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Colombia: A New Ethanol Producer on the Rise?

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Abstract

Colombia's sugarcane-based ethanol industry, after operating for only 3 years, is the second most developed in the Western Hemisphere. Most Colombian ethanol plants are energy self-sufficient and even generate surplus power that is sold to the national electric grid. Colombia's sugarcane-based ethanol production is increasing; proposed expansion projects have the potential to more than triple daily production from 277,000 gallons in 2007 to almost 1 million gallons in 2010. Most of the expansion is intended for exports, principally to the United States. However, it is unlikely that Colombia could export ethanol anytime soon because domestic production is insufficient to meet nationwide requirements that gasoline contain a 10-percent ethanol blend.

Keywords: sugar, sugarcane, ethanol, Colombia

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Introduction

After slightly more than 3 years of operations, Colombia's sugar-ethanol industry has become the most developed among all South American nations except Brazil. According to the Colombian Association of Sugarcane Cultivators (ASOCAÑA), Colombia's ethanol plants are also energy self-sufficient. This rapid development has been facilitated by a sugar industry that is one of the most efficient in the world, due to high sucrose yields and low production costs.

Cane-based ethanol production in Colombia is expanding, and land is needed for farmers to sow additional sugarcane needed to meet rising demand.¹ By 2010, a portion of the land that has been identified for use is expected to provide cane for ethanol. According to ASOCAÑA, if expansion projects develop as planned, ethanol production in Colombia could increase more than 200 percent from 2007 to 2010.

Colombia is unlikely to export cane-based ethanol in the immediate future. Current ethanol production in Colombia is not enough to satisfy domestic mandates, which increase every year and are believed to limit Colombia's export capacity. According to ASOCAÑA and the Colombian Sugarcane Research Center (CENICAÑA), growing demand for cane should not affect Colombian food exports and food security because the cane for future ethanol production will come from new cropland and unproductive pasture land.

In Colombia, as in other countries in South America, agriculture is important to the economy. According to the Central Intelligence Agency *World Factbook*, Colombia's agricultural sector accounts for more than a tenth of the country's GDP and employs more than a fifth of its labor force. Furthermore, within the agricultural sector, the sugar-ethanol industry is valued for its contributions to social and economic development in sugar-producing areas (ASOCAÑA 2007, 2008).

This report, which is based on data gathered and observations made on a visit to the Cauca Valley in Colombia, examines the sugar-ethanol industry in Colombia. Specifically, the report looks at the industry's structure, its role in the economy and in domestic and foreign markets, and the challenges and opportunities that lie ahead.

¹A small volume of cassava-based ethanol is currently being produced in Colombia and may have great potential for growth. As of this writing, however, most ethanol produced in Colombia uses sugarcane as feedstock.

Colombia's Sugar-Ethanol Industry

Colombian government policies have aided in the development of the domestic ethanol industry. In 2001, Law 693 established that gasoline must contain a 10-percent ethanol blend by 2006 and a 25-percent blend within 15 years. When the law was issued, Colombia had no ethanol production facilities. It was not until October 2005 that the country began to produce sugarcane-based ethanol.

At first, the mandate applied only to gasoline sold in southern metropolitan areas with populations larger than 500,000. In 2006, the law's reach extended to include the centrally located capital city of Bogotá. As of April 2008, 70 percent of all gasoline sold in Colombia was mixed at a 10-percent blend level with sugarcane-based ethanol. Because Colombian ethanol production is at a nascent stage and current production is not enough to cover a 10-percent ethanol blend nationwide, in mid-2008, the government announced that it would ease blending requirements in areas not sufficiently supplied with ethanol.

More than 95 percent of Colombia's sugarcane plantations and ethanol plants are located in the Cauca Valley.² This area, with rich soils and weather conditions that allow for year-round sugarcane production and harvesting, lies between the central and western Andes Mountains, the capital of the Cauca Department, Popayán, in the south, and the city of Cartago in the north (fig. 1). The valley's total crop area is about 988,000 acres, of which about 53 percent, or 518,000 acres, are used for commercial sugarcane production. About 20 percent of this land, or 101,000 acres, is used to raise cane for ethanol production. These findings suggest that, on average, 1 acre sown with sugarcane in Colombia provides about 740 gallons of ethanol.

Sugarcane has been produced in the Cauca Valley for more than 140 years. Crop area steadily increased from about 370,000 acres in 1990 to 494,000 acres in 2002. Further growth has been hampered by the unavailability of contiguous land for use by sugarcane producers.

Colombia's sugar exports have declined in recent years due to both a lack of available land in the Cauca Valley and the diversion of cane to ethanol production. Nevertheless, the average rates of growth of production and exports from 1990 to 2007 have been higher than the rate of growth of the crop area. These gains stem from increases in productivity, which have helped make Colombia one of the most productive sugarcane-producing countries in the world (ASOCAÑA 2008 and ERS calculations).

Still, Colombian production of sugar, which includes raw and refined sugar, has fallen since 2004 (fig. 2). Gains in productivity were not enough to offset the effect on sugar production caused by the diversion of cane to ethanol production, which started in late 2005. According to ASOCAÑA, ethanol production increased from 0 to 73.8 million gallons per year from late 2005 to the end of 2007. Despite this tradeoff in uses of cane, the production of ethanol has not caused shortages in the domestic sugar market. The decreased supply has affected only the export market because the price of raw sugar for exports is lower than the price of refined sugar in the domestic market (figs. 3 and 4).

²Colombia does not grow sugar beets.

Figure 1

Main sugarcane-growing region in Colombia



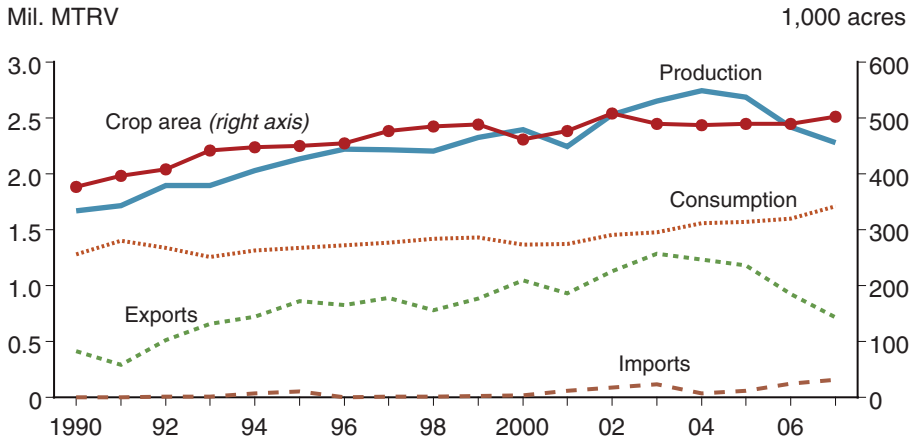
Source: USDA, ERS manual interpretation of satellite imagery from Environmental Systems Research, Inc.

The Colombian ethanol industry has several distinctive features. First, most Colombian mills that produce ethanol are energy self-sufficient. They use bagasse, the byproduct remaining after crushing and extracting juice from cane, to generate energy needed for processing. They also sell surplus bagasse-based power to the national electric grid. According to ASOCAÑA (2008), even though the cost of production of bagasse-based electricity is higher than that of coal-based or hydroelectric-based electricity, the final price (after tax, commercialization, and transportation costs) that the mills would have to pay for conventional electricity would be higher than that of bagasse-based electricity.

Currently, an equivalent of 1 percent of Colombia's annual electricity consumption, or 90 megawatts (MW), is produced from bagasse, and the mills sell 15 MW to the national electricity network. The industry has the potential to produce 230 MW, or about 2.5 percent of Colombia's annual electricity consumption (Hoy, 2008). According to ASOCAÑA (2008), the industry would require investments of about \$200 million and some government support to reach this capacity. Investors could be attracted by tax breaks for buying the technology required to produce the additional electricity. Other options to lower costs include selling the electricity directly to the national network without using an intermediary or obtaining monetary compensation for low carbon emissions. Because bagasse-based electricity is not cost

Figure 2

Colombia's sugar industry evolution

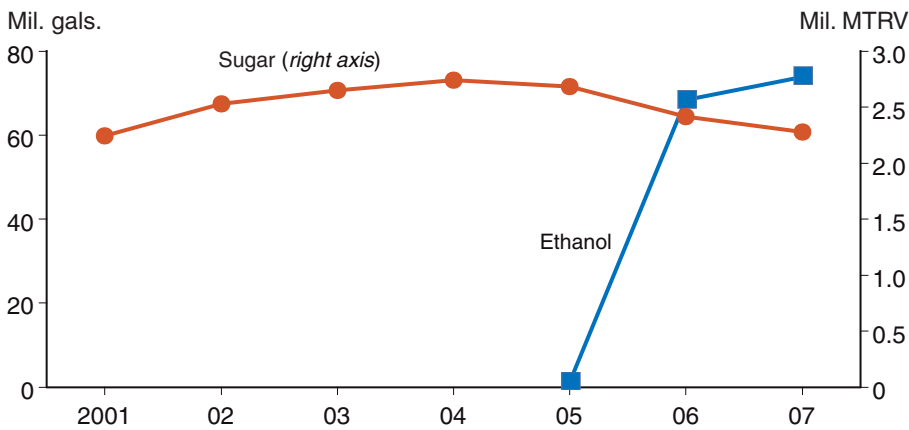


Note: Production includes refined and raw sugar. MTRV = metric tons raw value.

Source: Adapted by USDA, ERS using data from ASOCAÑA.

Figure 3

Colombia's sugar and ethanol production

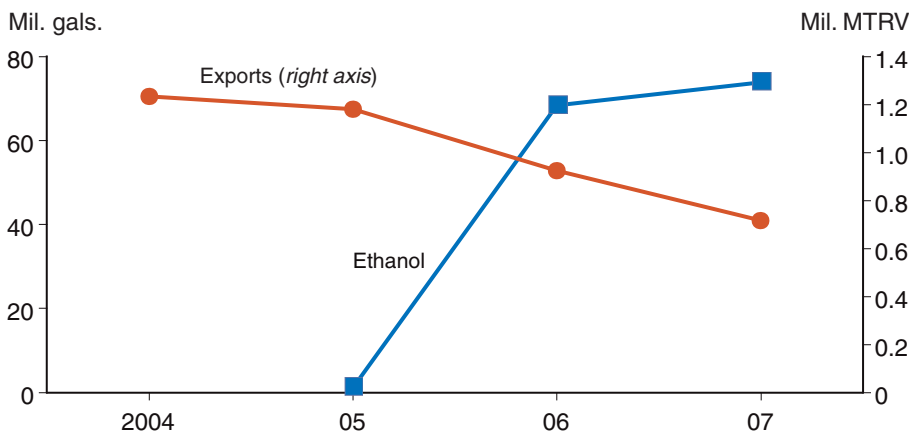


Note: Production includes refined and raw sugar.

Source: Adapted by USDA, ERS using data from ASOCAÑA.

Figure 4

Colombia's sugar exports and ethanol production



Source: Adapted by USDA, ERS using data from ASOCAÑA.

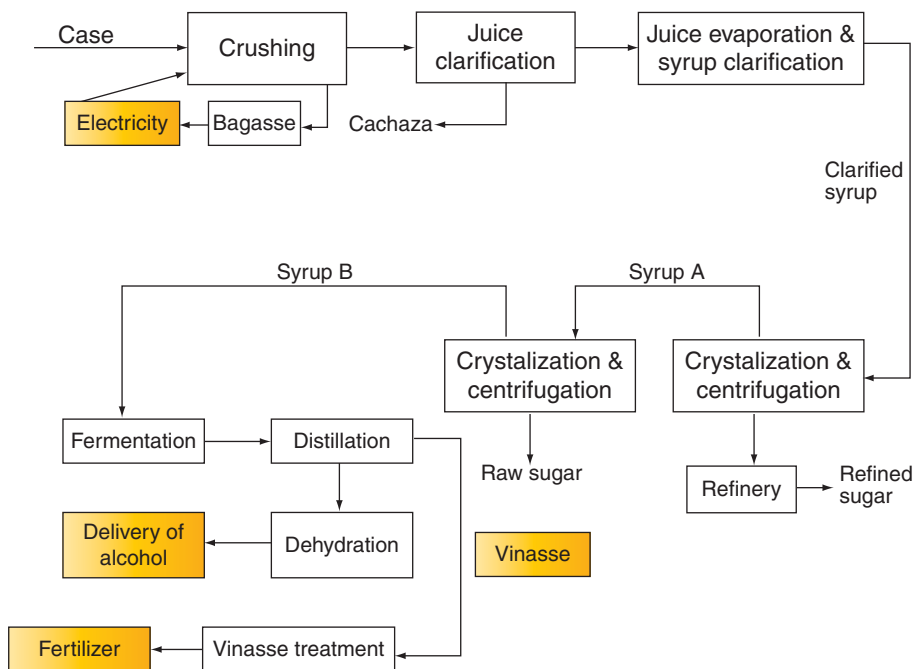
competitive with coal and hydro-based electricity, the industry is unlikely to further develop its potential for production without government assistance.

Another distinctive characteristic is that the technology used to produce ethanol in Colombia apparently provides environmental benefits comparable with those associated with the technology used in neighboring Brazil, which has the most developed sugarcane-based biofuels industry in the world. Colombia uses Indian technology rather than Brazilian technology. According to engineers at Colombian ethanol plants, Indian technology enables the plants to comply with tight environmental regulations set by the Colombian government. The advantage of Indian technology is that it produces low volumes of vinasse, the byproduct generated after the distillation of fermented molasses, and allows for the vinasse to be further processed. Most ethanol plants in Brazil do not further process vinasse. On average, Colombian ethanol production generates 1 to 2 liters of vinasse per liter of ethanol, whereas in Brazil, a liter of ethanol generates 15 liters of vinasse. If not properly disposed of or further processed, vinasse can pose a threat to water or soil conditions.

The decision to use Indian technology appears to be paying off. Colombian-processed vinasse contains high volumes of potassium, phosphor, and magnesium, which allows it to be sold as fertilizer (fig. 5). Annual vinasse sales return about \$40 million to the industry. Lastly, ethanol plants in Colombia use about one-third of the water of Brazilian plants, and about one-half of the energy (ASOCAÑA 2007, 2008). Most sugarcane plantations in Colombia, however, need irrigation, whereas most Brazilian plantations do not.

Figure 5

Sugar and ethanol production process in Colombia



Source: USDA, ERS using information from Manuelita sugar mill.

Highly Efficient Sugarcane Industry

According to ASOCAÑA, the Colombian sugar industry is the most efficient in the world when measured by sucrose yield tons/acres/year, and the 2007 LMC International “Worldwide Survey of Sugar and HFCS Production Costs” reveals that the industry ranks among global leaders in lowest costs of production (figs. 6 and 7).³ The cost of production is measured as the sum of field costs, factory costs, and administrative costs.⁴ The Center South region of Brazil has the lowest production costs in the world, with costs 27 percent lower than those in Malawi, the second-ranked country, and 46 percent lower than those in Colombia, the sixth-ranked country. According to ASOCAÑA, the Colombian industry could decrease costs by improving training and, perhaps, expanding use of mechanized harvesting.

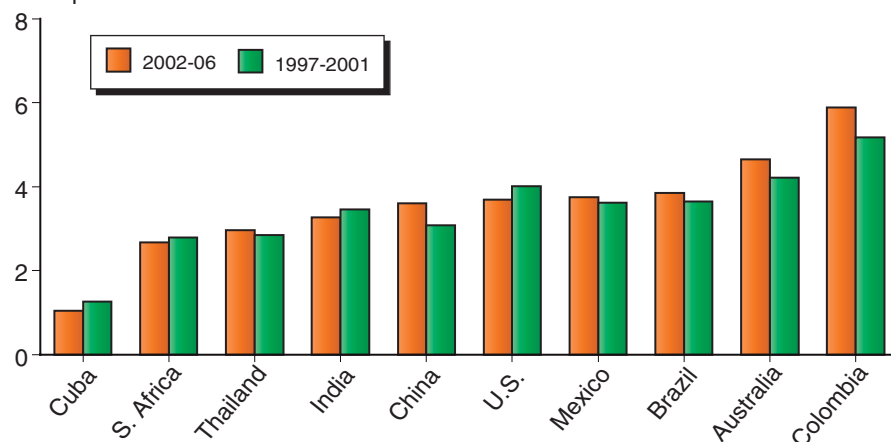
³LMC International surveyed 63 countries, including leading sugar-producing countries such as Australia, Brazil, China, Cuba, Guatemala, Mexico, Pakistan, Peru, South Africa, Thailand, and the United States.

⁴Colombia has the lowest factory costs; it ranks 16th in field costs and 6th in administrative costs. Field costs are the sum of labor, capital, and fuel costs. Colombia ranks 3rd in fuel costs, just below Venezuela and Indonesia, where fuel is subsidized; 15th in capital costs; and 31st in labor costs.

Figure 6

Average sucrose yield in selected countries

Tons per acre

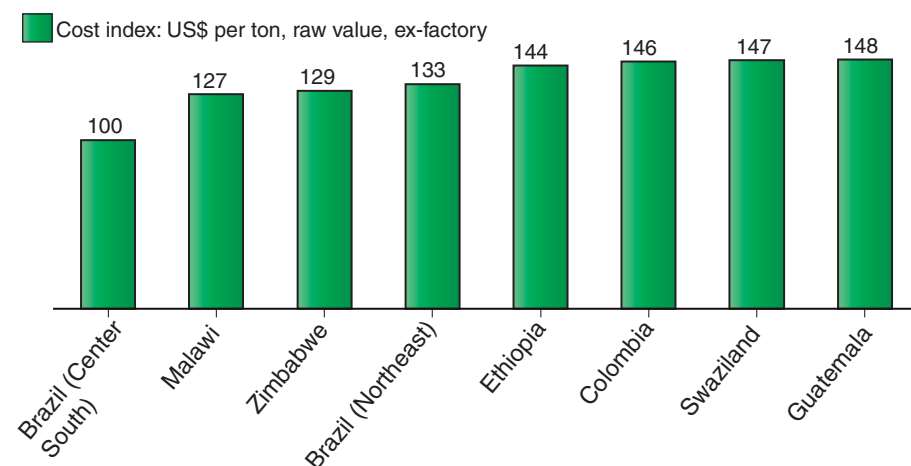


Source: Adapted by USDA, ERS using data from ASOCAÑA.

Figure 7

Sugarcane production average costs index, 2002/03-2006-07 in selected countries

Index



Source: Adapted by USDA, ERS using data from LMC International, “Worldwide Survey of Sugar and HFCS Production Costs.”

In addition to producing ethanol using an apparently environmentally friendly process and producing sugarcane efficiently, Colombia's sugar-ethanol industry takes other steps aimed at protecting the environment. From 2004 to 2007, the industry spent \$127.3 million in the Cauca Valley on activities such as conserving riverbank walls, reforestation, and monitoring air quality. These efforts appear to have paid off. In 2007, pollution levels in the region were significantly lower than the levels set by the environmental ministry. Moreover, even though the sugar-ethanol industry is the largest industry in the Cauca Valley, it accounts for only 2 percent of the pollution in the Cauca River (ASOCAÑA, 2008). There are six entities that provide institutional support to the Colombian sugar-ethanol industry (see box, "Institutional Support for Colombia's Sugarcane and Ethanol Industries").

Institutional Support for Colombia's Sugarcane and Ethanol Industries

In Colombia, as in all countries where ethanol is made from sugarcane, the sugar-ethanol industry is interconnected. ASOCAÑA, PROCAÑA (the Colombian Association of Sugarcane Cultivators and Suppliers), AZUCARI (the Sugarcane Cultivators and Suppliers of the Risaralda Sugar Mill), CENICAÑA (the Colombian Sugarcane Research Center), TECNICAÑA (the Colombian Association of Sugarcane Technicians), CIAMSA (the International Commercialization Society of Sugar and Honey), and DICSA (the Industrial Development and Commercial Assembly) are the entities that control the sugar-ethanol industry. Because official government data for the sugar-ethanol industry are scarce, this report relies on information provided by the above-listed organizations, which have varying roles:

- ASOCAÑA represents the 14 sugar mills and the 5 ethanol plants; its mission is to promote the development of the industry.
- PROCAÑA groups small sugarcane producers, and its goal is to advise them in signing contracts to sell cane and in obtaining loans.
- TECNICAÑA's role is to train people and to transfer technology to the industry.
- CENICAÑA's mission is to perform research to obtain the highest yields and the most pest- or disease-resistant crops.
- CIAMSA is responsible for commercializing and providing the logistics for sugar exports.
- DICSA is responsible for commercializing sugar for animal feed and alcohol for human consumption, such as cachaca.

Ethanol Capacity and Policy

In October 2005, production began in two Colombian ethanol plants owned by the Incauca and Providencia mills, which supply ethanol to the country's major southwestern cities. In February 2006, three more ethanol plants owned by the Risaralda, Mayaguez, and Manuelita mills, respectively, launched production, thus enabling Bogotá to receive gasoline blended at the 10-percent level with ethanol. In June 2007, the Departments of Santander and Norte de Santander and areas of the Departments of Boyaca and Cesar began mixing gasoline with ethanol. As of April 2008, about 70 percent of all gasoline sold in Colombia was blended at the 10-percent level with ethanol. In 2009, a new ethanol plant owned by the Riopaila mill will start producing 79,200 gallons per day. Additionally, an existing ethanol plant is adding production equivalent to 26,400 gallons per day. These new investments will allow Colombia to produce 383,000 gallons of ethanol per day, almost enough to reach a blending rate of 10-percent ethanol in the whole country. This volume of production will help Colombia maintain its position as one of the world's top eight producers of sugarcane-based ethanol. Despite the expansion, ethanol production in Colombia will equal just about 2 percent of production in Brazil.

The progress of Colombia's ethanol industry has encouraged the government, international organizations, and the industry itself to expand the production of biofuels.⁵ Anticipating an increase in demand, the government created an agency whose principal objective is to coordinate the sustainable development of the domestic biofuels industry. Also, the government developed a strategy in March 2008 through the interagency "CONPES" process that describes the manner in which it will help support the development of the industry. This strategy includes policies on prices, taxes, and research and development. Moreover, the government is developing a law that will mandate that, by 2012, all new cars be equipped to handle gasoline mixed with at least 20-percent ethanol; in Colombia, this is known as "Hacia el E-20 (towards the E-20.)" An Inter-American Development Bank project, "Sustainable Energy and Biofuel Strategies for Colombia," is aimed at finding and correcting bottlenecks in biofuels production.

⁵Colombia is starting to produce biodiesel from palm oil.

Industry's Role in Colombia's Economy

In 2007, Colombian farmers sowed about 518,000 acres of sugarcane, mostly in the Cauca Valley. This amount reflects the importance of the sugar-ethanol industry to the economy of the nation as well as of the municipalities of the valley. The industry accounts for 1 percent of Colombia's GDP and 6 percent of the Cauca Valley's GDP. Furthermore, it accounts for 4 percent of the nation's agricultural GDP and 43 percent of the valley's agricultural GDP (fig. 8).

Taxes paid by the sugar mills and ethanol plants are key sources of revenue for most of the municipalities located in the Cauca Valley. In 2007, tax payments by the industry accounted for, on average, 11 percent of the 34 municipalities' budgets. In addition, in one out of every five municipalities, sugar-ethanol sector tax revenues as a share of the budget reached 20 percent, and in a few municipalities, 50 percent. The industry also is a boon to Colombia's labor market. In 2008, it provided 36,000 direct jobs and 216,000 indirect jobs, which implies that the economic well-being of more than 1 million people depended on the industry (ASOCAÑA, 2007; 2008).⁶

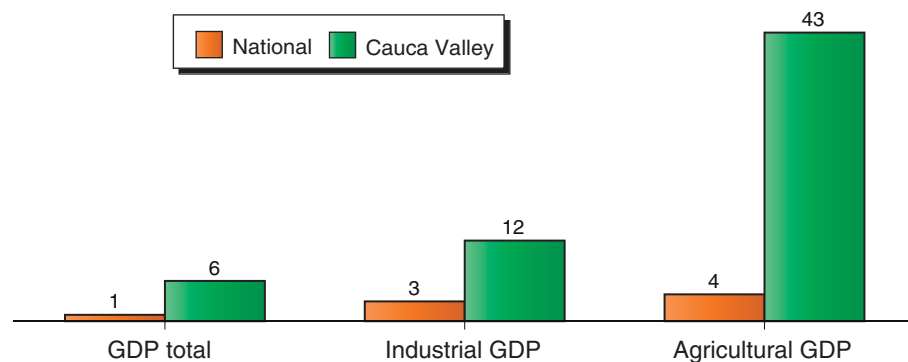
Additionally, through ASOCAÑA, the industry partners with other organizations to promote social development for the communities located in the Cauca Valley. For instance, ASOCAÑA currently teams with ICBF (Colombian Institute of Family Welfare), SENA (National Learning Service), and several universities on projects ranging from teaching family planning to advising people to plant legal crops to providing physical infrastructure for schools. Moreover, it is not uncommon for mills to finance housing for their employees, who, on average, have been working at the plants for 15 years. Due to underdeveloped Colombian credit markets, many workers would not be able to own a home without financial assistance from their employers.

⁶This statement assumes that each family consists of four to five members.

Figure 8

Share of the sugar-ethanol industry in GDP (Colombia and Cauca)

Percent



Source: Adapted by USDA, ERS using data from ASOCAÑA.

International Markets and Plans To Expand Cane Production

Colombia is not yet an ethanol exporter due to the strength of policy-induced domestic demand; however, it does export sugar and may eventually export ethanol. The industry is supportive of the proposed U.S.-Colombia Trade Promotion Agreement (see box, “U.S.-Colombia Trade Promotion Agreement”). If enacted, the agreement will permit Colombia to ship ethanol to the United States duty free and not subject to any quota (U.S. Trade Representative (a)). Currently, Colombia can export ethanol to the United States duty free under the Andean Trade Preference Act (ATPA), but the act is subject to periodic reauthorization by the U.S. Congress.

Global Trade Atlas statistics show that Colombia is the eighth largest cane sugar exporter in the world.⁷ From 2004 to 2007, Colombia exported an average of 355,879 metric tons of raw cane sugar annually. Still, its sugarcane export capacity has dropped more than 50 percent in recent years (fig. 9). According to USDA’s Foreign Agricultural Service, the decrease stems from the diversion of cane to ethanol production.

As it plans for further expansion, the industry is looking beyond the Cauca Valley, which has only 74,000 acres remaining that could be used for sugarcane. CENICAÑA, for example, has identified the northwestern and eastern parts of the country as potential sugarcane-growing areas.

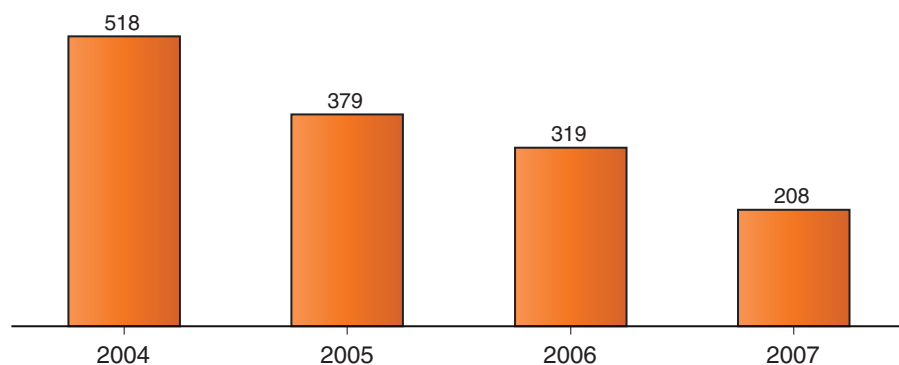
According to CENICAÑA, the northwestern Colombia Departments of Sucre, Bolívar, and Córdoba have about 494,000 acres that could be sowed with sugarcane (fig. 10). This amount of land is roughly the same as that used for sugarcane in the Cauca Valley and five times that used for sugarcane in ethanol production. Projects planned for 2008 and 2009 are expected to use about half of the 494,000 acres to produce sugarcane-based ethanol, which will be mostly for exports. CENICAÑA also identified the eastern Colombia Departments of Vaupes, Guainia, Vichada, Meta, Auraca, Casanare, and Guaviare as potential cane-growing areas. CENICAÑA and Colombia’s

⁷From 2004 to 2007, raw sugarcane exports from the world’s top eight exporters represented 97 percent of global trade flows.

Figure 9

Colombia’s raw sugar exports

Metric tons (1,000)



Source: Adapted by USDA, ERS using data from *Global Trade Atlas* (calendar year exports).

U.S. -Colombia Trade Promotion Agreement

The United States concluded trade negotiations with Colombia on February 27, 2006. On June 14, 2007, the Colombian Congress approved the U.S. Colombia Trade Promotion Agreement (TPA), but as of December 2008, the U.S. Congress has yet to reach a decision.

The TPA could open a significant new export market for the United States. Bilateral trade between the United States and Colombia reached \$18 billion in 2007. Colombia is the fourth largest U.S. trading partner in Latin America and the largest recipient of U.S. agricultural exports in South America. Currently, 92 percent of U.S. imports from Colombia face no duties due to most-favored nation tariff rates and preference programs such as the Andean Trade Preference Act and the Generalized System of Preferences. In contrast, Colombia's tariffs on most imports from the United States range from 5 to 15 percent, with some as high as 35 percent. The U.S.-Colombia TPA would give the U.S. access to a market of 45 million people where a growing middle class is a sign of robust economic expansion.

Sugar, sugar-containing products, and ethanol products are included in the TPA. A complete list of the schedule of tariff elimination and other trade barriers to goods and services is available at the Office of the U.S. Trade Representative Web site, http://www.ustr.gov/Trade_Agreements/Bilateral/Colombia_FTA/Section_Index.html

Figure 10

Potential sugarcane production areas in Colombia



Source: USDA, ERS using boundary data from Environmental Systems Research, Inc.

Ministry of Agriculture and Rural Development estimate that the country contains between 2.4 and 4.9 million acres that could be used for sugarcane production. CENICAÑA expects that yields in the northwestern and eastern regions will not be as high as those in the Cauca Valley but will be high enough to make ethanol production profitable. Moreover, as the land in these two regions is currently either unused or used only as low-density livestock pasture, CENICAÑA suggests that sugarcane plantations will not displace any crops and, thus, future ethanol production will not affect food security.

Colombia has plans to meet increases in both domestic and foreign demand for ethanol. Within 2 years, at least 247,000 acres of new sugarcane area located in the northwestern part of the country could be available to use in ethanol production. As northwestern cane yields are expected to be lower than those in the Cauca Valley, the 247,000 new acres could result in production of about 607,000 gallons of ethanol per day (ASOCAÑA, 2008). This amount, plus trend-based production elsewhere in the country, could boost production in Colombia to about 990,000 gallons per day. Colombia's production could grow even more if sugarcane is grown on the identified land in the eastern region and on the remaining 247,000 acres in the northwestern region.

Colombian entrepreneurs are not just focused on identifying land for sugarcane within Colombia; they have plans to sow sugarcane and produce ethanol abroad. For instance, the business group that owns the Manuelita mill is building an ethanol plant in northern Peru. This plant, located in the State of Trujillo, is expected to start producing by 2010, and its managers intend to ship its output to the United States to take advantage of the 2005 U.S.-Peru Trade Promotion Agreement, which is pending implementation (U.S. Trade Representative(b)). This same business group holds a 25-percent share in the Brazilian Vale do Parana sugar refinery, which was scheduled to start producing in July 2008. Moreover, in early 2008 a Colombian delegation visited Cuba and declared that the Colombian government will install a small pilot ethanol plant on the island. This plant will produce 1,300 gallons per day and will serve as a trial to help determine the feasibility of future investments.

Conclusion

The sugar-ethanol industry is becoming increasingly important to Colombia's economic and social development. The industry provides thousands of jobs, is a source of significant government revenues for the municipalities located in the Cauca Valley, and supports social programs aimed at improving people's well-being.

The Colombian sugar industry is the most efficient in the world when measured by sucrose yield tons/acres/year and has the sixth lowest cost in terms of cost of production. Colombia has been producing ethanol for only 3 years but it is recognized worldwide for its efficiency and its treatment of vinasse. Colombia's plants produce higher quality, lower quantity vinasse and use less water than Brazil's plants. They also produce a surplus of energy that is sold to Colombia's national network of electricity.

Available land with access to adequate infrastructure is critical to Colombia's plans to expand ethanol production. In this regard, CENICAÑA has identified areas in eastern and northwestern Colombia that would be suitable to grow cane. These areas combined have at least 2.4 million acres of available land. If current plans and projections are met, by 2010, production could reach 990,000 gallons of ethanol per day. It is unlikely that the boost in ethanol production will affect Colombia's future sugar exports, and, thus, world sugar markets, because additional production is expected from new crops.

Additionally, Colombian firms are investing in ethanol production in Peru, Brazil, and Cuba. The steps being taken by the government, the private sector, and multilateral organizations should help ensure that Colombia further develops its potential and strengthens its position as a player in the biofuels industry in the Western Hemisphere.

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