

## EVOLUTION OF THE SUGARCANE INDUSTRY IN THE SÃO PAULO STATE

*Luiz Carlos Corrêa de Carvalho*

### INTRODUCTION

The evolution of the sugarcane fields in the São Paulo State in the 2000s shows an annual growth of 10.3% in products volume over the last eight years, demonstrating a significant investment in this industry. As far as products are concerned, sugar had a yearly growth of 10.3%, the same rate as ethanol! This was not by mere coincidence, as this analysis will show. Among the ethanol products, the anhydrous (which is a gasoline additive) grew 4.2% per year, and the hydrated (car fuel) increased 16% per year. This difference in growth is directly related to the breakthrough caused by the launch of flex-fuel (ethanol/gasoline) cars, in view of the impressive acceptance of this product in the Brazilian market. Between 2005 and 2008, forty new plants focusing on the production of hydrated ethanol were installed in the São Paulo state. The sugarcane products mix in this state varied around 50% throughout this period, exceptions made to 2007 (47%) and 2008 (42%). The figures show a trend toward increasing ethanol in the mix. However, it is something to be observed in the next São Paulo state harvest seasons, with a potential period (over the next two years) of higher prices for sugar and, very likely, a new reversion toward ethanol. This will happen until the time when it becomes a global commodity, eliminating these sugar-ethanol shifts.

This reality opens an important outlook for analysis and R&D to be done in the socio-economic and agro-industrial fields, always from the stance

of sustainability and added value. The greenfields expansion has been showing internal return rates from such projects in São Paulo between 13% and 15%, depending on internal competitiveness (productivity/costs) of the projects, their technology, handling and logistics.

The effect on the whole industry production chain displays investments and expansions before the agro-industrial production, in the fuel distribution, in the co-generation of electric power and in the automotive chain.

### THE SÃO PAULO STATE SUGARCANE FIELDS (PLANTATIONS WOULD BE BETTER)

The São Paulo state, responsible for 69% of the sugarcane milling in the Center-South Region, was divided in six large areas, as shown on Figure 1.

To show the evolution of the São Paulo state sugarcane fields, an attempt was made to use the TRS (Total Recoverable Sugars) index, which represents the end products placed in domestic and foreign markets, as shown on Table 1 below.

The two columns on Table 1 show the fantastic growth of the sugarcane fields and their products in the new expansion area in the Western São Paulo state (Araçatuba) area which, in a seven-year period grew its weight in São Paulo by 6%; on the other hand, the traditional regions of Piracicaba, Ribeirão Preto and Jaú lost their relative weight; Assis remained stable; and only Catanduva grew, in an impressive way.

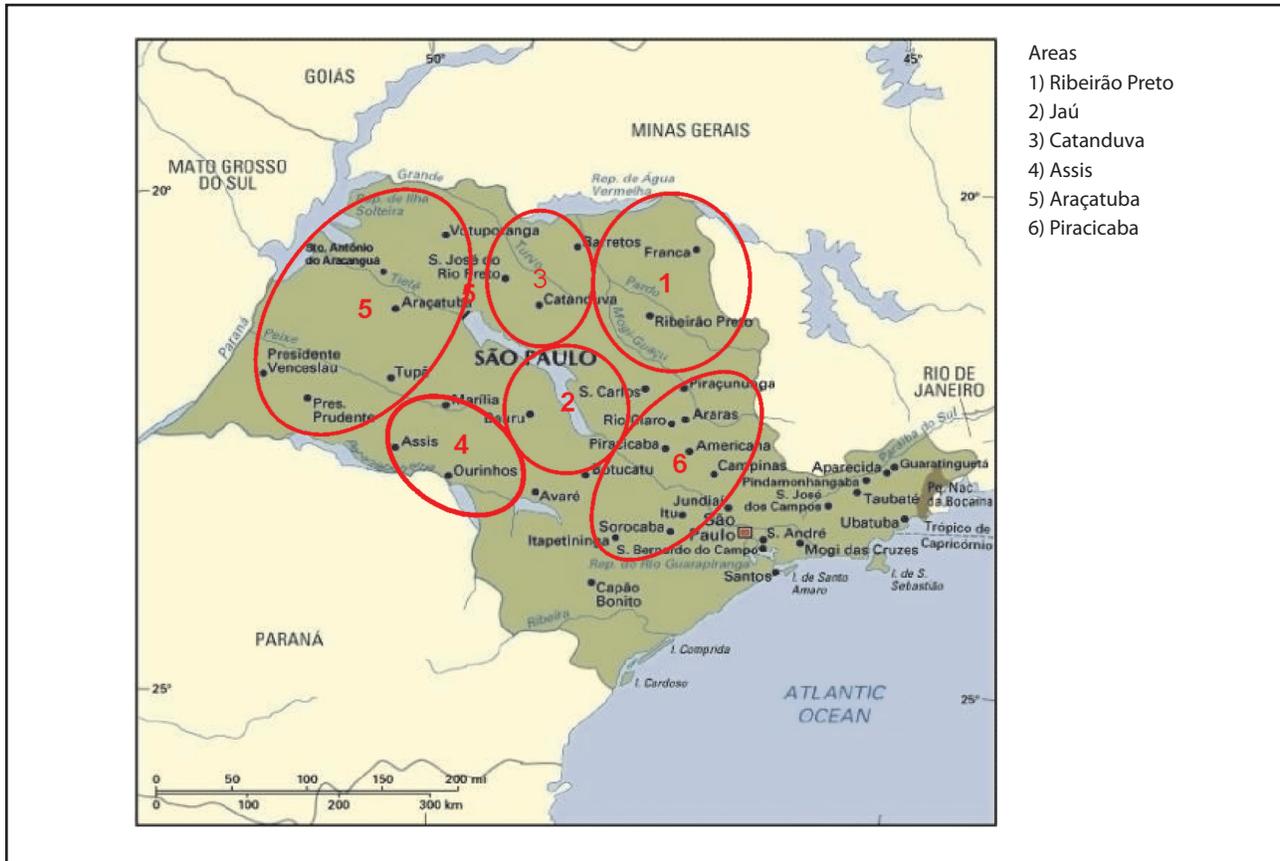


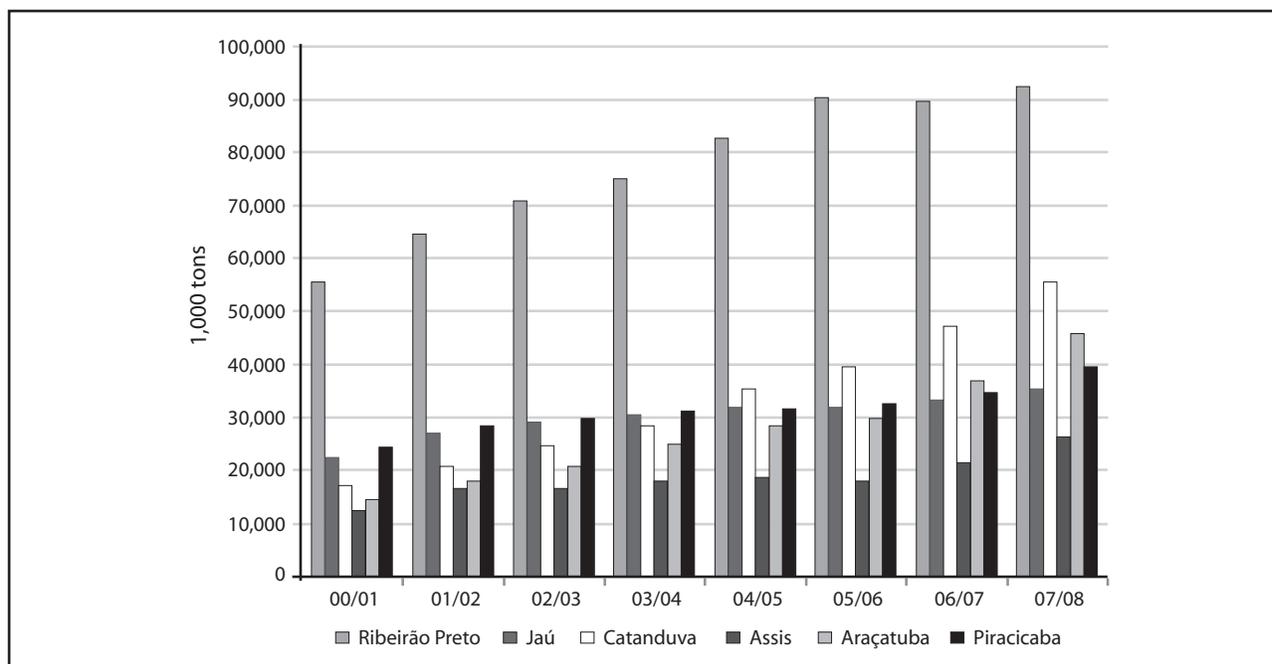
FIGURE 1 Regions from São Paulo State used in the present analysis.

TABLE 1 Growth in the great areas defined in the São Paulo state – TRS\*.

Areas	Annual growth rate (2000/2001 – 2007/2008) (%) – ATR	Weight in the total TRSs offered (%)	
		2007/2008	2000/2001
Assis	10.87	8.62	8.31
Araçatuba	18.19	15.39	9.49
Catanduva	17.52	18.93	12.14
Jaú	6.83	12.27	15.34
Piracicaba	7.19	12.87	15.71
Ribeirão Preto	7.17	31.91	39.01
São Paulo	10.29	100.0	100.0

\* TRS – Total Recoverable Sugars.

Source: Producers database – production; Unica; compilation Canaplan.



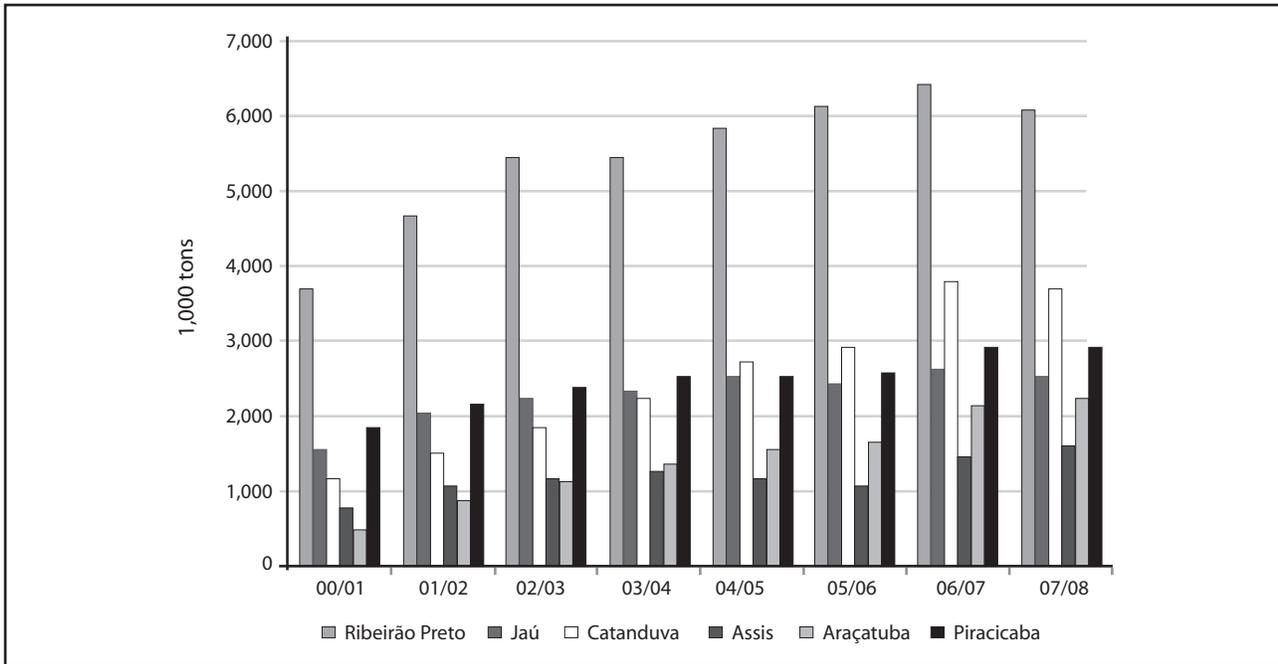
Source: Producers database – productions; Unica; compilation Canaplan.

GRAPH 1 São Paulo: sugarcane production per region.

TABLE 2 Evolution of offer of sugarcane products – São Paulo state.

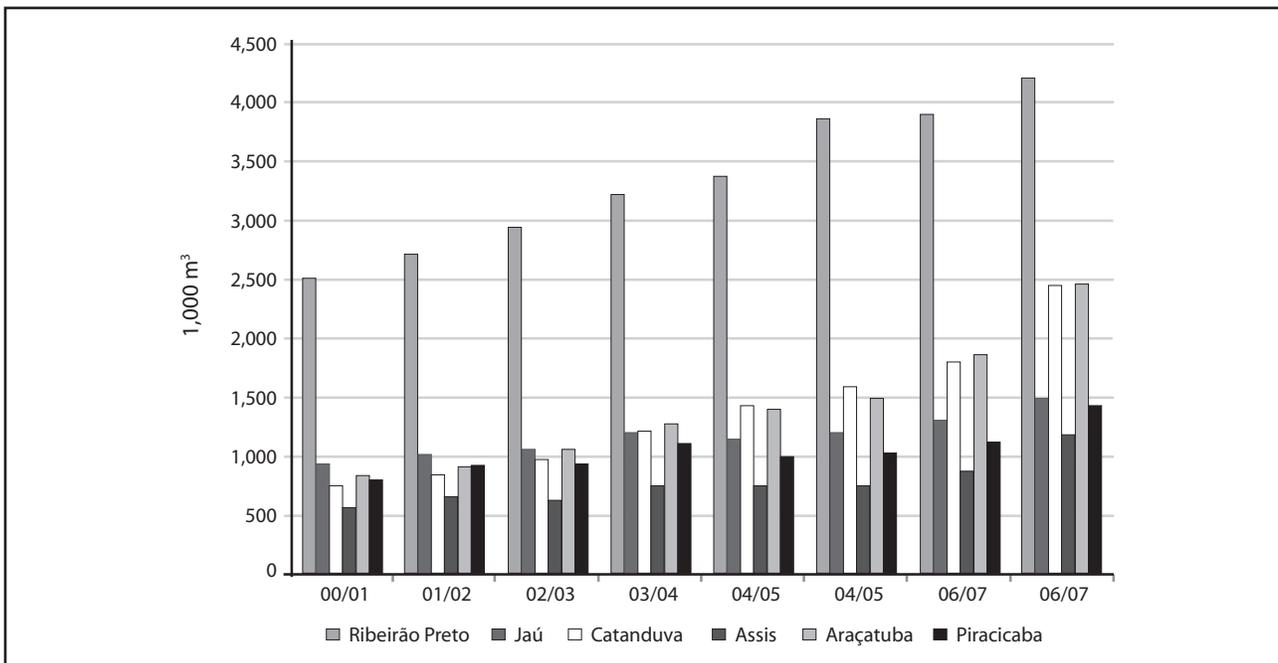
Areas/Harvest	Sugar (million metric tons)			Ethanol (billion liters)					
	2000/2001	2007/2008	Annual rate (%)	Anhydrous			Hydrated		
				2000/2001	2007/2008	Annual rate (%)	2000/2001	2007/2008	Annual rate (%)
Assis	0.79	1.68	11.38	0.60	0.70	2.23	0.39	1.29	18.64
Araçatuba	0.55	2.35	23.05	0.77	1.34	8.24	0.72	2.87	21.84
Catanduva	1.26	3.88	17.43	0.61	1.33	11.78	0.74	2.85	21.24
Jaú	1.64	2.66	7.15	1.03	0.97	(0.85)	0.62	1.60	14.50
Piracicaba	1.95	3.01	6.40	0.92	1.03	1.63	0.51	1.44	15.98
Ribeirão Preto	3.87	6.37	7.38	2.49	3.22	3.74	2.01	4.00	10.33
<b>São Paulo</b>	<b>10.06</b>	<b>19.95</b>	<b>10.27</b>	<b>6.43</b>	<b>8.59</b>	<b>4.22</b>	<b>4.98</b>	<b>14.05</b>	<b>15.97</b>

Areas/Harvest	Ethanol (billion liters)		
	2000/01	2007/08	Annual rate (%)
Assis	1.00	1.99	10.33
Araçatuba	1.49	4.21	16.00
Catanduva	1.35	4.19	17.56
Jaú	1.66	2.57	6.44
Piracicaba	1.43	2.47	8.12
Ribeirão Preto	4.50	7.22	6.99
<b>São Paulo</b>	<b>11.41</b>	<b>22.65</b>	<b>10.29</b>



Source: Producers database – productions; Unica; compilation Canaplan.

GRAPH 2 São Paulo: sugar production per area.



Source: Producers database – productions; Unica; compilation Canaplan.

GRAPH 3 São Paulo: alcohol production per area.

On every new harvest since 2000, it is possible to see the actual growth of each of the featured areas, as shown on Graph 1.

It is interesting to notice the logic in the growth of sugarcane products in the state, the relevant differences being shown on Table 2.

A few interesting facts may be observed from Table 2 about the options for products growth among the various areas in the São Paulo state. While the traditional sugar areas of Ribeirão Preto, Jaú and Piracicaba grew around 7% per year in sugar and ethanol, the Araçatuba and Catanduva areas showed considerably higher rates. In the early 2000s, Araçatuba had a small sugar production that increased more than four times, the ethanol offer increasing threefold; Catanduva, on its turn, increased both products threefold.

The sugar and ethanol offers are shown on Graphs 2 and 3.

The weight of the Araçatuba area in the ethanol offer is evidenced in this recent evolution of the São Paulo state.

Basically the increased products offer in the industry was accomplished by expanding the existing units. In most cases, growth took place in two stages, as it may be observed:

- Until 2003/2004 with the crises that resulted from ethanol-only fueled cars, when investments were focused on sugar and anhydrous ethanol.
- After 2004, shift to hydrated ethanol, mostly from the reality of flex-fuel cars and their amazing growth.

It was precisely from the new reality of the domestic market growth for hydrated ethanol, as well as the outlook for sugar and the potential represented by the growing international market for ethanol, added to the worldwide priority to fight global warming and the beginning of the astounding rise in oil prices, that new investments in sugarcane began to take place at considerable speed.

The quantity of new units (greenfields) implemented in the São Paulo state from 2004 on is shown on Table 3.

It is interesting to note that – differently from what some might imagine – there were also investment only for sugar, sugar and ethanol and, as a majority, only for the production of ethanol, many of them also aiming at selling surplus electricity. In the recently closed 2008/2009 harvest season, 13 new units began the harvest milling 8.72 million tons of sugarcane, 368,000 metric tons of sugar, and 533 million liters of ethanol (76% for hydrated).

Examining the mix (different products obtained for each ton of sugarcane processed), it is noticeable that for the period under study (harvest seasons 2000/2001 through 2007/2008) in São Paulo began and ended with 46.9% for sugar. The maximum for sugar was 52.2%, as well as there is a clearly visible drop in the offer of anhydrous ethanol (from 29.94% to 20.17%) and the increase in hydrated ethanol (from 23.21% to 32.99%) in São Paulo. Nevertheless, the mix for alcohol went from 53.15% to 53.16%!

This simple analysis allows us to observe that, among the states in the Center-South Region, São Paulo keeps, in fact, a “sugar” pattern. Even so, it is known that the 2008/2009 harvest season showed 61% for alcohol in the mix, after two years with ethanol prices better than those for sugar, as shown on Graph 4.

On Graph 4, it may be observed that – except in the new Araçatuba sugarcane expansion area – the other areas use, in average, above 50% of milled sugarcane to produce sugar.

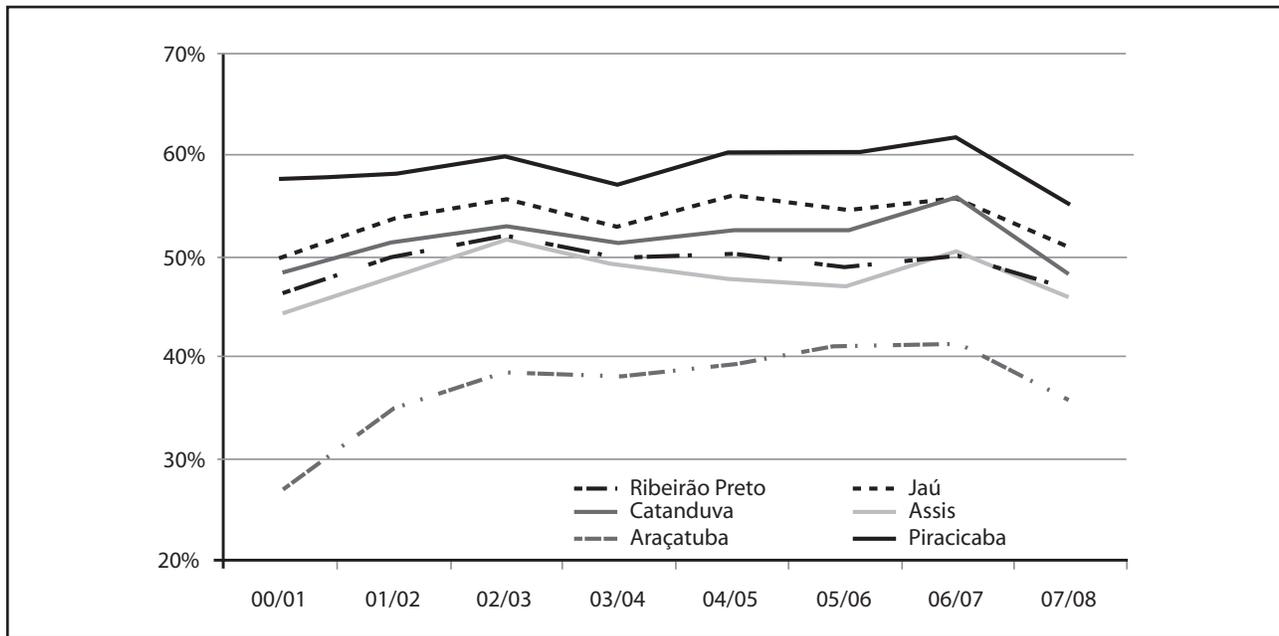
**TABLE 3** Evolution of greenfields in the São Paulo state – 2005 to 2008.

Year	Number of units
2005	03
2006	13
2007	11
2008	13
Total	40

Source: Database – UDOP; compilation Canaplan.

## TRENDS IN PRODUCTION EXPANSION IN SÃO PAULO, PRODUCTS, TECHNOLOGY AND PRODUCTION SCALE

Overall, the stages of the sugarcane agro-industry in São Paulo, since the Proalcool (1970s) are initial investment in ethanol, followed by the implementation of a sugar plant, and later, the co-generation of electric power. In the late 1990s, plummeting hydrated ethanol sales led to sugar; with the increased sales of flex-fuel cars and better



Source: Producers database – productions; Unica; compilation Canaplan.

**GRAPH 4** São Paulo: sugar mix per area.

prices for hydrated ethanol, the expansion toward ethanol and electric power took place. It is worth noting that there were investments focused on exporting ethanol.

The continued positive growth of the Brazilian GNP began to raise some clear concern over a potential electric power crisis, due to the scarce investments to increase the offer to face the demand growth. The possibilities of expanding electric power supply by means of co-generation in the sugarcane industry became part of the governmental program for this purpose: Proinfa. The expansion of sugarcane fields in São Paulo would allow, in addition to ethanol, a considerable increase in the offer of electric power during the dry season, supplementing hydroelectric power. The fact is that, based on the success of increasing the sugarcane offer, its products became the second most important source of primary energy, after oil products.

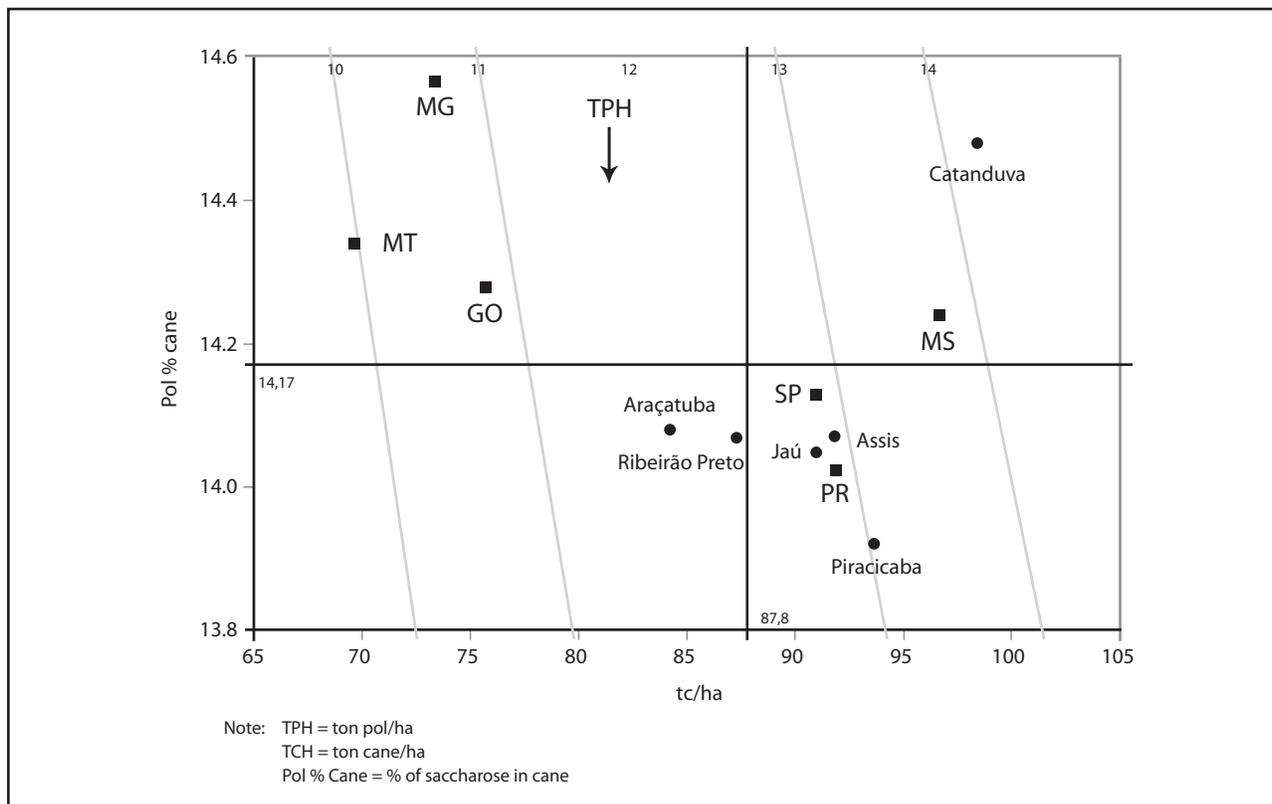
The analysis of the facts and the reality of improved infrastructure and logistics conditions in São Paulo state ports – both for sugar and ethanol – will take producers, as a trend, to seek plant flexibility and, in future development, to diversify

and add value to the products and sub-products of the sugarcane industry.

A few areas in the state are still capable of further expansion of sugarcane fields. These areas, mostly in the West of São Paulo state and located between the Tietê and Paranapanema rivers, show this capability. Likewise for the mentioned areas, other areas should also display a likely clustering effect, with acquisitions and mergers, seeking a larger agro-industrial scale. As a trend, this has already been taking place, and may occur significantly faster in the next five years, **post-crisis**.

From the technological standpoint, the São Paulo state displays relevant variation in productivity, due to soil and climate diversity, resulting in different productive potentials, for which managerial efficiency and the use of proper technology will be essential.

In the 2008/2009 harvest, the final productivity results measured in TPH (metric tons of saccharose per hectare), dedicated to the production of sugar and ethanol, show the Greater Catanduva area as the most productive, followed by Piracicaba, Assis, Jaú, Ribeirão Preto and Araçatuba. The Mato Grosso do Sul state stands between the



Source: Canaplan.

**GRAPH 5** Productivity x cane quality – harvest 2008/09 – Central-South – until December.

**TABLE 4** Agricultural productivity – t/ha – São Paulo and Center/South Region (up to Dec. 2008).

Areas	1 <sup>st</sup> cut		Ratoons					Average	Average number of cuts (index)
	Year/Winter	Year and a half	2 <sup>nd</sup> cut	3 <sup>rd</sup> cut	4 <sup>th</sup> cut	5 <sup>th</sup> cut	Others		
North (Ribeirão Preto)	96.9	113.7	95.4	84.6	75.6	71.4	75.2	87.3	3.32
Central (Jaú)	101.1	126.9	100.7	83.1	79.5	67.9	80.5	91.0	3.44
Northwest (Catanduva)	116.8	126.5	103.5	90.1	77.6	69.7	78.4	98.4	2.86
Southwest (Assis)	97.0	122.4	100.1	90.4	75.8	74.1	73.7	91.8	3.35
West (Araçatuba)	102.4	106.4	90.5	77.4	67.5	64.0	70.8	84.2	3.13
Southeast (Piracicaba)	103.6	131.5	101.7	88.1	79.2	73.0	77.9	93.7	3.21
São Paulo	102.4	120.1	98.6	85.6	76.2	70.0	76.0	90.9	3.18
Center-South	101.5	115.9	94.7	82.7	74.4	68.0	73.0	87.8	3.20

Source: Canaplan.

**TABLE 5** Pol (%) cane – PC – 2008/2009 harvest.

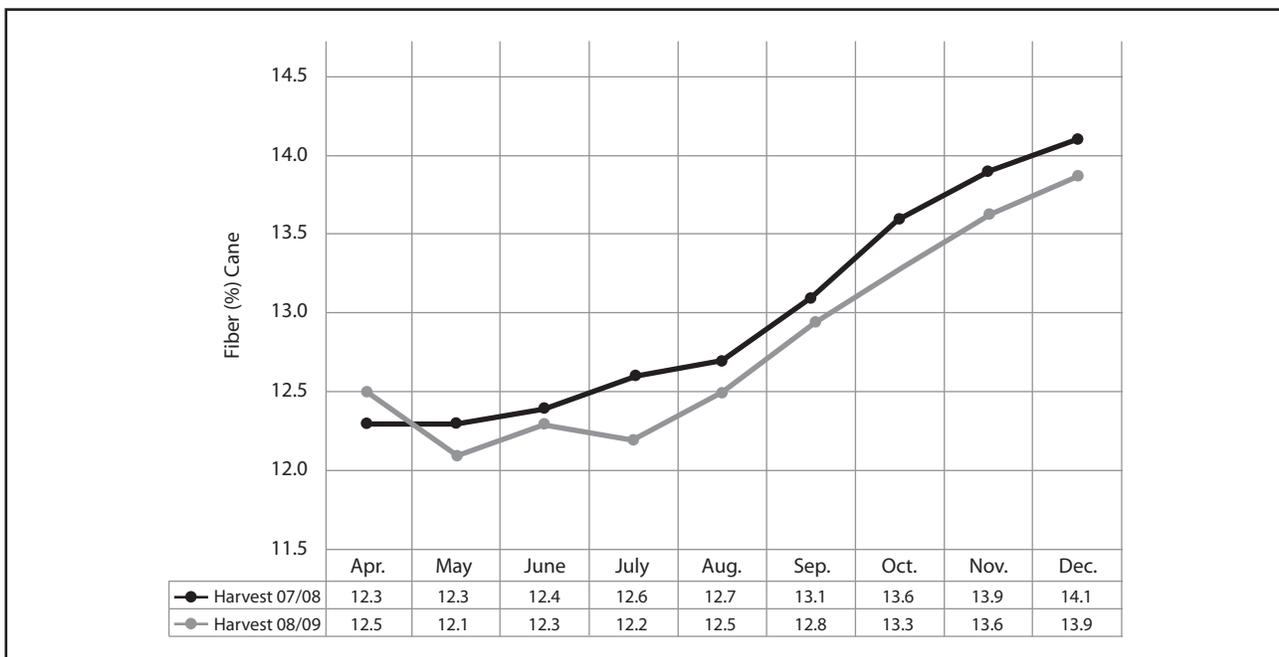
Areas	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Acc.
North (Ribeirão Preto)	–	10.64	11.59	12.87	14.47	15.09	15.87	15.38	14.06	13.38	14.07
Central (Jaú)	–	11.62	12.14	12.98	14.12	14.95	15.55	15.21	14.34	13.94	14.05
Northwest (Catanduva)	–	11.50	12.26	13.34	14.55	15.26	16.04	15.64	14.59	14.08	14.48
Southwest (Assis)	–	12.58	12.72	13.31	14.01	14.41	15.07	15.33	13.89	–	14.07
West (Araçatuba)	11.54	11.20	12.36	12.85	14.18	15.01	15.59	15.36	14.33	13.60	14.08
Southeast (Piracicaba)	–	11.60	12.66	12.99	13.94	14.53	15.07	14.77	14.13	13.55	13.92
São Paulo	11.54	11.36	12.15	13.03	14.28	14.97	15.65	15.31	14.28	13.72	14.13
Center-South	11.46	11.42	12.19	13.09	14.32	15.06	15.71	15.31	14.18	13.51	14.17

Source: Canaplan.

**TABLE 6** TSR – 2008/2009 harvest (December 2008).

Areas	TSR (kg/ton sugarcane)
North (Ribeirão Preto)	138.9
Central (Jaú)	138.9
Northwest (Catanduva)	143.3
Southwest (Assis)	139.3
West (Araçatuba)	139.5
Southeast (Piracicaba)	137.4
São Paulo	139.7

Source: Canaplan.



Source: Canaplan.

**GRAPH 6** Fiber (%) sugarcane – harvest 07/08 x 08/09.

first two, while the Paraná state is between Assis and Jaú, as shown on Graph 5.

Upon separating the agricultural productivity aspect, some areas become noticeable for their results below the São Paulo state average, in this case partially explained by a meteorological event in the year (Ribeirão Preto) and, in the case of Araçatuba, by actually higher water deficits in some months of the year, as shown on Table 4.

Considering the raw material quality, measured by pol % cane (saccharose), most areas are below the São Paulo state average, due to the outstanding performance of the Catanduva area:

However, considering industrial efficiency, TSR (total sugars recovered) results are lower than in the preceding years for each area in the state, for the 2008/2009 harvest in December 2008, as shown on Table 6.

Another relevant measurement (fiber % cane) also reflects regional differences, and will be an important source of energy, either as electricity or raw material (bagasse and trash) for producing cellulose ethanol.

## FINAL CONSIDERATIONS

Sugarcane fields development in the São Paulo state, in view of productivity and logistic issues, tends to seek, among other aspects, scale, diversity and added value. If the industrial flexibility logic came to be for reasons including even the unbalanced growth of market opportunities and their price volatility cycles shifting between sugar and ethanol, the new order of competitiveness calls for focus, investments in technology and a vision of the agro-industry as a bio-refinery.

If the internal return on investment in standard ethanol and electric power projects is around 13-15% in the São Paulo state, only added value and agro-industrial efficiency will be able to improve this financial return.

The most relevant issues involve the search for more productive kinds of sugarcane, either for

sugar or for power, resistant or tolerant to the major diseases and pests and responsive to drought and irrigation.

On the other hand, the planting mechanization process will tend to follow the one in harvesting, with precision agriculture, and using not only the stalks, but the tips and trash as well.

Biorefineries will be the delivery point of high agricultural yield, focusing on biotechnology and chemistry, adding value to the business.

The effect of these sugarcane fields on the local society and environment, under the logic of the production chain as a whole, should be measured more accurately. Certification of the products achieved will benefit exporters.

Carbon credits will be more valuable, as well as a source of funds and industry awards.

Efforts in R&D should be backed by essential investments in communication and industry image, in addition to pilot plants and fields for demonstrating new technology.

Major efforts in R&D would be:

- a. High-yield varieties intended mostly for producing sugar and ethanol, but also for electricity or cellulose ethanol. Such effort shall encompass not only traditional breeds, but also GMOs, both for resistance/tolerance and for irrigation.
- b. Efforts concentrated on natural enemies for pest control and biomass-originated herbicides.
- c. Technically improved irrigation.
- d. Planting and harvesting mechanization, exploiting all the biomass from the sugarcane.
- e. Large-scale and lower-cost efficient transportation.
- f. Biorefineries with value-adding processes, both in biotechnology and chemistry, including the conversion of carbohydrates into green hydrocarbons, and the use of by-products.
- g. Intelligent investments in logistics and port infrastructure.

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