



Evolução comparativa da atividade canavieira: uma análise via censo agropecuários Alagoas, Pernambuco e São Paulo

Samir Alberto Rêgo Café	UNEAL - State University of Alagoas (<i>Universidade Estadual de Alagoas</i>), Alagoas, Brazil. Economist and Postgraduate, Specialization in Management and Strategic Business Planning. samir.rego1978@hotmail.com
André Maia Gomes Lages	UFAL - State University of Alagoas (<i>Universidade Estadual de Alagoas</i>), Alagoas, Brazil. Master's Degree in Applied Economics. PhD in Economics from IE/UFRJ. andre_lages@msn.com
Kellyane Pereira dos Anjos Gonçalves	Economist Master in Applied Economics UFAL and PhD in Production Engineering, UFSCar. kellyane.anjos@gmail.com
Jonathan de França Santos	UFAL - State University of Alagoas (<i>Universidade Estadual de Alagoas</i>), Alagoas, Brazil. Graduated in Economics and Master's student in Economics at UEPG. jonathanfranca22@gmail.com

Resumo	O presente artigo foca na evolução comparativa da atividade canavieira via censos agropecuários de Alagoas, Pernambuco e São Paulo. Examina a realocação do setor sucroenergético e suas microrregiões selecionadas nos três estados e a passagem da transição das etapas da criação e consolidação do Instituto do açúcar e do álcool (1933-1960), Proálcool (1975-1990), desregulamentação (1991-2002) e o lançamento do carro <i>flex-fuel</i> (2003-atual), bem como o rendimento agrícola da cana-de-açúcar, área ocupada e quantidade produzida da cana através dos dados dos censos agropecuários de 1975-2006 e a expansão migração e a competição das usinas nordestina com centro-sul na década de noventa.
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Palavras-chave	Cana-de-açúcar. Açúcar. Etanol.
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Comparative evolution of sugarcane activity: an analysis using the agricultural census Alagoas, Pernambuco and São Paulo

Abstract	This article focuses on the comparative evolution of sugarcane activity via agricultural censuses in Alagoas, Pernambuco and São Paulo. Examines the relocation of the sugar-energy sector and its selected micro-regions in the three states and the passage of the transition stages of creation and consolidation of the Sugar and Alcohol Institute (1933-1960), Proálcool (1975-1990), deregulation (1991-2002) and the launch of the flex-fuel car (2003-current), as well as the agricultural yield of sugarcane, occupied area and quantity of sugarcane produced through data from the agricultural censuses of 1975-2006 and the expansion, migration and competition between northeastern and central-south plants in the 1990s.
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Keywords: Sugarcane. Sugar. Ethanol.



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1 INTRODUCTION

This article discusses the Comparative Evolution of the Sugarcane Industry: An Analysis via the Agricultural Censuses. Alagoas, Pernambuco and São Paulo, based on the agricultural censuses from 1970 to 2006, to update the tables of a master's dissertation Technological Differentiation of the Sugar and Alcohol Industry in Brazil, explaining the spatial relocation of sugarcane activity over time. But since the creation of the *Instituto do Açúcar e do Alcool* - IAA (Sugar and Alcohol Institute) in 1933, the federal government has intervened in the sugar-energy sector through price control policies, production planning, production accounts and by protecting competition from the Northeast in relation to the Center-South.

In the fifties and seventies, the national sugar-energy sector underwent a process of modernization, especially in the northeastern region, with the development of sugarcane cultivation throughout the country, with the creation of the sugarcane improvement program Planalsucar and other programs that motivated the sector to modernize, also with the creation of *Proálcool* 1975-1990, which was an important milestone in the use of the alcohol car until the deregulation of the sector through the extinction of the IAA in the 1990s and the launch of the flex-fuel car.

Data on the agricultural yield of sugar cane in the states of Alagoas, Pernambuco and São Paulo and their selected micro-regions will be researched and collected through the 1975-2006 agricultural censuses, and proposed by some authors, surveying the changes in the expansion of agricultural productivity of sugar cane, caused by the expansion of sugar cane varieties, the advance of mechanization, the reduction in planted area and the increase in sugar cane production.

Sugarcane varieties will be researched using data from Rideza (formerly Planalsucar), which reveals the expansion of sugarcane throughout the country by type of variety, collected by various experts from different areas of the agribusiness sector. The changes that have taken place in the sugar-alcohol sector as a result of public

policies have been very significant. This article will attempt to verify these changes in the spatial area, as well as other changes that have occurred in the profile of the use of biological, chemical and mechanical technologies. These changes are generally the result of changes in the institutional environment over the sector's recent history. It is these changes that are important to capture, because they present a very different picture for each situation. In general terms, there are two situations that explain why this aspect stands out. The sector is concentrated in the northeast. The greater pressure on firms due to greater exposure to competition has resulted in this. On the other hand, studies show that the sector has deconcentrated to the Center-South of Brazil (SIQUEIRA & CASTRO JUNIOR, 2013).

In this context, it is worth remembering that the process of deregulation has played a major role in all the changes since the 1990s. What are the reasons for this apparent contradiction?

The sugar-alcohol sector in the northeastern region, in addition to the natural difficulties of suitable land for its expansion and consequent possible gains via economies of scale, was also relatively behind in the diffusion of technologies. Thus, deconcentration in the Center-South was also an invitation for new firms to enter this production area, which includes the Brazilian Center-West. It was therefore no surprise that business groups from Alagoas expanded into sugar and alcohol production in Minas Gerais and São Paulo, as reported by Soutinho et al (2013). The less rugged topography and fertility of the soil are always cited as factors that help in this process of attraction. In addition to Minas Gerais, Goiás, Mato Grosso and Mato Grosso do Sul are cited as areas where sugarcane plantations are expanding (CARVALHO & MARIN, 2011).

Since the gradual deceleration of *Proálcool* and the closure of Planalsucar (now Ridesa), the sugar-alcohol sector in Alagoas has shown changes and undergone transformations in the economic and institutional environment that have led sugar mills to necessarily adopt more competitive strategies, through the process of modernization making these mills more efficient and competitive, but this has also meant more concentration in the sector. It is important to remember that there is some link between this situation and changes in the Brazilian energy matrix, as outlined in Lages & Cavalcanti (1994). On the other hand, the sector's potential for sustainability was clear, both in terms of the potential for cogeneration, using sugarcane bagasse, and in terms of fertigation through the use of vinasse. The need for a greater presence of renewable

energy in the energy matrix was another crucial point, even in the macroeconomic strategy of stabilizing prices.

This process of deregulation of sugarcane activity was an important milestone for the development of the national sugar and alcohol industry, because as a process of comparative statics it changed important variables.

General Objective: The sugar-alcohol industry has been impacted by changes in its institutional environment. This change induced and had repercussions on the selection of crops that would be adopted in areas previously occupied by sugarcane. The aim of this work is to try to understand these locational changes in sugarcane activity within three major producing states. São Paulo, Alagoas and Pernambuco. It should be clear that there have already been changes in the period that have led to a reduction in the area planted or a shift in production, but this has been quite different between the cases analyzed. This study seeks to make a comparative analysis of sugarcane activity in the three producing states, by updating data from 1975 to 2006. The option was to use agricultural censuses because they contain census data. This guarantees greater confidence in the results.

Specific Objective: The main points of the specific objectives of this research are: To measure the main changes that have occurred within the possibilities allowed for their use, in terms of measures of inequality, measures of concentration and indicators of localization and specialization; to identify the profile and migration of the crop in the three producing states; to carry out an analysis and survey of secondary statistical data, by calculating the net area to verify the change in the planted area since 1975-2006.

2 THEORETICAL FRAMEWORK

Ramos & Szmrecsányi (2002), the main reason for the creation of the *Comissão de Defesa da Produção Açucareira* in 1931 and its transformation into the *Instituto do Açúcar e do Alcool* (IAA) in 1933. The IAA, which was responsible for controlling the supply of sugar on the domestic market, had an impediment to São Paulo's expansion and its main dimension: They sought to prevent new producers from entering, but could continue to guarantee a place for northeastern products on the São Paulo market, as mentioned below:

“This control of supply was accompanied by an administration that stabilized or defended sugar prices, and soon after sugarcane prices too. It is clear to see

how attractive it became to set up companies to exploit sugarcane and sugar production in São Paulo. The state was also concerned with reducing the supply of sugar by redirecting the crushing of cane to produce alcohol for use as fuel. It even promoted the transformation or conversion of sugar into alcohol. This explains why some groups entered the complex producing not sugar, but alcohol (RAMOS & SZMRECSÁNVI, 2022)”.

Silva (2013), considers that there is a specification of the sugarcane crop, the centers of knowledge generation have a cumulative knowledge that comes from the 2010 milestone, with the experimental stations of Campos (RJ) and Barreiros (PE). Research was carried out in different chronological stages in Brazil. There have been a few generations, so the Public Research Institutes have been assigned an information flow that has been consolidated since the IAA/Planalsucar was abolished and then Ridesa was incorporated into the Federal Universities, as we can see below:

“As early as 1970, Coopersucar's flowering station began crossbreeding, obtaining 724,000 seedlings that year, which gave rise to 400 clones of the SP 70 series, 12 of which became industrial varieties (Revista Conjuntura Econômica, 1994). Around 1972, even before the end of the Campos station in Rio de Janeiro, whose selected varieties bore the acronym CB, Coopersucar and the IAA/Planalsucar began their development programs for new sugarcane varieties (SILVA, 2013).”

Lima (2014), in this context of the growth of national sugarcane production, Alagoas also experienced a great euphoria, as quoted by Andrade Neto (1984), this state in the 1950s went through an important scenario for the development of the sugar plantation, as it brought us, especially for sugarcane cultivation, a new stage, with the incorporation of the coastal tablelands into the production process.

In 1974, Brazil was the largest oil importer among developing countries and the seventh largest in the world. In 1972, before the oil shock, Brazil spent approximately 15% of its income on oil exports and imports. By 1974, this expenditure had exceeded 40% because the country depended on imported oil, which accounted for 80% of its energy needs, and the military development project was affected by the increase in the price of this product (SANTANA, 2006 & MORAES, 2014). According to the same authors, Brazil's exports of Brazilian products to the Middle East were significantly affected by the price increase, with a negative balance of trade with the Arab countries of US\$ 353 million in 1973, US\$ 1.759 billion in 1974 and US\$ 3.314 billion in 1978 (SILVA, 2003).

According to Ramos (2016), *Proálcool* financed an expansion in the production of both anhydrous and hydrated alcohol, which was produced by a large number of

autonomous distilleries that were built in regions throughout Brazil. The expansion was made possible to a large extent by the fact that the financing provided by the aforementioned program made it possible for new producers to emerge and for economic groups linked to sugarcane activities to expand. These groups did not annex the distilleries to the mills, but built autonomous units in areas that had previously been concentrated in livestock activities. For Veiga Filho & Ramos (2006), *Proálcool* is divided into three phases: First phase (1975-1979) 1st oil shock and the launch of anhydrous alcohol added to gasoline; second phase (1980-1985), 2nd oil shock and the launch of hydrated alcohol used as fuel; third phase (1986-1990) the supply crisis and the extinction of the IAA.

Carvalho (2009), the deregulation of sugarcane activity still maintained the old practices, such as fixing the prices of crystal sugar, ethanol and sugarcane; liberalizing the national market and eliminating the sugar market reserves in the northeastern region, which until then had monopolized regional producers; privatizing exports, which were now made by mills or trading companies, putting the main asymmetric sugar producers on an equal footing in the competition with the northeastern and foreign markets. This result brought us to a significant level: Brazil increased its sugar exports, São Paulo followed a strong dynamic growth in sugar production and exports, surpassing the states of Alagoas and Pernambuco.

According to Vian (2003), in this context, production diversification into sugar was no longer attractive to independent distilleries, and some sugar units diversified in the mid-1990s, looking for other areas of activity, but always based on the sugarcane complex. Thus, the use of by-products emerged as a good alternative and led to the production of feed, the confinement of cattle and the cogeneration of energy from sugarcane bagasse. For the same author, in the field of neutral alcohol used in the beverage industry, the strategy of Usina Ester, which specializes in the manufacture of beverages and cosmetics, deserves to be highlighted, as it is recognized for the quality of its products by all its customers.

Moraes (2002), there was currently no model for the formation of strategic fuel alcohol stocks in Brazil. In fact, as he observed in 1999, 2000 and 2001, the federal government intervened on a one-off basis to buy surplus fuel alcohol as a way of reducing the crisis faced by the sugar-energy sector, rather than a policy of forming fuel stocks, as stipulated by existing law.

Moraes & Bacchi (2014), car markets and technology have changed with the introduction of the flex-fuel vehicle. This technology began in the United States and the first pioneering automaker was Ford in 1984. In 1992, General Motors (GM) commercially launched its first flex-fuel car in the USA, which had a “capacitive sensor for measuring the ethanol content in the fuel”. In Brazil, three companies were involved in encouraging the development of this technology: Bosch, Magneti Marelli and Delphi, which began to establish partnerships with other automotive companies to launch flex-fuel engines.

Macedo (2011), with flex-fuel technology, the choice of whether to consume ethanol or gasoline is transferred from the moment the car is purchased to the moment it is filled up, which means that the sugarcane complex is now regulated via the market, where competitiveness is determined by the relative price of the two fuels - gasoline and ethanol.

Rissardi Júnior (2015), like mergers and acquisitions, while the strategies are determined by the companies have been seeking to rationalize the production process by improving the management process and transferring skills, and mirror the current situation of the mills and distilleries where they were insolvent in the fertile field in 2004 and beyond.

3 METHODOLOGY

In order to develop this article, the following procedures will be carried out: Updating the data contained in the tables in Lages (1993) based on the 1975-2006 agricultural censuses; this stage, however, requires adaptation due to changes in the composition and names of some micro-regions. Subsequently, all clusters of municipalities where sugarcane production has become irrelevant will be partially excluded from the analysis. In fact, the way in which resources are reallocated in these cases will be analyzed. The central point will be the reason for the relocation. The first hypothesis is the regulation already used in another analysis with a similar profile (ANJOS & LAGES, 2010). This aspect, by its nature, is indirectly linked to other points in the analysis, such as the edaphoclimatic nature of certain micro-regions, and the relocation to another more competitive product in that context. But this is a consequence of the change in the institutional environment. Certainly, in São Paulo, as it

is a more mature and organized market, these changes are faster and dictated by the prices of the commodities market, spot and future.

Methodologically, on the other hand, there should be four large blocks of empirical data. The classic division will apply: Biological-chemical technologies and mechanical technologies. But this division will be mediated by the important question of the presence of agroecology, on the one hand, and the nature of family farming, on the other. In fact, there is a paradox here. The Green Revolution established “rules of conduct” that favor monoculture and the spread of environmentally damaging technologies that run counter to the so-called agroecological paradigm.

SUGARCANE CROP YIELD

- a) Sugarcane crop yields in the three producing states;
- b) Sugarcane crop yields by selected micro-regions;
- c) Sugarcane agricultural productivity by selected microregions;
- d) Share of sugarcane in the net area by related microregions.

4 RESULTS AND DISCUSSIONS

EVALUATING THE AGRICULTURAL YIELD OF SUGARCANE ACTIVITIES

Note that agricultural income is growing in Alagoas and São Paulo. However, in Pernambuco it fell between 1985 and 1996. This also happened in Alagoas in an earlier period.

**Table 1 - Sugarcane crop yield (ton./ha)
Alagoas, Pernambuco and São Paulo**

Year	Alagoas	Pernambuco	São Paulo
1975	42.39	42.5	50.13
1985	51.28	51.05	73.75
1996	55.91	43.06	72.38
2006	54.55	52.80	77.58

Source: Censos Agropecuários, 1975, 1985, 1995 and 2006, IBGE.

Table 4.1 shows that São Paulo obtained 77% in the 2006 census, surpassing the state of Alagoas due to the migration of northeastern mills and distilleries to the

center-south. This data is actually important, because it opens up the possibility that this increase in yield could lead to an increase in production, even with a reduction in the area planted.

This can be analyzed from some of the following tables.

Opening up the analysis by micro-region, it can be seen that in 1985, as noted in Lages (1993, p. 128), Arapiraca achieved high agricultural productivity, similar to the performance of São Paulo micro-regions; but strangely, it fell steadily afterwards. How can this be explained? One aspect is that this micro-region has large portions of flat land. Another is that in 1985 the region was coming out of a major drought. A third factor that may help to explain the phenomenon is that this rich agricultural region has undergone a major transition from one of the best tobacco producing regions in the country to a polyculture area with vegetable and fruit plantations; since there is a large open market in Alagoas for this (DEOLINDO et al., 2011; LAGES et al., 2013).

In addition, the decline of sugarcane activity in certain microregions of Alagoas can be added to the deregulation of the activity in 1990 with the end of the IAA. The drop in area and increase in productivity is due to the following reasons: Deregulation of the sector, this change in the institutional environment forced an increase in the diffusion of technologies that led to greater vertical production and less horizontal expansion. In this case, new varieties of sugarcane and greater use of mechanization. In addition to the abandonment of less suitable areas, which leads to higher production costs, and relocation to better areas, as shown in the following tables:

Table 2 - Pernambuco and Alagoas sugarcane agricultural yield (ton/ha) microregions and selected years.

Year	1975	1985	1995/96	2006
Microregions				
Tabuleiro de São Miguel dos Campos	47.05	60.03	59.17	56.72
Arapiraca	50.03	72.66	58.82	48.09
Mata Seca	41.88	54.36	39.53	67.98

Source: Censos Agropecuários, 1975, 1985, 1995 and 2006, IBGE.

Table 4.2 shows the agricultural productivity of sugar cane in the dry forest microregion in the state of Pernambuco, which has the highest concentration of sugar cane plantations at 67% in the 2006 census, surpassing the other microregions of Arapiraca, which had 72% in the 1985 census due to the expansion of *Proálcool* and the production of hydrated alcohol and the reduction in the price of sugar cane equalization, but had a drop of 48% in the 2006 census due to the bankruptcy of mills in that region.

Table 3 - Sugarcane agricultural yield (ton/ha) 1975-2006 by selected microregions.

State and Microregions/Year	1975	1985	1996	2006
Alagoas	[42.2]	[51.3]	[55.92]	[58.52]
North coast of Alagoas	40.3	47	58.02	57.07
Alagoas Forest	39.8	43.6	51.5	52.87
Maceió	47.4	50.6	54.12	64.08
Tabuleiro de São Miguel dos Campos	47.1	60	59.17	56.72
Pernambuco	[42.5]	[51.0]	[43.06]	[54.05]
Recife	38.3	52.2	48.84	53.18
Pernambuco's Dry Forest	41.9	54.4	39.53	67.98
Pernambuco's Humid Forest	44.9	50.9	39.3	48.6
São Paulo	[50.1]	[73.8]	[72.38]	[79.42]
Ribeirão Preto	57.1	76.1	59.7	81.29
Açucareira de Piracicaba	47	78.8	54.35	76.32
Araraquara	45.8	69	62.06	42.43
Jaú	54.8	78.6	65.8	74.44

Source: Censos Agropecuários, 1975, 1985, 1995 and 2006, IBGE.

According to data from the 2006 agricultural census of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística - IBGE*), the Ribeirão Preto micro-region accounted for 81% of the agricultural productivity of sugarcane due to the expansion of sugarcane plantations, the production of sugar,

ethanol and energy and many mills and distilleries concentrated in that region, surpassing the other micro-regions of the three Brazilian states, surpassing the sugar micro-region of Piracicaba with 76%, compared to data from 1985 with 78%, surpassing the micro-region of Jaú due to the expansion of hydrated alcohol fuel at the time of the advent of *Proálcool*.

RELOCATION OF SUGARCANE CULTIVATION IN TERMS OF NET AREA, OCCUPATION OF THE PLANTED AREA, QUANTITY PRODUCED AND AGRICULTURAL YIELD, AND ITS MAIN IMPACTS

According to the data in Table 4.4 of the 1975-2006 agricultural censuses of the Brazilian Institute of Geography and Statistics (IBGE), 76% of the area occupied by sugarcane is concentrated in the Tabuleiro de São Miguel dos Campos (AL) and the second is the Ribeirão Preto micro-region, which accounts for 62% of the data collected in the 1996 agricultural census as a result of the process of productive restructuring of the sugarcane industry in the 1990s with the extinction of the IAA.

Answering these questions explains why the growth in sugarcane production and the reduction in the area planted were accompanied by the first and second oil shocks and the expansion of *Proálcool* in the 1970s and the extinction of the IAA, which led the sugarcane industry to adopt a process of “deregulation”, through administrative reforms by former president Fernando Collor de Mello, which led the sugarcane industry to undergo a process of productive restructuring, making them more competitive and free of prices and production quotas from the 90s onwards, this was also due to the increase in sugar exports on the foreign market, the launch of the flex-fuel car in 2003, the expansion of ethanol production and also the advance of mechanization in agriculture, the end of the drought, investment in research into sugarcane varieties, via Ridesa (PLANALSUCAR), which stimulated an increase in sugarcane productivity in the three states of Alagoas, Pernambuco and São Paulo in the following harvests.

Table 4 - Share of sugarcane in net area in 1975 and 2006 selected micro-regions.

State and Microregions/Year	1975	1985	1996	2006
Alagoas	[0.14]	[0.23]	[0.19]	[0.32]

North coast of Alagoas	0.26	0.57	0.3	0.08
Alagoas Forest	0.32	0.47	0.25	0.08
Maceió	0.31	0.55	0.6	0.006
Tabuleiro de São Miguel dos Campos				
Campos	0.32	0.67	0.76	0.02
Pernambuco	[0.06]	[0.09]	[0.09]	[0.08]
Recife	0.38	0.51	0.5	0.27
Pernambuco's Dry Forest	0.36	0.56	0.58	0.1
Pernambuco's Humid Forest	0.36	0.48	0.5	0.09
São Paulo	[0.04]	[0.09]	[0.14]	[0.20]
Ribeirão Preto	0.2	0.42	0.62	0.005
Açucareira de Piracicaba	0.41	0.55	0.56	0.02
Araraquara	0.11	0.21	0.26	0.009
Jaú	0.23	0.43	0.54	0.02

Source: Censos Agropecuários, 1975, 1985, 1995 and 2006, IBGE.

Looking at Table 4, Tabuleiro de São Miguel dos Campos had 76% of the net area surpassing that of the Ribeirão Preto microregion, according to the 1996 agricultural census, due to the expansion of the area occupied by sugarcane in those microregions, but it fell in the 2006 census as a result of the increase in sugarcane production in the three Brazilian states.

According to Anjos & Lages (2010), it can be seen that the withdrawal of government regulation has meant that competitiveness has become more competitive. In the sugarcane agro-industry, this meant a sharp drop in the area planted with sugarcane in certain micro-regions of Alagoas, which have endoclimatic problems, as the study shows.

FINAL CONSIDERATIONS

Therefore, the aim of this work is to update the tables in Lages' master's thesis (1993), which studied agricultural income and net area by selected micro-regions that underwent changes in nomenclature and composition and the creation of new municipalities, which presented a satisfactory result in the evolution of the sugarcane agro-industry responsible for the production of sugar, alcohol, molasses and electricity.

This data from the agricultural censuses shows the evolution of the sugarcane industry, which went through the transition from the creation of the Sugar and Alcohol Institute (IAA), which was responsible for regulating the production and marketing of these products for the internal and domestic markets and protecting northeastern producers from competition with the state of São Paulo through government intervention in 1933-1990, to the creation of Planalsucar (Ridesa, an agency incorporated into the federal universities), which was responsible for producing a variety of sugarcane to stimulate the production of sugar and alcohol. Another important factor is the creation of the National Alcohol Program (*Proálcool*), which greatly contributed to the expansion of sugarcane plantations for the production of automotive fuel alcohol. This stimulated the creation of attached and autonomous distilleries in the three Brazilian states at the time of the 1st and 2nd oil shock (1975-1985) and the supply crisis (1986-1990) and deregulation (1991-2002) with the extinction of the IAA and the advent of the flex-fuel car in 2003 was an important milestone in the expansion of the sugar-energy sector.

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