their productive sectors. As mentioned in the conceptual framework, Adam Smith was promoting countries to specialize in what they knew how to do better and to import from their partners what their trading partners could produce more efficiently.

Trade agreements signed by the United States with other countries where maize represents an important source of livelihood in any of its phases has led to situations in which the weakest links in the chain are violated. like the famous tortilla war in Mexico that stems from the similar initiatives from Mexicos government underthe FTA with the United States and Canada in which the first six years, the Mexican government allowed imports of 10.9 million tons of American maize above the negotiated quota, without the payment of tariffs valued at $1.766 million; which caused Mexican maize to be taken away from living space and additionally jeopardized by the employment of 2 million farmers and attained losses to the national treasury(Espinosa, 2013)

Perhaps this has been the trade agreement that imposed the most challenges for Colombian farmers, since this magnified the non-complementarity but the obvious competitive and comparative disadvantages of Colombian producers, which has been the consequence of an inadequate assessment by the Colombian government of the level of complementarity at the time of signing the agreement. (Trujano Velasquez , 2017). The disadvantage is evidenten to the higher productivity of U.S. farmers compared to Colombian farmers productivity.
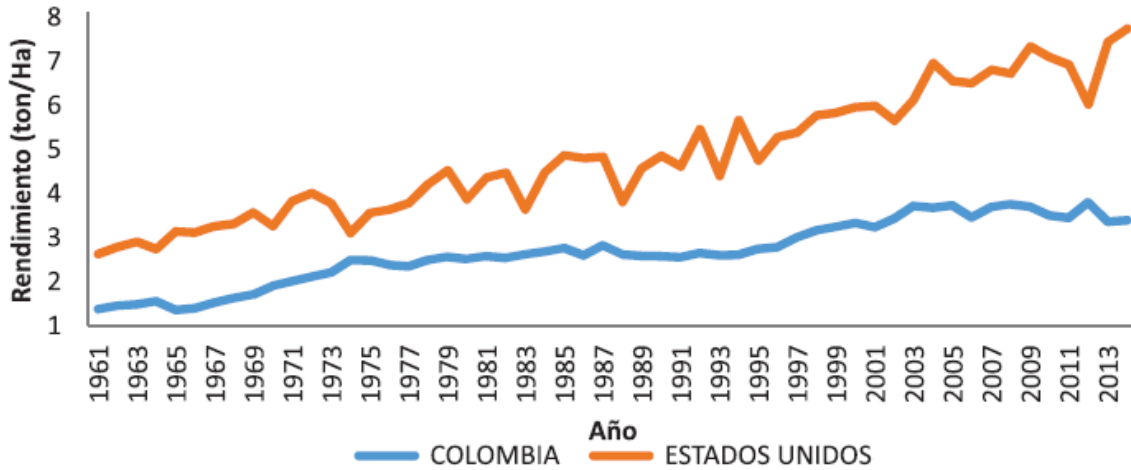
Figure 18. Comparison of corn yields between Colombia and the United States.

Source. Tróchez González , Valencia Cárdena , & Salazar , 2017

In the negotiations they included several sensitive chains in order to minimize the effects for Colombian producers: chicken, rice and maize cuts.

Under this export and market diversification policy, the Free Trade Agreement with the United States entered into force on May 15th 2012.

in which Section G contains everything related to agriculture and agreements on trade-related intellectual property aspects of the WTO - TRIPS, the Agreement on Sanitary and Phytosanitary Measures - SPS Measures and the WTO Agreement on Safeguards are implemented. In subparagraph (c) of Article 2.15 on the administration and implementation of quotas, it details that, under these, the parties may not:

1.   Assign no quota to a producer group
2.   Condition access to a quota amount to a domestic production purchase
3.   Limiting access to the quota only to processors

In this regard, subparagraph (d) of the same article dictates that quota quotas that importers request must be allocated.

Article 2.16 on agricultural export subsidies details that neither party may subsidize exports and that they "should prevent their reintroduction in any form".

Annex 2.3 on rebate, includes in the "N" tax relief category NANDINA subheadings for yellow maize (1005.90.11), with an initial tariff of 25% and annual tax relief in equal parts for 12 periods and white maize, (1005.90.12) with an initial tariff of 20%, annual tax relief in equal parts for 12 periods and with an annual 5% increase in the size of the zero tariff quota , so by 2024, there will be no import limits.

Año	Cantidad
	(Tons. Métricas)
1	2,100,000
2	2,205,000
3	2,315,250
4	2,431,013
5	2,552,563
6	2,680,191
7	2,814,201
8	2,954,911
9	3,102,656
10	3,257,789
11	3,420,679
12	Ilimitado

Figure 19. Yellow corn tax relief program.

Año	Cantidad
	(Tons. Métricas)
1	136,500
2	143,325
3	150,491
4	158,016
5	165,917
6	174,212
7	182,923
8	192,069
9	201,673
10	211,756
11	222,344
12	Ilimitado

Figure 20. White corn tax relief program.

Source: Ministry of Commerce, Industry and Tourism, 2020

2.3.2 Economic supplementation agreement No. 72 Colombia Mercosur

The other agreement that impacts directly the agro-industrial maize chain is that signed between Colombia with mercosur member countries, as Brazil and Argentina (member countries of this market) are international players in grain production as previously demonstrated.

Under Economic Complementation Agreement No. 72, Colombia, as a member of the Andean Community of Nations, accesses the markets of Brazil, Argentina, Paraguay and Uruguay with tariff preferences. The reference to maize in these agreements is limited by Colombia to the gradual rebate of the common external tariff stipulated in the Andean Community of Nations for subheading NALADISA 1005.90.20 "grain maize", which is part of the tax relief schedule D.

However, it stipulates that this subheading will remain protected under the Andean Price Strip System, so the benefits of the agreement for agribusiness processing have not been the same as those which farmers have received because of the protection level.

Año	Preferencias otorgadas por Colombia a:			
	Argentina	Brasil	Paraguay	Uruguay
2008	43%	43%	34%	34%
2009	49%	49%	40%	40%
2010	54%	54%	47%	47%
2011	60%	60%	54%	54%
2012	66%	66%	60%	60%
2013	71%	71%	67%	67%
2014	77%	77%	73%	73%
2015	83%	83%	80%	80%
2016	89%	89%	87%	87%
2017	94%	94%	93%	93%
2018	100%	100%	100%	100%

Figure 21. Tax relief program of the Common External Tariff in the framework of the Trade Agreement of Colombia and Mercosur

Source: National Federation of Cerealists, 2012

Aspectos/variable	Estados Unidos	Brasil	Argentina
Subpartida sometida a desgravación	1005.90.11: Maíz-los demás-amarillo 1005.90.12: Maíz-los demás-blanco	NALADISA 1005.90: Maíz-los demás	NALADISA 1005.90: Maíz-los demás

Arancel de Colombia sujeto al programa de desgravación (1005.90: Los demás)	Maíz amarillo: 25% Maíz blanco 20%	15%	15%
Desgravación del maíz (subpartida 1005.90)	Maíz amarillo: Anual durante 12 años en partes iguales: (2.0833% c/a) Maíz blanco: anual durante 12 años en partes iguales: (1.66% c/a)	Ver ilustración 10	Ver ilustración 10
Subvenciones a la exportación de bienes agrícolas	Se prohíbe	Se prohíbe	Se prohíbe
Salvaguardias	No	No	No

Table 1.General aspects summary of colombian commercial agreements with United States, Brazil and Argentina.

Surce: Own elaboration from MinCIT 2020 data.

2.3.3 Effects

The effects are approached by two perspectives: the price of grain and the behavior of local production. According to the DANE, by 2016, cereal imports amounted to 7,323,515 tonnes (2020), of which 4,562,348 belonged to yellow and white maize, with a 135% growth in the total imported, when 3,181,412 tonnes of which came from the three countries under study in 2012. (DATER, 2020)

Etiquetas de fila	Cantidad total	Valor CIF total	Costo CIF / Ton
ARGENTINA	2,465,519	$ 739,591,476	$ 300
BRASIL	455,266	$ 143,392,193	$ 315
ESTADOS UNIDOS	175,154	$ 61,071,069	$ 349

Figure 22. Imports from United States of America, Argentina and Brazil, 2012.

Source: own elaboration from DATER 2020 data.

With the entry into force of the trade agreement with the United States, grain importers immediately turned to the exporters of this country, to the point of drastically reducing the purchase of Argentine and Brazilian grain in some seasons as shown in the following figure (Tróchez González, Valencia Cárdena, & Salazar, 2017).
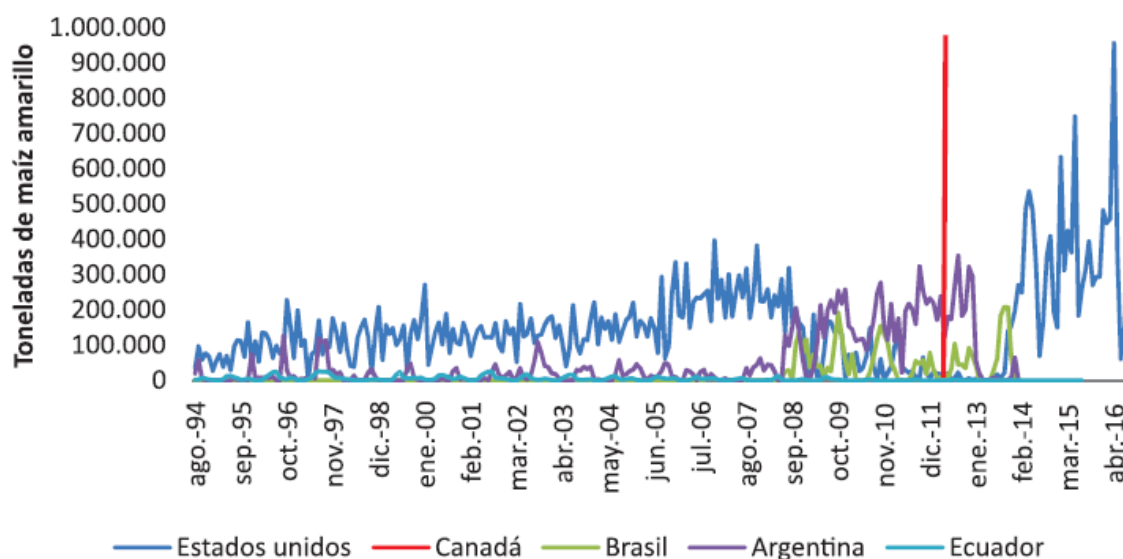

Figure 23. Origin of yellom maize imports between 1994 and 2016

Source: Tróchez González , Valencia Cárdena , & Salazar , 2017

It is clear that the technological stagnation of Colombian farmers, in contrast to the continued advance in the efficiency of foreigners, had negative effects on these actors in the chain. This is reflected in the correlation between production and imports. During the study period it is found that the planting area has had a slight decrease and although the yield per hectare has been higher, total production has not grown. Opposite behaviour is observed in imports of yellow maize, which by 2016 amounted to 4.5 billion tonnes.
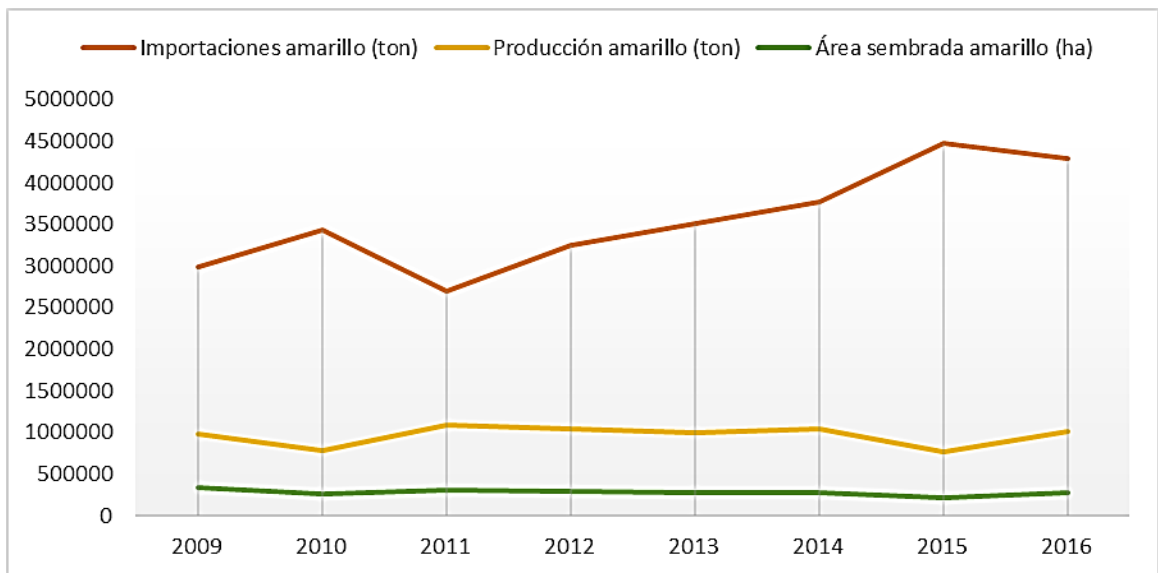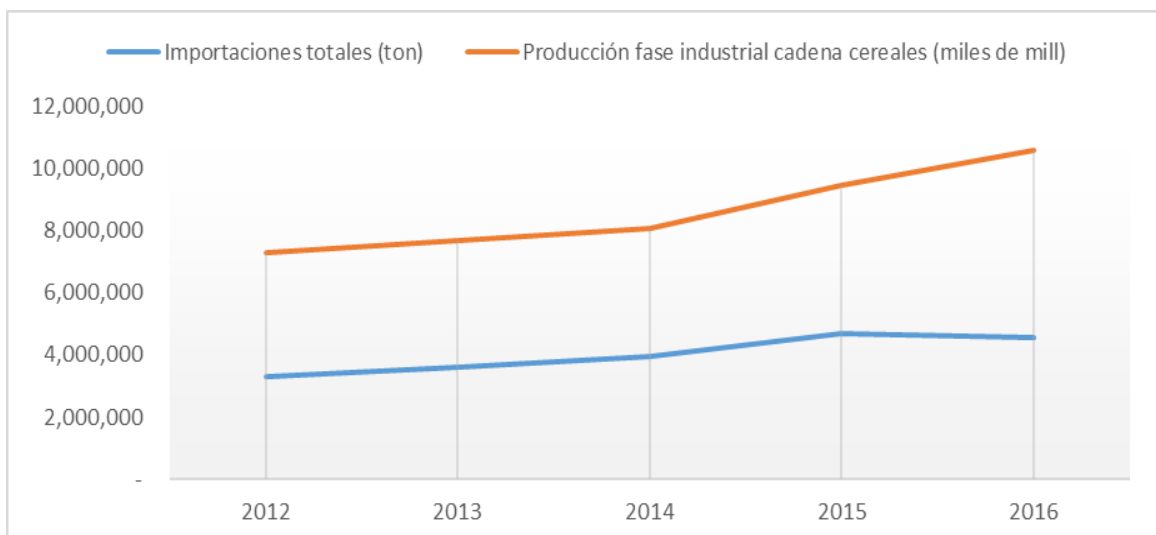

Figure 24 Correlación entre importaciones totales, cantidad total producida (ton) y área sembrada (ha).

Source. Own elaboration from Fenalce, 2020 data.

The trends observed shows that the agreements effect has been different to each different actor in the agro-industrial maize chain, favouring more people who take the processing phase.

In conversation with Mr. Henry Vargas, FENALCE economic director, this versatility of the agreements is discussed and above all, there is a need to take action in the agricultural phase implementing technological improvements to the

Figure 25. trends of total maize imports and growth of the industrial pase of thr cereal chain, 2012 – 2016 period.

planting, harvesting and post-harvest processes that allow their sustainability in the face of the obvious competitive advantage of the imported product and the actors integration in the chain for the development of productive plans that allow farmers to concentrate on production of specific products that add value to processing processes, such as the production of vitreo endosperm seeds, ideal for the grits production.

3.Conclusions

Responding to the research question how Colombia's trade agreements with the United States, Argentina and Brazil have been influenced by the agro-industrial maize chain between 2012 and 2016, there are benefits and challenges in different measures for the actors in the chain. Agricultural actors are the main actors affected by foreign competition, as maize has been able to import at lower prices (below the cost of local production). However, it is clear that this effect of trade agreements has allowed the expansion of production of animal protein sources (pork, chicken, egg, milk, cheese) which is reflected in the well-being of most of society and the growth of these producing industries in both the agricultural and agro-industrial maize chain.

Describing the agro-industrial maize chain, the permanent increase in grain imports is understood as the simply result of growth in the consumption of animal proteins which drives the production of balanced foods for poultry, swine and bovine (milk production) industries, followed by the consumption of maize flours, flakes and arepas. In this way, the national discussion cannot be reduced to claims for increased imports to the detriment of local farmers as it is shown that these would not reach domestic demand of grain in the medium term. In addition, it is found the two fundamental elements that warrant constant monitoring for the planning of business strategies by the actors of the chain: Growth in the consumption of animal proteins at the local level, thus making estimates of grain demand; and global production of ethanol, a factor that strongly influences in a global level the grain availability and price.

On agricultural policy, it is evident that it is essential for the agricultural phase of the chain that three main elements strengthen from the government: interest rate subsidies, facilitating access to credit for medium and smallholder farmers, agricultural insurance subsidies, providing in this way greater coverage of these mechanisms to medium and smallholder farmers and technological renewal programmes for the mechanization of sowing land, harvesting, expanding drying

and drying systemsgrain storage. These measures do not guarantee the expansion of production in the short term with a self-sufficiency view, but bring the conditions of the domestic farmer closer to those of abroad in the guarantees terms he has for his activity development.

To the extent that the trade agreements mentioned before have matured, the increase in the area planted with maize has stalled, so the rate of production growth has been limited to productivity gains per hectare planted in some regions, which is why it culd not be affirmed that the country is self-sufficient in the midum term.

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