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SUGAR CANE AGROINDUSTRY IN SÃO PAULO STATE, BRAZIL: AN OVERVIEW OF POLITICAL AND ENVIRONMENTAL IMPLICATIONS (1930-2002)

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ABASTRACT

Brazilian sugar cane agroindustry has been an issue of concern because of political and environmental implications. The modernization of sugar cane production has affected the environment and the Brazilian society, especially São Paulo State. This State has experienced a major transformation of sugar cane agroindustry since colonial times. Today, sugar cane production has been ranked as one of the most important agribusiness in São Paulo. This paper intends to give an overview of sugar cane agroindustry from 1930 up today with especial attention to government policies, environmental problems and social aspects.
KEY WORDS: sugar cane, São Paulo, agroindustry, agriculture, Proalcool

RESUMO

A agroindústria canavieira brasileira tem se destacado por suas particularidades políticas e implicações ambientais. A modernização da produção canavieira vem afetando não só o meio ambiente como também a sociedade brasileira, especialmente no Estado de São Paulo. Desde a época colonial este estado vem sofrendo grandes transformações na agroindústria da cana-de-açúcar. Atualmente a agroindústria canavieira está entre os mais importantes agronegócios paulista. Este artigo tem o objetivo de discutir o desenvolvimento da agroindústria canavieira, desde 1930, com atenção especial às políticas governamentais e implicações socioambientais relacionadas à agroindústria canavieira Paulista.
PALAVRAS-CHAVES: cana-de-açúcar, São Paulo, agroindústria, agricultura, Proalcool

I – INTRODUCTION

The economic importance of sugar cane emerges from the number of its alternative uses. Sugar cane is considered an industrial plant, which is used as raw material for the manufacturing basic food - sugar - and as a source for sub-products such as sugar cane syrup, aqua vitae, protein for ration, alcohol, bread ferment, cellulose, and fertilizer. Because of its higher value in the market, sugar cane crops represent an important source of income as well as employment for a significant number of people in rural areas. Besides it, sugar cane is directly connected with the agroindustry of sugar mills as well as alcohol distilleries and its production has large domestic and industrial consume inside and outside the country (SZMRECSÁNYI, 1979).

Sugar cane activity in Brazil has varied according to its level of industrialization, for example, traditional sugar mills and specialized distilleries. Traditional mills may use primitive methods to make sugar, syrup, and aqua vitae even though traditional processes in reality use considerable infrastructure and complex technology for manufacturing these products. Specialized distilleries constitute a complex business with political and economic importance, which will be discussed in this paper later.

Expansion and Cultivated Area of Sugar Cane in São Paulo

São Paulo State is a traditional sugar cane producer. Since the colonial times, it has had sugar mill farms. However, at that time, the state could not compete very well in the international trade due to its geography position. That is, Bahia and Pernambuco States, in Northeastern Brazil, which are closer to Europe than São Paulo, were able to provide cheaper sugar. Therefore, Northeast's sugar was exported to Europe while São Paulo's sugar was restricted to regional markets. This situation started changing during the second half of the 19th century when coffee expansion took place in São Paulo State. Coffee crop initially planted in Paraíba Valley began to expand westward in the São Paulo State, bringing population growth and economic activities into the state because of the immigrant laborer. Sugar cane crops followed the coffee routes due to its need. Sugar, however, was planted in small plots. The 1920s and 1930s were especial decades for sugar cane in São Paulo State because of two factors. Firstly, sugar demand became higher than its production in the state's market. Secondly, the coffee demand had dropped due to

international crisis, which opened an area for agricultural diversification into the state resulting in the expansion of sugar cane in areas where coffee plantations were abandoned (ANDRADE, 1994).

In the 1930's, São Paulo's sugar cane plantations were enhanced due to new mills that were installed in Ribeirão Preto, Sertãozinho, Bebedouro, Araraquara, and Jaboticabal cities. Also, the state started researching programs that led São Paulo to become self-sufficient. As a consequence, in the 1950s, this State became the largest Brazilian sugar producer. From 1931 to 1980, sugar cane expanded to an annual rate of 6.53% (average) (SANTOS, 1984; ANDRADE, 1994) (Table 1). As part of the modernization of agriculture, these programs focused on research related to soil management, pest and disease control, plant nutrition as well as genetic breeding programs.

Table 1. Cultivated areas of crops in São Paulo State (1933–1978).

	Crop Areas (1000 ha)				
Year	Sugar cane	Cotton	Coffee	Orange	Soybean
1933	33,4	108,8	2.214,7	33,7	-
1939	62,1	1.159,9	1.766,6	36,7	-
1945	100,6	1.706,5	1.192,7	28,9	-
1951	146,7	1.152,6	1.381,4	17,8	-
1954	209,2	1.115,3	1.451,7	15,7	-
1960	345,9	649,7	1.633,9	29,2	2,64
1963	396,7	698,6	1.358,5	45,9	3,06
1966	487,1	674,3	1.081,9	63,5	3,68
1969	496,0	448,9	785,2	79,9	15,35
1972	594,0	594,3	719,5	105,1	46,16
1975	675,3	421,1	659,3	271,4	125,43
1978	794,8	289,5	593,0	298,4	373,40

Source: Adapted from SANTOS (1984).

According to ANDRADE (1994), the trade growth in the 1950s led to the establishment of many mills in the West and Paranapanema regions of the state. Most of them started making aqua vitae and then, years later, transformed their production into sugar and alcohol. This was possible due to the use of equipment manufactured by metallurgical industries in São Paulo. By the middle of the 1970s sugar cane became the major crop in São Paulo State (Table 1).

The results of São Paulo's efforts to become a strong sugar cane producer started to appear in the 1970s. Research programs, which were developed by the state since the 1930s led São Paulo to have extraordinary yield results, compared to other states (Table 2). However, the demand of sugar cane products did not follow the sector expansion. According to ANDRADE (1994), it was very difficult for Brazil to trade its overproduction in the competitive international market. To solve this problem, Brazil started a new program, the National Alcohol Program (*Proalcool*), which will be discussed in the next section. But the expansion of sugar cane area in São Paulo State continued during the following years. Table 3 shows the increasing area and production by São Paulo, from 1984 to 2001, in comparison to selected states.

Table 2. Cultivated area and yield of sugar cane by states in Brazil (1970 – 1980).

	Cultivated Area and Yield by States							
	São Paulo		Pernambuco		Alagoas		Rio de Janeiro	
Year	Area (ha)	T/ha	Area (ha)	T/ha	Area (ha)	T/ha	Area (ha)	T/ha
1970	580,487	52.3	273,877	40.6	166,194	43.9	180,946	30.6
1980	1,073,120	67.3	380,509	47.2	380,151	46.8	199,655	35.4

Source: Adapted from ANDRADE (1994).

Table 3. Cultivated area and production of sugar cane by region in São Paulo State (1984-2001).

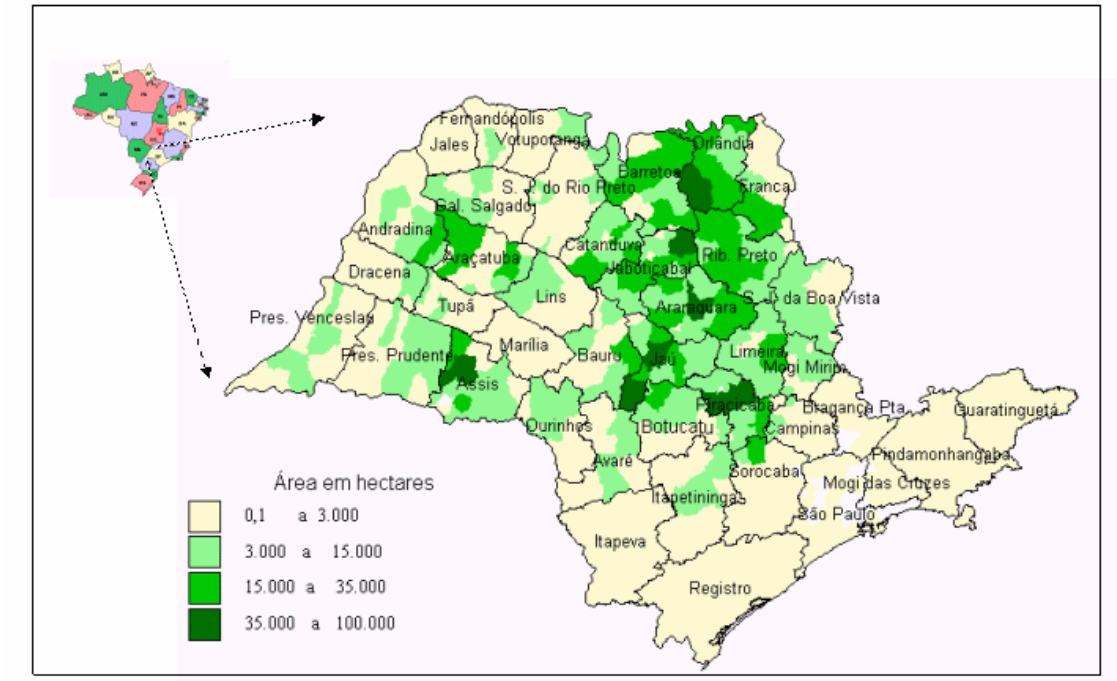
	Area (1,000ha)			Yield (1,000ha)		
Region	1984-89	1990-95	1996-01	1984-89	1990-95	1996-01
Rib. Preto	252	290	312	15,022	18,836	21,326
Jaú	177	204	223	11,710	13,676	15,546
Piracicaba	181	185	170	10,124	10,938	10,853
Araraquara	143	184	230	7,660	10,482	14,353
Orlândia	106	160	268	7,029	10,026	18,894
Jaboticabal	128	148	175	8,765	10,299	11,371
Limeira	125	135	143	8,694	9,692	10,078
Assis	116	126	138	7,491	9,266	9,420
Barretos	70	106	192	4,787	7,734	14,272
Catanduva	87	103	120	5,262	6,135	7,370

Total	1,384	1,640	1,972	86,546	107,084	133,483

Source: Adapted from VEIGA FILHO & NEGRI NETO (2002).

In 1975, after Proalcool implantation, many alcohol distilleries were installed in several regions of São Paulo State. With the possibility of car fuel production, which was the basic Proalcool's incentive, ranchers and farmers decided to invest in sugar cane crop for supplying raw cane needed by the distilleries. Additionally, distillery owners expanded the land areas, which they were leasing from landowners, what also contributed for spreading the crop over the state. In 1992, the State of São Paulo had 71 mills and 137 distilleries, contributing to 49.4% and 65% of Brazil' sugar and alcohol production, respectively (ANDRADE, 1994). In 1995, São Paulo's sugar cane ranked the second crop area in the state with 2,258,900 ha (IBGE, 1997). The toped city producers were Ribeirão Preto, Jaú, Assis, Jaboticabal, Piracicaba, Barretos, and Araraquara (Figure 1).

Figure 1. Distribution of sugar cane in The State of São Paulo (1995/96).



Source: CATI, Secretaria da Agricultura e Abastecimento do Estado de São Paulo (http//www.cati.gov.sp) (1996).

Sugar Cane Politics in Brazil

The politics of sugar cane has traditionally been oriented according to international market (CERRO, 1991). Sugar cane production has been a very important activity in Brazil because of its political and economic implications. The importance of sugar and alcohol derives firstly from the fact that sugar production has been highly relevant in the historical development of Brazil. Secondly, sugar cane products are a very important part of people's lives. Finally, sugar and alcohol's production is a political issue with a variety of social questions derived from the system such as land ownership and attitudes about working with the land. In Brazil, the Government has actively participated in sugar cane policies since the 1930s.

In the 1930s, the northeastern region of Brazil and Rio de Janeiro State were the leaders of sugar production in Brazil. These two regions competed for the international market, which was retracting at that time, and for south market of Brazil, which was consuming more than producing (ANDRADE, 1994). To solve this problem, the dictatorial government of president Getúlio Vargas took three basic actions: (1) created the Sugar and Alcohol Institute (IAA – Instituto do Açúcar e Álcool), (2) fixed productive quota for each state (Table 4), and (3) prohibited establishment of new mills in Brazil (SZMRECSÁNYI, 1979).

As reported by SZMRECSÁNYI (1979), according to the Federal Decree n. 22.789 of 07/25/1933, IAA major goals were:

> …"(a) Assegurar o equilíbrio interno entre as safras anuais de cana e o consumo de açúcar, mediante a aplicação obrigatória de uma quantidade de matéria prima, a determinar, ao frabrico do álcool;
> (b) Fomentar a frabricação do álcool anidro, mediante a instalação de destilarias centrais nos pontos mais aconselháveis, ou auxiliando as cooperatives e sindicatos de usineiros que para tal fim se organizarem, ou os usineiros individualmente, a instalar destilarias ou melhorar suas instalações atuais".

In other words, IAA had to achieve sugar industry by eliminating overproduction and stabilizing prices. Also, IAA's goal was to establish or improve distilleries to give solution for the problems of alcohol production.

In the 1940s, the exportation of sugar to the European market declined due to World War II. Internal and external producers, especially the Caribbean, supplied the USA and the United Kingdom, other possible markets for Brazil.

According to ANDRADE (1994), the IAA also lost control of the Brazil's sugar production because of problems with the system of boat transportation between South and North of Brazil that occurred at that time. However, for São Paulo State, in which production was lower than the demand, the situation was not unfavorable. The state was benefited with a new law in 1941 that guaranteed participation of the sugar producers (farmers) with 50% of raw cane to be used by Distillery owners. This led to the expansion of sugar cane cultivation in the state, especially over coffee areas.

By the early 1950s, the IAA reestablished sugar quota production in Brazil, which favored São Paulo. In other words, as the state was in process of industrialization and urbanization, demand for sugar increased substantially. With the expansion that occurred in the 1940s as well as the growth of the production, the Distillery owners of São Paulo acquired power and began pressuring the IAA to establish new mills and distilleries. In fact, many mills were installed and some of them were created from small farmer associations sponsored by governmental loans. Along with the growth of the internal sugar market in the 1950s, alcohol demand also had a significant growth, especially fuel alcohol (álcool anidro) that was mixed with gas. This fact led many mills to adjust their production for alcohol by using equipments manufactured in São Paulo State by corporations linked with the Distillery owners. In 1960, Brazil' sugar policy was guided for expanding exportation due to great production as well as retraction of the internal market due to Brazil's recession (SZMRECSÁNYI, 1979).

In part, Brazil's goals became reality due to the Cuban Revolution. The breakdown of the political relationship between Cuba and the USA, with subsequent suspensions of Cuba's sugar exportation to USA, opened a new market not only for Brazil but also for other Latin American countries. Cuba became member of the Socialist Group, which started to absorb all Cuba's sugar. This factor, however, was not enough to guarantee Brazil's stability in terms of sugar market. By the mid-1960s, Brazil had a overproduction, of sugar especially in São Paulo, increasing its quota about 30% in ten years (Table 4).

According to SZMRECSÁNYI (1979), sugar problems in the 1960s were related to two factors. Firstly, once more coffee was experiencing a crisis, which led the Brazilian Government to create new policies. That is, coffee producers were able to have loans from the Bank of Brazil for both removing coffee plantations and planting sugar cane. Secondly, many farmers who acquired loan from the Bank of Brazil were not register in the IAA. As a consequence, they did not have a sugar cane quota for production. Only in São Paulo State sugar cane had an expansion of about 22%. The IAA, which suffered many transformations since its establishment, weakened with these facts. The pressure from the distillery owners and other groups, such as distilleries manufactories, led the government to reorganize the sector (ANDRADE, 1994).

In 1971, the National Sugar-Cane Improvement Program (PLANALSUCAR) - a research program for discovering new sugar-cane varieties that could be more productive and more ecologically adapted - was created. Following that, the National Alcohol Program (Proálcool) was implanted.

Table 4. Quota of sugar production in Brazil by states, in percent (1933-1963).

	Pernambuco	Alagoas	Rio de Janeiro	São Paulo	Other States
1933	29.5	10.7	16.6	21.5	21.7
1951	28.9	9.4	15.2	23.8	22.7
1957	26.6	8.7	13.1	31.6	20.0
1963	22.7	8.4	11.9	40.8	16.2

Source: Adapted from SZMRECSÁNYI (1979).

Brazilian Government created Proalcool in 1975, under the administration of the Ministry of Industry and Commerce. The Proalcool's goal was to increase the production of agricultural crops used for generating energy as well as the improvement of the industrial alcohol process, which later would be used as gasoline substitute (MELLO & FONSECA, 1981). Proalcool's program was Brazil's first attempt to substitute gasoline, which had become very expensive due to the petroleum crisis in the 1970s. According to BARZELAY (1986), those who had committed their resources to alcohol production and consumption were: (a) large sugar cane producers, (b) small agricultural producers organized through cooperatives, (c) individual owners of alcohol powered cars, (d) multinational automobile companies, (e) the state owned Banco do Brasil, and the (f) World Bank.

As reported by ANDRADE (1994), Proalcool benefited distillery owners and distillery manufacturers. That is, Brazil's Government provided 90 percent loans for the establishment of new distilleries and 100 percent for sugar cane plantations. Besides it, interest was less than inflation and a long period of payment was offered. Distillery owners, agricultural producers, and ranchers invested in land to protect themselves against inflation that was approximately 65% per month. As alcohol production was the major and practically unique agricultural incentive promoted by the government at that time, there was an alcohol boom by the early 1980s.

As stated by BARZELAY (1986), the program certainly reached its goals at a specific point:

> …"As a result of extremely strong political and price signals, about 75 percent of the automobiles sold in 1983 were powered by alcohol engines. Investor interest in alcohol distilleries also revived during this critical period. By November 1983, Government had approved 452 distillery project (194 annexed and 258 autonomous) with a combined capacity of over 10 billion liters per year. Investments credits, while less subsidized than during earlier periods and unavailable for many other activities, were available for the alcohol sector. The provision of these financial resources was apparently linked, at least in part, to World Bank loans for the alcohol program".

In addition, Proalcool program was looked upon with special attention by many Latin American and Caribbean countries. As sugar price collapsed in the mid-1980s, many countries became interested in alternatives of derived product of the sugar cane. However, the Proalcool was not successful at all, making these countries question the validity of the program. Much of the loans responsible for the establishment and continuation of the program were not paid by the distillery owners. Therefore, Brazil's Government, especially Bank of Brazil accumulated enormous debt, which mostly contributed to the depletion of the Proalcool program in the 1990s (ANDRADE, 1994). The Proalcool was the major political and economic intervention on sugar cane since colonial times. Today, the government has not abandoned this idea yet, but multinational automobile companies decreased substantially the production of alcohol-powered car.

II – THE IMPLICATIONS OF SUGAR CANE CROP ON THE ENVIRONMENT

Since the late 1960s, Environment Impact Assessment (EIA) has become an important topic studied in the international agenda with the idea of "to prevent is better than remedy" (AB'SÁBER & MÜLLER-PLATEBERG, 1998). The intensification of sugar cane production in São Paulo, brought by Proalcool's establishment, has become an important issue for EIA investigations. Although much importance has been given to EIA, few studies reporting sugar cane ecological impacts in the last thirty years, in São Paulo State, has been done. There are no scientific data to show the total implications of the sugar cane agroindustry on the environment. However, possible problems that have been affecting the environment due to agricultural and industrial impacts can be pointed out.

Agricultural Implications

Basically, sugar cane impacts on the environment are related to (a) agricultural operations, (b) chemical fertilization of soils and, (c) chemical control of pests and disease.

Agricultural operations: sugar cane agricultural operations include several procedures, which use heavy machinery. These procedures include tillage operations, planting, cultural practice, and harvest/transport. Tillage operations affect physical soil qualities due to its intensive use of equipments such as disc plow and subsoiler, which are used for soil preparing. These equipments move larger portion of soil working at a depth of 30-45 cm (PLANALSUCAR, 1980). This same situation is observed when using furrowers, which are employed for planting purposes. Agricultural practice, mechanized harvest, and transport harden the soil due to the repeatedly activities with heavy machinery and trucks. That is, if the soil becomes hard, water cannot penetrate normally, causing soil erosion (CASSOL, 1984). Non-mechanized harvest can also affect the environment because, usually, sugar cane is burned before it is cut and transported. Brazilian Agricultural Research Corporation (EMBRAPA) and National Spatial Research Institute (INPE) have recently monitored sugar cane burning in São Paulo by using remote sensing in order to analyze atmosphere effects for future conclusions.

Chemical fertilization of soils: it has been used in 100% of sugar cane cultivation (Table 5). Although chemical fertilization increases yield, when used excessively, it can affect biological and chemical soil qualities, with the risk of contaminating underground water and rivers immediately (AB'SÁBER & MÜLLER-PLATEBERG, 1998). As distilleries are usually located close to the cities, entire populations who use these waters are at risk of being contaminated.

Chemical control of pests and diseases: generally, pest and disease control procedures are made by using chemical products though biologic control has been used for specific insect (PLANALSUCAR, 1980). Continue use of chemical products in tropical regions declines biodiversity among insect and animal populations. Therefore, it can streamline environments decreasing their balance (AB'SÁBER & MÜLLER-PLATEBERG, 1998). Additionally, temporary workers known are exposed to chemical products all day long and in many cases without protection.

Table 5. Technology applied on the sugar cane cultivation in The State of São Paulo, in percent (1971-1980).

Technology	1971	1975	1980
Mechanized tillage	94	96	97
Mechanized planting	22	40	27
Mechanized cultural practices	35	38	50
Mechanized harvest	8	9	21

Use of chemical fertilizers	85	99	100

Source: Adapted from SANTOS (1984).

Industrial Implications

Sugar cane industrial implications are those related to sub products brought by the alcohol and sugar production. Residue and vinasse resulted from alcohol distillation, were discharged into the rivers causing water pollution. The distilleries have tried to solve this problem by using these sub products as fertilizers, which have presented satisfactory results in terms of yield (PLANALSUCAR, 1980). However, there are not studies about the affects of long-term usage of these sub products on the soil.

III – THE IMPLICATIONS OF SUGAR CANE ON THE SOCIETY

The modernization of sugar cane production, which began in the 1960s and was enhanced in the 1970s with Proalcool, has affected productive units and workers. Mills and distilleries constantly have changed the productive systems due to the market demand. In order to decrease costs, yield improvement and mechanization are becoming common among sugar cane agroindustries. These practices, which benefit mill and distillery owners, have gradually been introduced to the agricultural systems and also have diminished labor for rural workers. Yield improvement has been possible thanks to the discovery of new sugar cane varieties that shorten the plant cycle, offering more resistance against pests and diseases, and increasing plant life capability making possible gradual reduction of required labor.

According to SCOPINHO & VALLARELI (1995), mechanization first took place in tillage operations during the 1960s, which permitted total substitution of the rural workers by equipment. In the planting operation, the combination of equipment and rural worker decreased the time of activity and required labor. In cultural practices, mechanization decrease approximated 35% the cost of operation and improved fertilizer efficiency. Harvest and transport, the last stage of agricultural operations currently have been mechanized and improved.

Harvest mechanization started in the 1970s but was not successful due to high cost and technical problems. Also, at that time rural laborers were numerous and had less paid income. Basically, three social-economic facts brought back harvest mechanization projects in the 1980s. First, rural workers organized themselves and acquired better income. Second, lower rate of government loans was made available for improving technology of harvest machinery. Last, ecological movements were organized to enforce new laws protecting environment such as the prohibition of sugar cane burning one kilometer far from the cities (Decree n. 28.895 of 09/20/98). In the 1990s new harvest machines have been introduced to the sector making the harvest costs decrease one third. Also, studies have demonstrated that in one day of work, a harvest machine can replace the labor of 137 workers (SCOPINHO & VALLARELI, 1995).

The city of Ribeirão Preto, the most developed sugar cane area in the state, has approximated 30% of mechanized harvest. The state legislation has changed since the year 2000 in order to regulate the burns that occurs before traditional harvest. The new legislation foresees the end of burns by the year 2031 (FERRI, 2003). But, according to USTULIM & SEVERO (2004), the establishment of mechanized harvest has become very difficult because of many factors, such as: (a) mechanized harvest can only occurs in slope of 12% or less, which eliminates 45% of sugar cane plantations in São Paulo; (b) mechanized harvest can harden the soil because of the equipments that can weight 17 ton or more, which can lead to decrease of production in long term.

Harvest is the most important period for rural workers in sugar cane production, which is basically subdivided in two phases, a) when labor offer is high, and b) when labor offer is low or unstable. The first situation brings better income, therefore better life for local workers and outside workers who migrate during this time of the year. A study in 1981 cited by SCOPINHO & VALLARELI (1995), shows that from a sample of 443 migrants 80,6% migrated because of the work and 43% stayed in the sugar cane region. On the other hand, the second situation (non-harvest), represents uncertain moments when men and women have to find other jobs in rural or urban areas that are usually in other crops, civil construction, or yet as a maid or trash recycler, etc.

Cities rounded by sugar cane do not have sufficient jobs to absorb rural workers whom increasingly migrate to the urban areas. The urbanization rate has significantly increased, especially in Ribeirão Preto that has the third rate of the state (Table 6). Although sugarcane agroindustry bring economic development to the interior of the State of São Paulo, many problems yet have been observed among rural workers. Life conditions sometime are not good as expected. Many workers, who left rural areas for cities, live in inadequate conditions especially in the outskirts. Even living in the cities, rural workers (bóias-frias) make long journey every day going to sugar cane plantation without knowing what time they will be back home. Some distilleries offer dormitories for homeless but life conditions in them seem to be not so good and many go to the cities or go back to their places of origin (SCOPINHO & VALLARELI, 1995).

Table 6. Urbanization rate of selected cities in The State of São Paulo (1980-1991).

	Urbanization Rate (%)			
	Ribeirão Preto	Araraquara	Barretos	Franca
1980	88.25	82.07	79.42	83.01
1991	93.37	88.60	87.90	89.73

Source: Adapted from SCOPINHO & VALLARELLI (1995).

IV – CONCLUSIONS

Historically, the expansion of sugar cane production in São Paulo State occurred due to several factors, including sugar demand due to urbanization and international market. Research programs developed by the State of São Paulo also played an important hole in sugar cane production. Politics, however, can be pointed out as one of the most important factors associated with sugar and alcohol productions. Programs such as IAA and Proalcool were strongly motivated by government in an attempt to regulate sugar production and stimulate alcohol production as a car fuel. Although these programs partially reached their goals, they also reflected in economic problems. Political interests in sugar and alcohol production, which resulted in large sugar cane cultivation, reflected on the environment. Today sugar cane production is still a factor that compromises the environment. Although the politics have been not playing a strong hole on sugar and alcohol production as it occurred in the past, sugar cane is still the second crop in São Paulo State. Therefore, there is a need for more studies and researches that can identify the total implication of sugar cane on the environment. Mechanization of sugar cane cultivation has also affected the environment. Additionally, a social implication has resulted from modernization of sugar cane production. Considering that modernization is expected to occur as associated with agriculture, social implications would be a concern.

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