

CTC

Centro de Tecnologia Canavieira



**Alcoholic Fermentation: Industrial Technology Evolution
and Future Perspectives**

**Fermentação Alcoólica: Evolução da Tecnologia
Industrial e Perspectivas para o Futuro**

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**V Semana de Fermentação Alcoólica
“Jayme Rocha de Almeida”**



Brazil as an Emerging Power: The View from the United States

Shannon O'Neil CFR

RECOMMENDATIONS

- Brazil's rise as an economic and global emerging power has finally been recognized by the US. To leverage this interest, Washington needs to strengthen the policy community dedicated to Brazil to ensure more thorough and consistent attention to US–Brazil relations.
- Despite the potential, an ambitious 'special relationship' may be difficult to achieve. Too many differences in policies and priorities remain, particularly over security and trade. This is most evident in the context of regional leadership and a broader vision for the Americas.
- Bilateral relations should focus on a more permanent dialogue on many issues, thus converting growing areas of interest into concrete action and policy.
- The US and Brazil should identify clear issues and strategies of mutual interest to start deepening the bilateral partnership and multilateral engagement. *Energy and climate change*, as well as global financial stability, are good starting points.
- *The biofuel industry and associated technology development* is an area of mutual interest that satisfies national and multilateral ambitions on climate change. This is an obvious point of intersection where bilateral co-operation would have a global impact.



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CTC 40 years

Brazilian Ethanol Cost Evolution



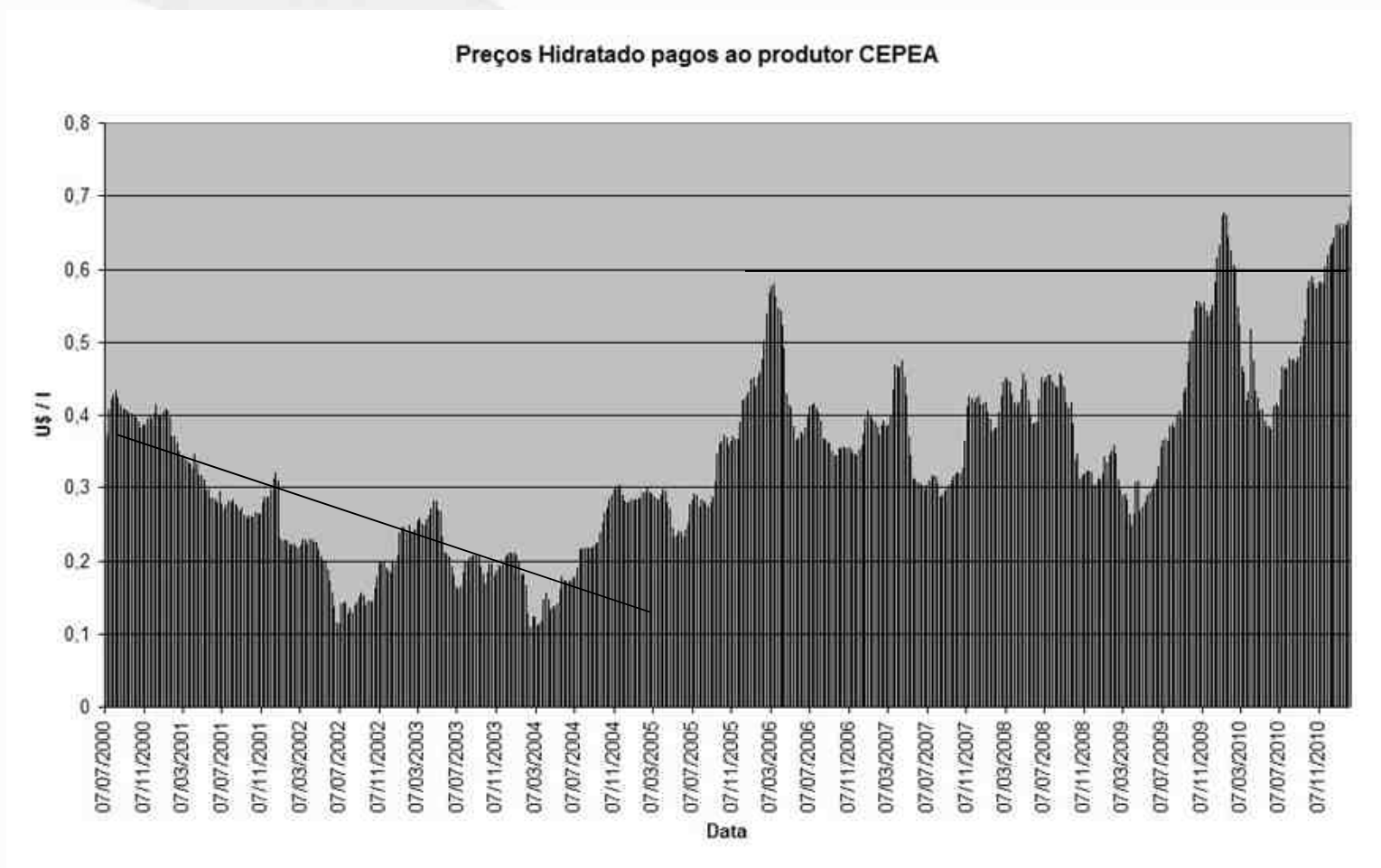
DEFLACIONADOS PELO IGP-DI - valores de julho de 2005

- Preços aos produtores sem impostos

- 1976 = base 100

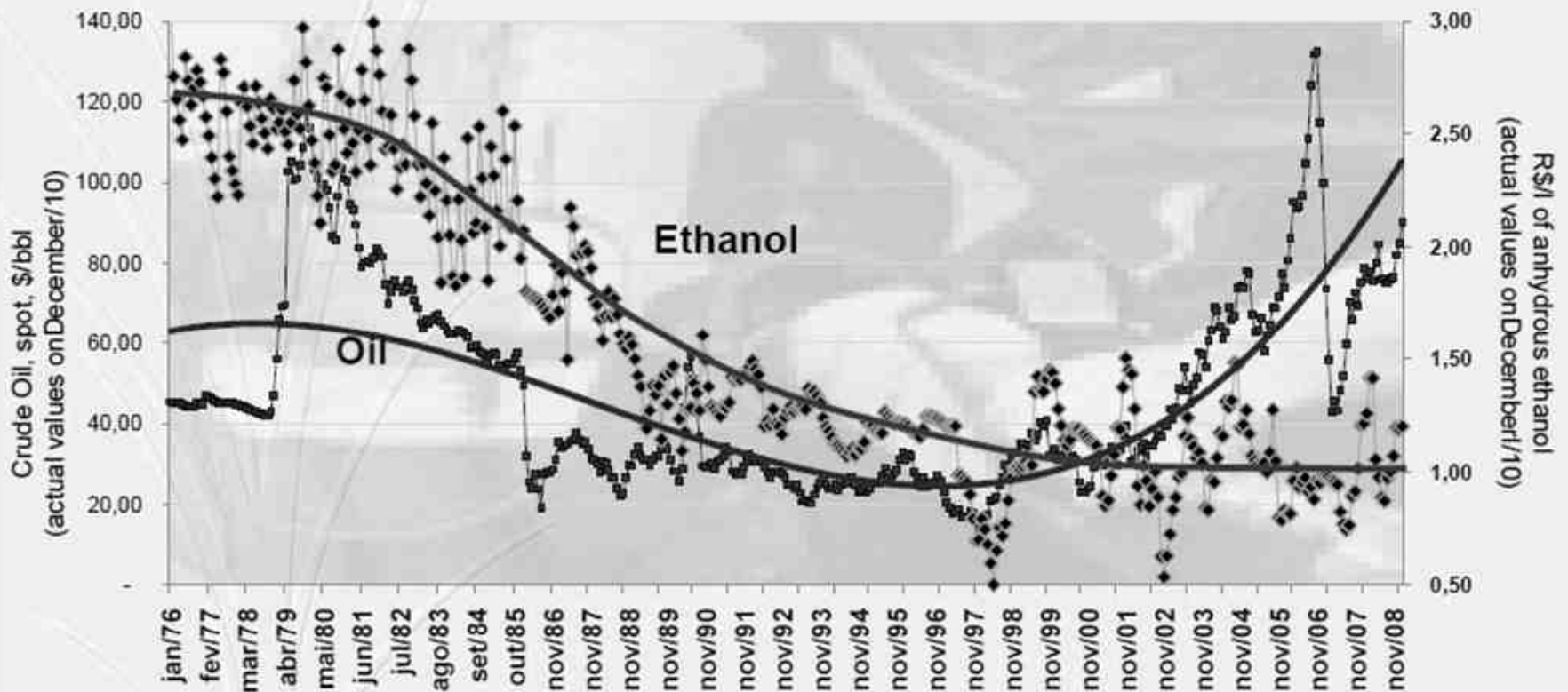
(*) - momento de excesso de oferta

Ethanol prices 2000 - 2011



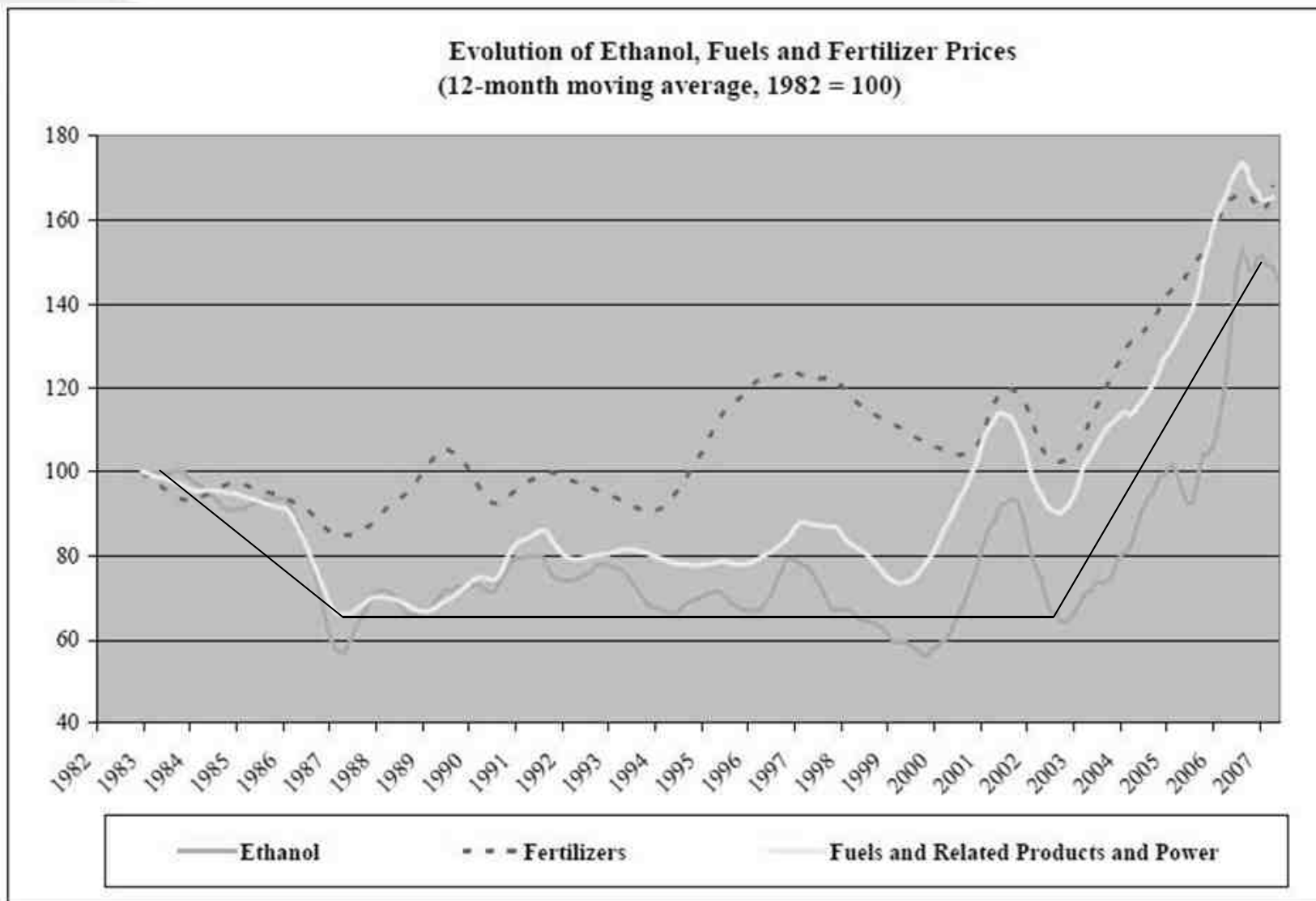
INDUSTRY COMPETITIVENESS AND OUTLOOK FOR EXPANSION

Anhydrous ethanol: evolution of the prices received by producers and international oil prices



As a reflection of efficiency gains, current ethanol prices are a little over 30% of the observed price during the beginning of the Proálcool program

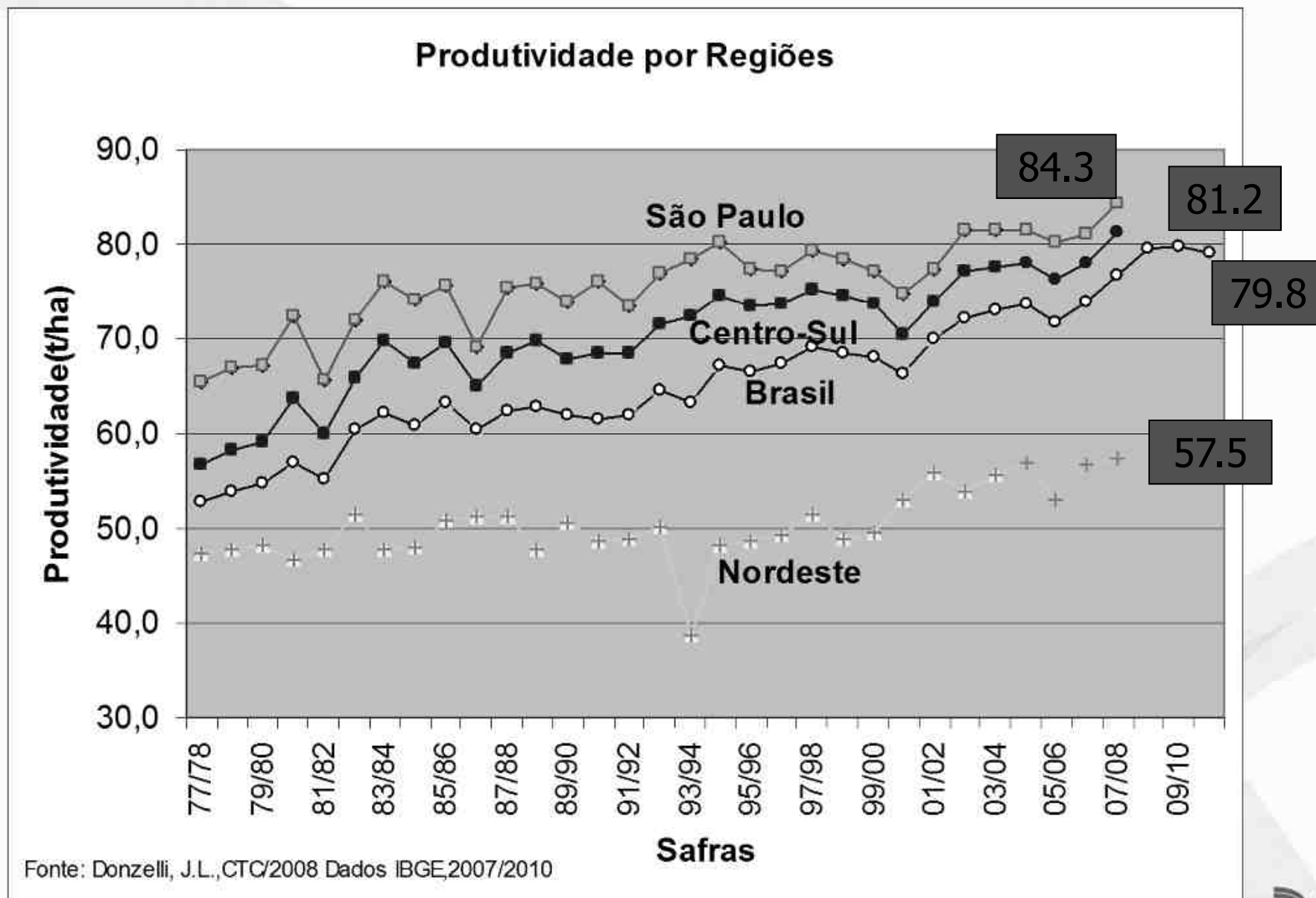
Source: UNICA and World Bank. Note: values deflated to December/2010 using the IGP-DI and CPI.



Note: Data are presented as 12-month moving averages to smooth monthly and seasonal fluctuations.

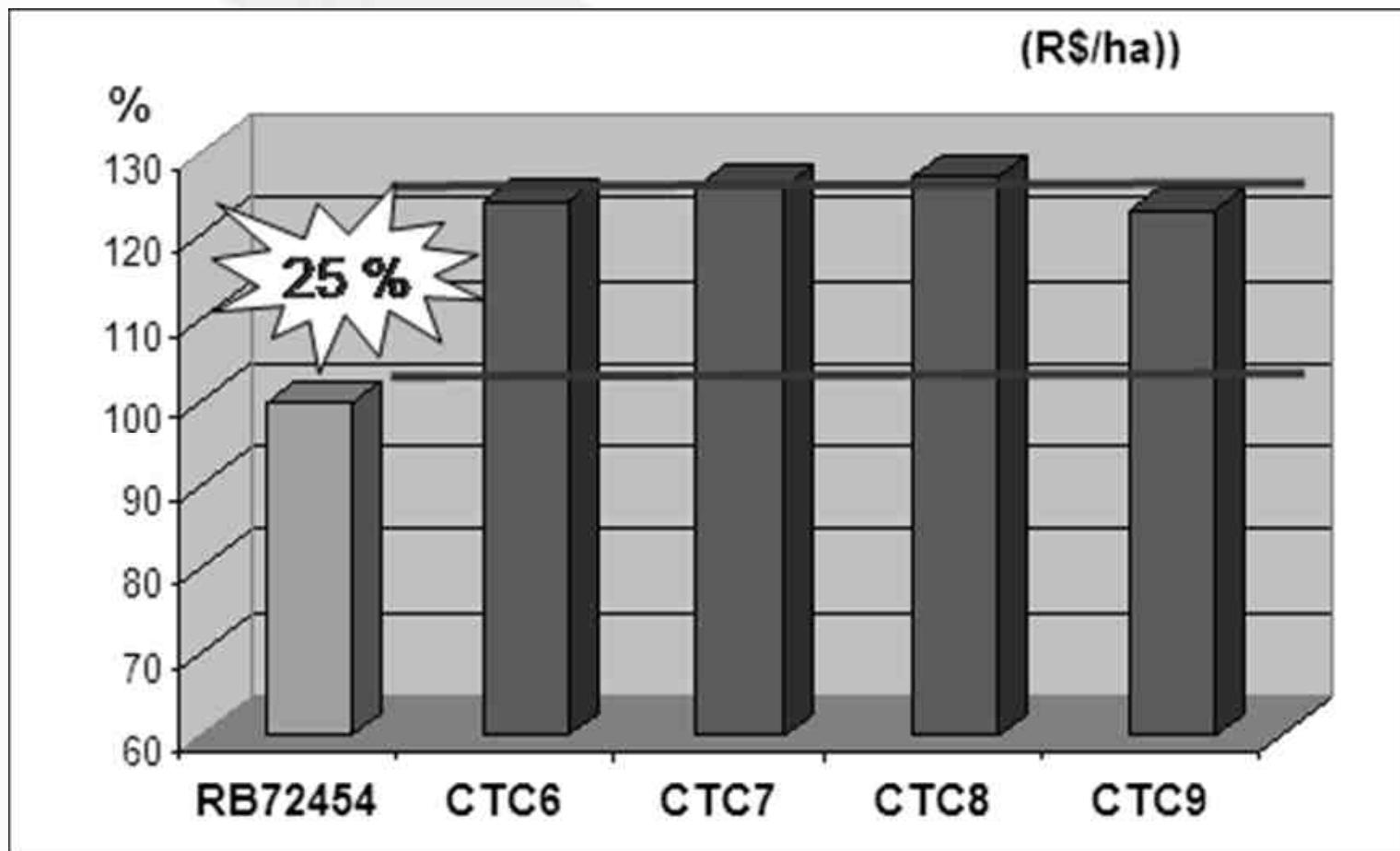
Data sources: US Bureau of Labor Statistics and Nebraska Energy Office.

Dados sobre a cultura de Cana de Açúcar no Brasil

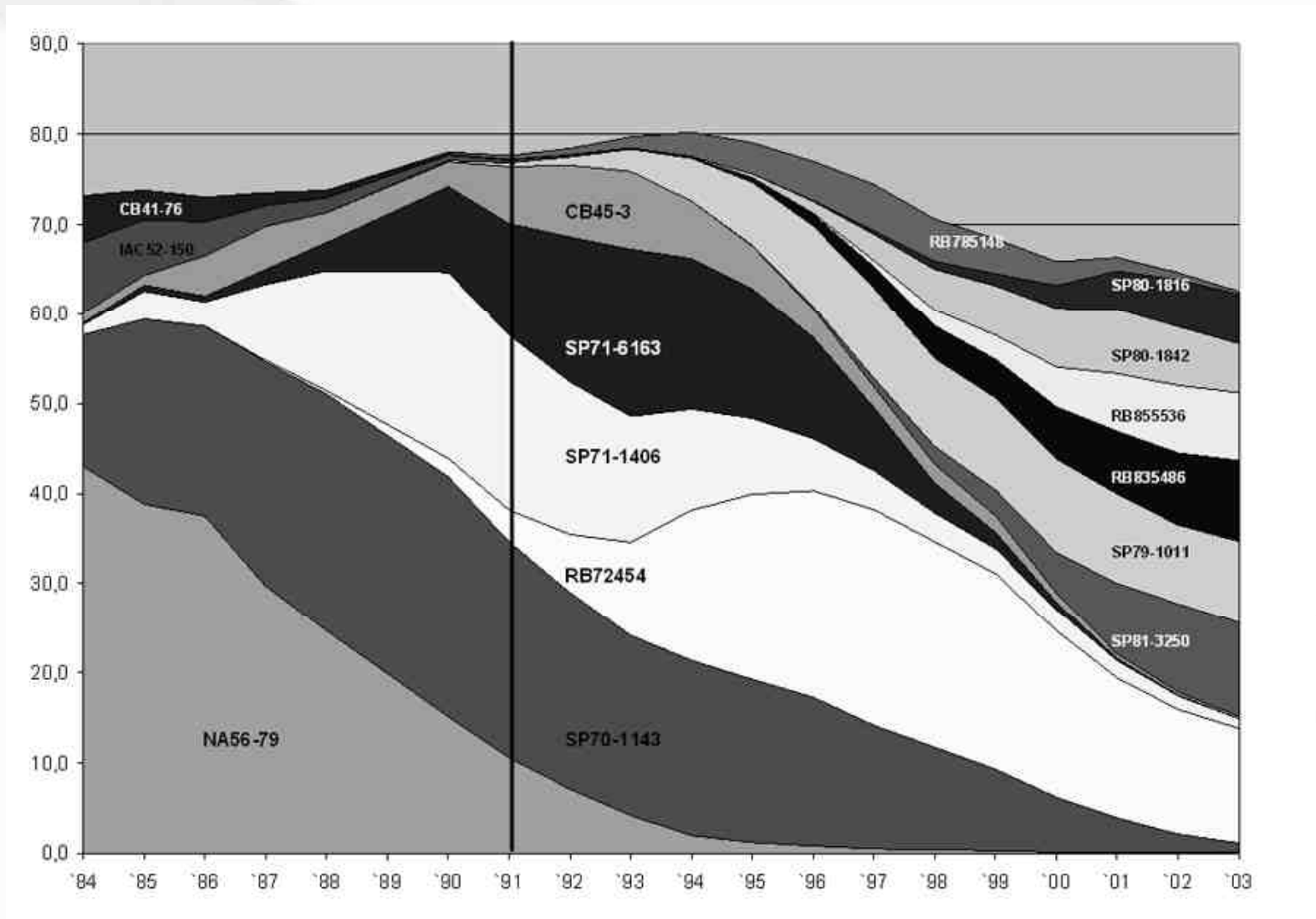


Fonte: Donzelli, J.L., CTC/2008 Dados IBGE, 2007/2010

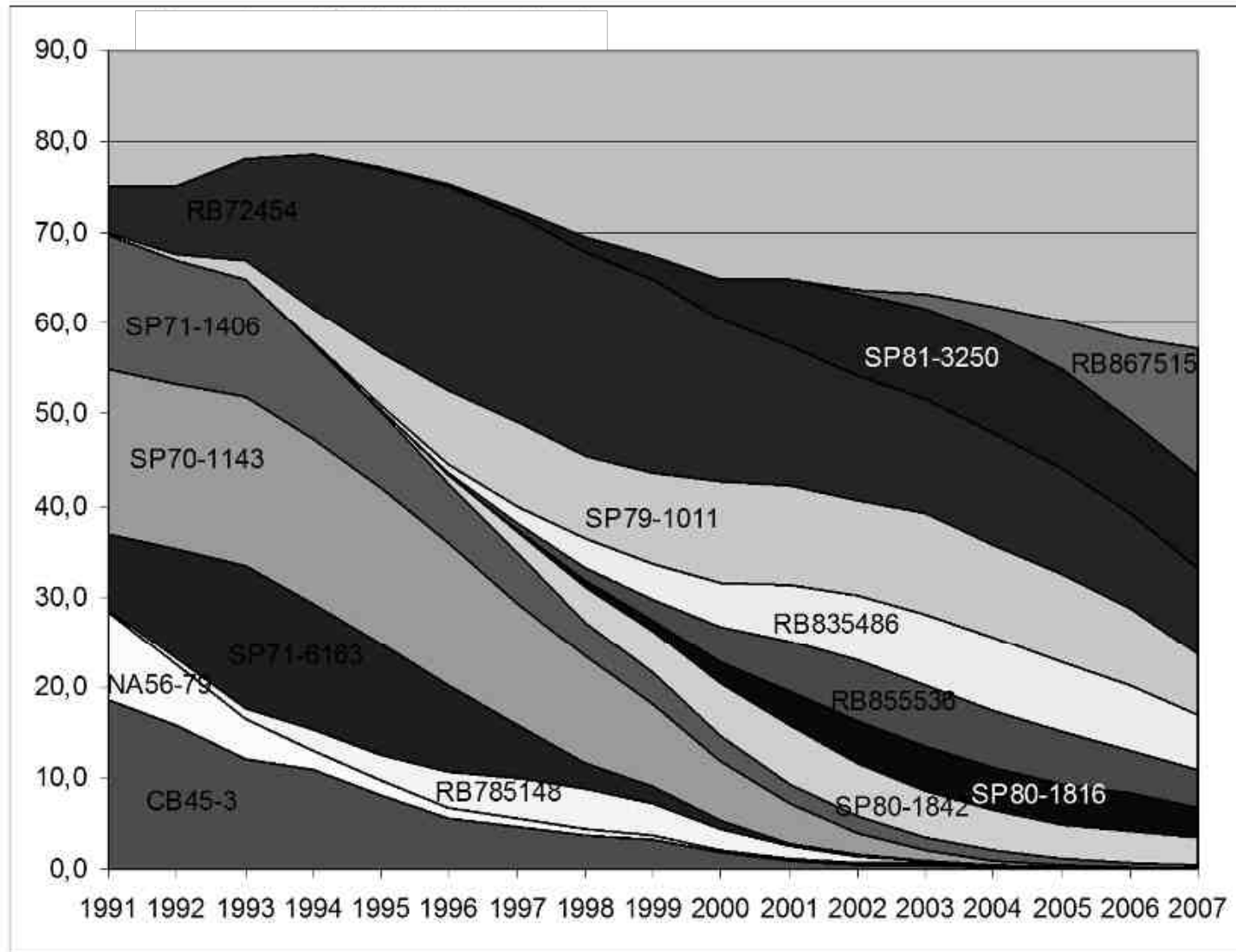
New varieties benefits



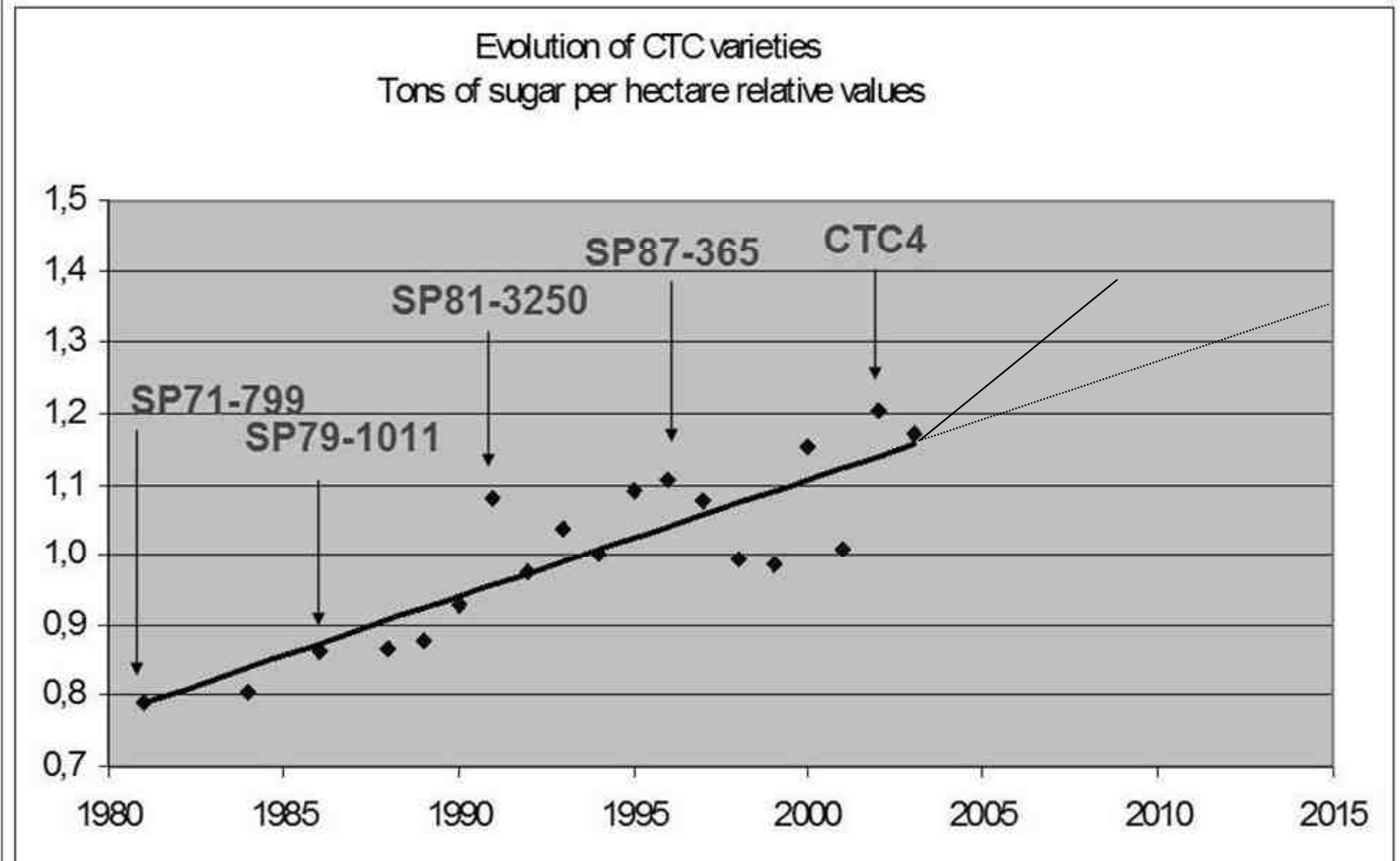
Area (%)



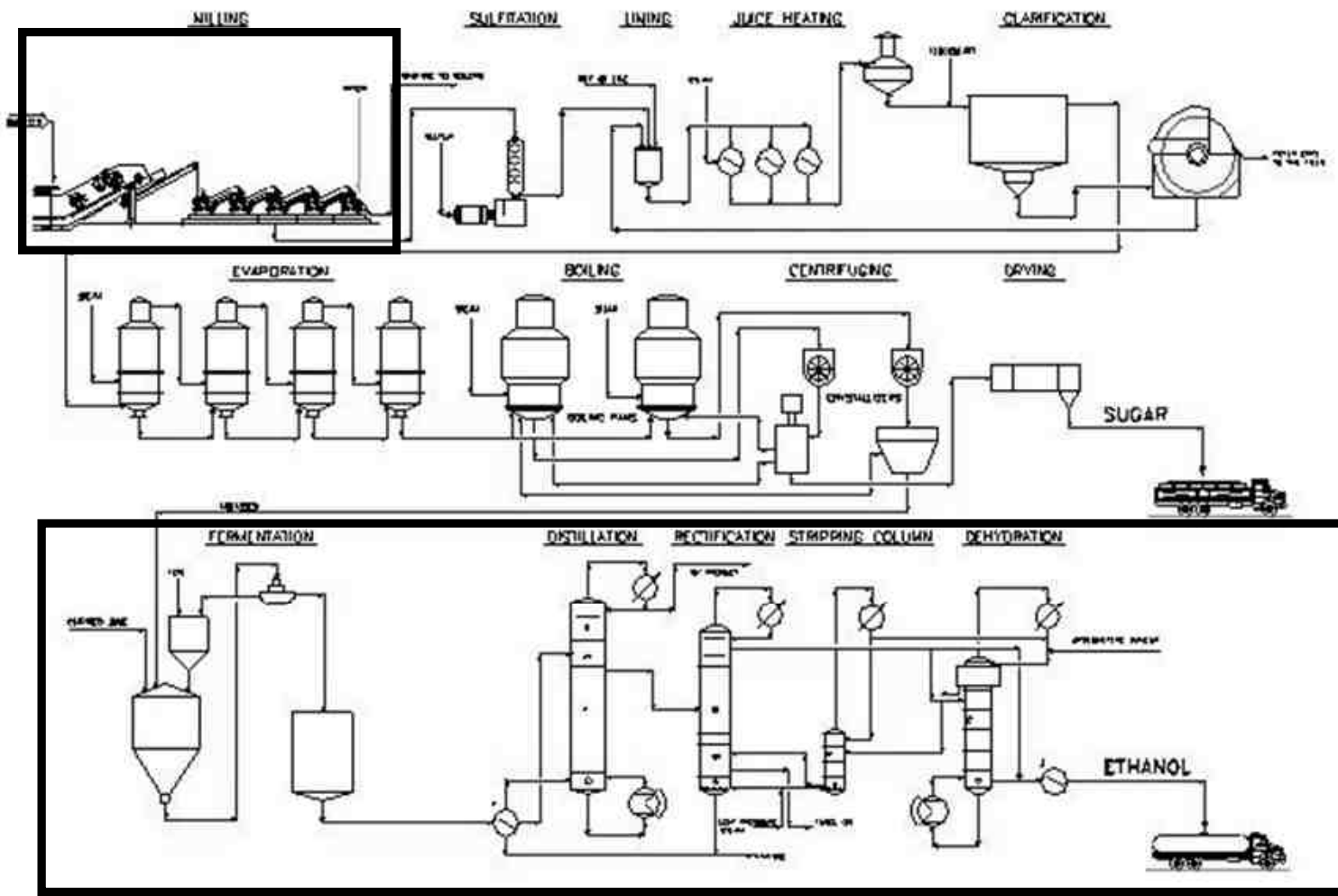
Area (%)



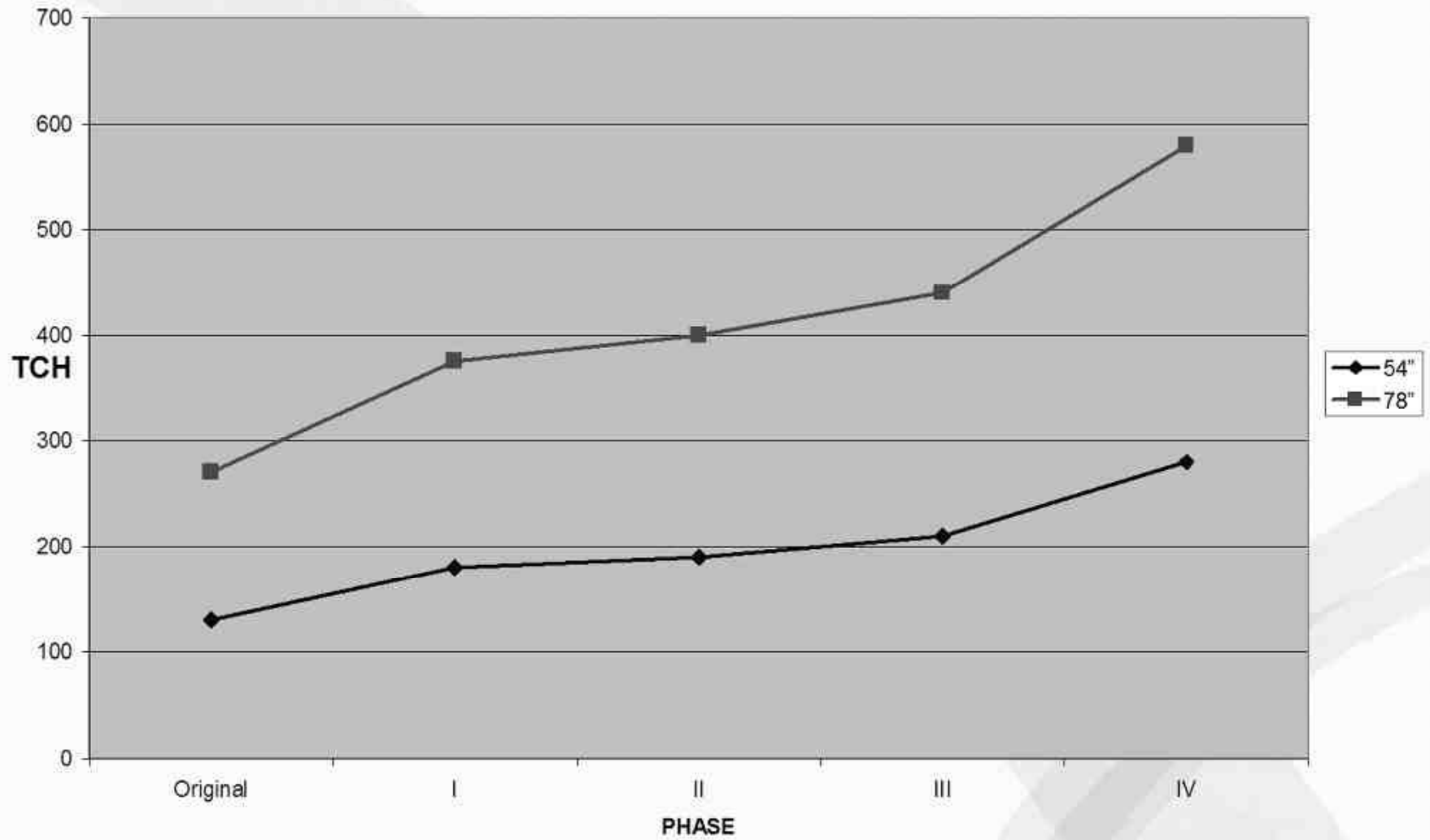
CTC Sugarcane Breeding



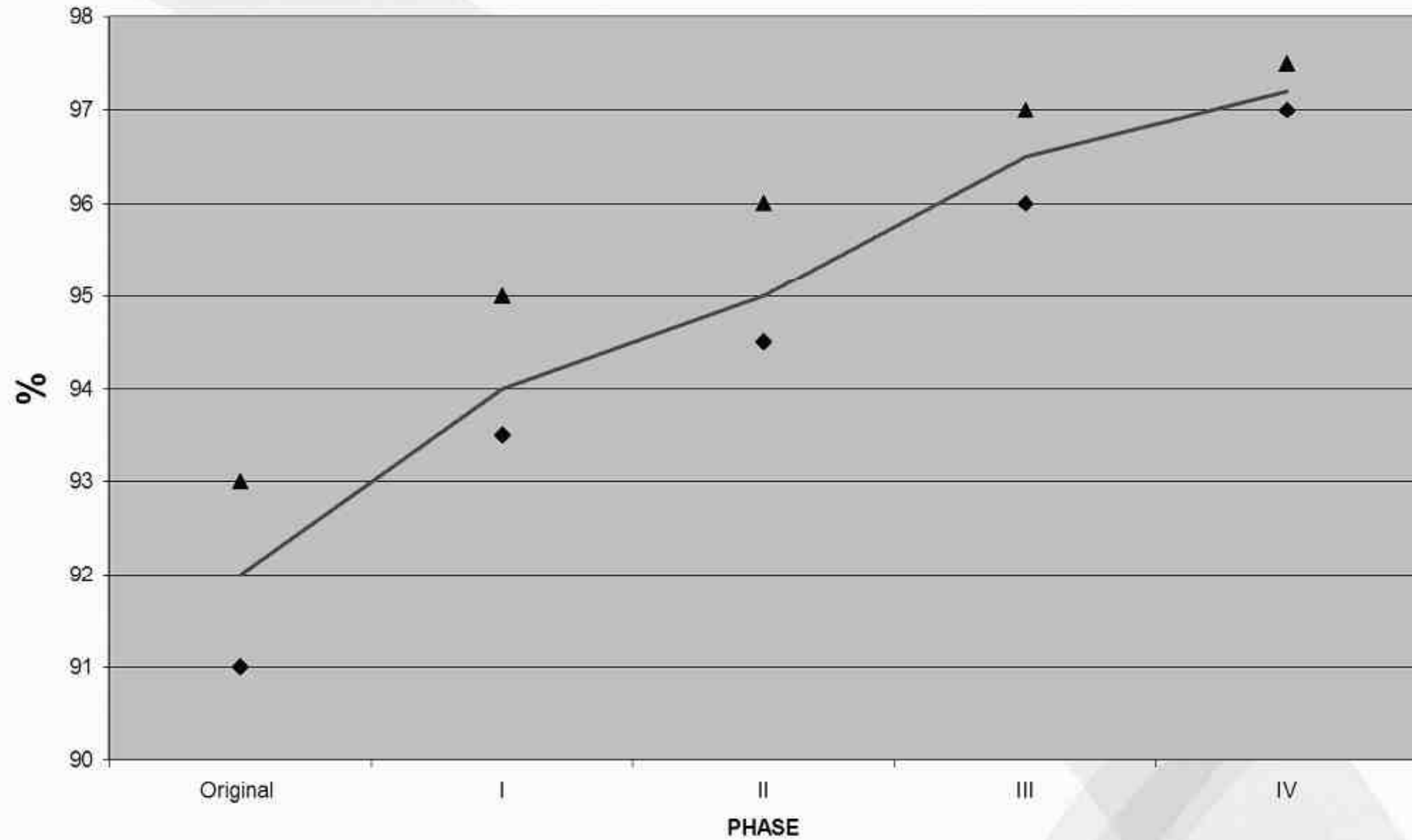
FLOW DIAGRAM - SUGAR AND ETHANOL



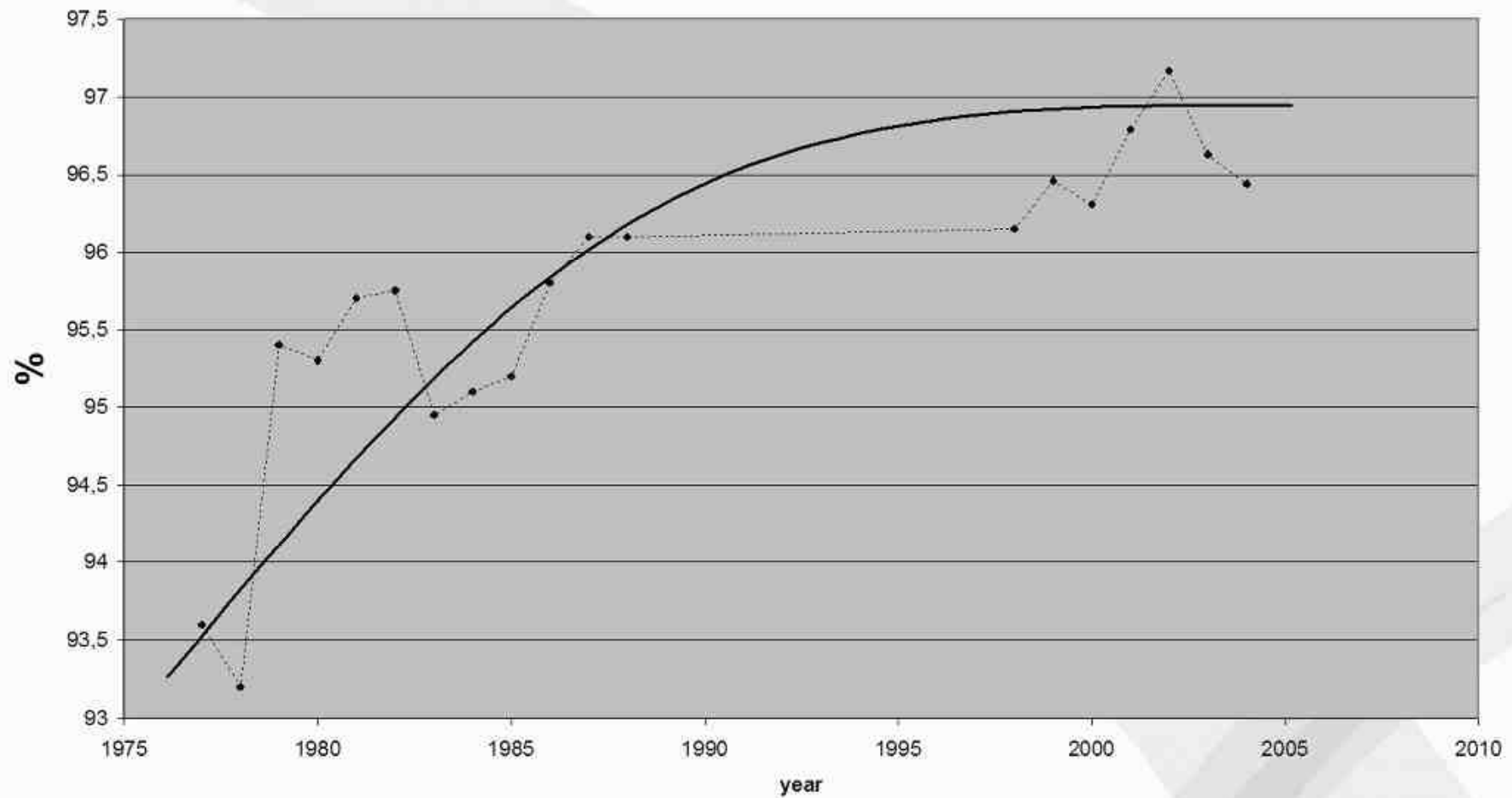
Evolution of milling capacity



Evolution of milling efficiency

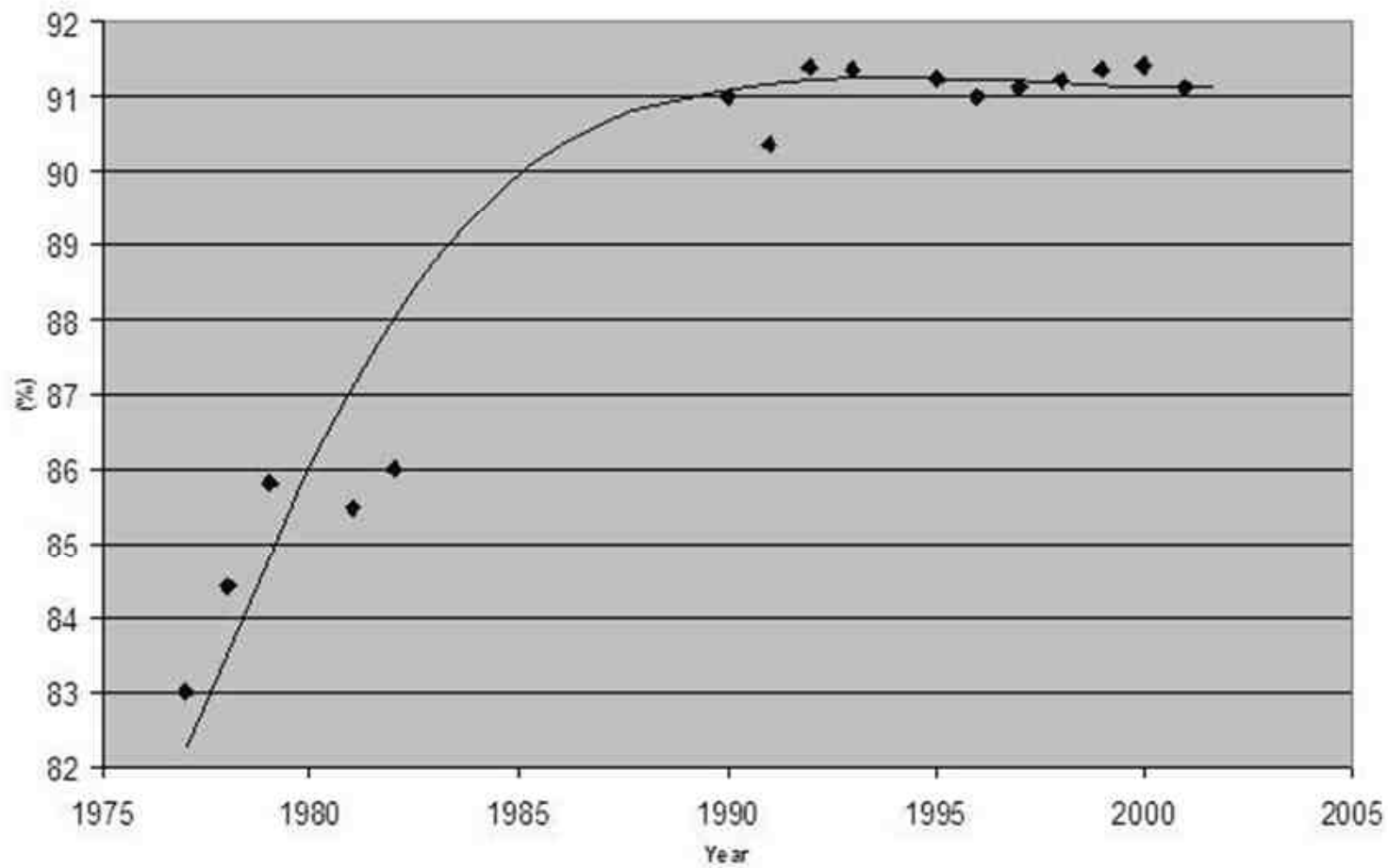


Evolution of milling efficiency

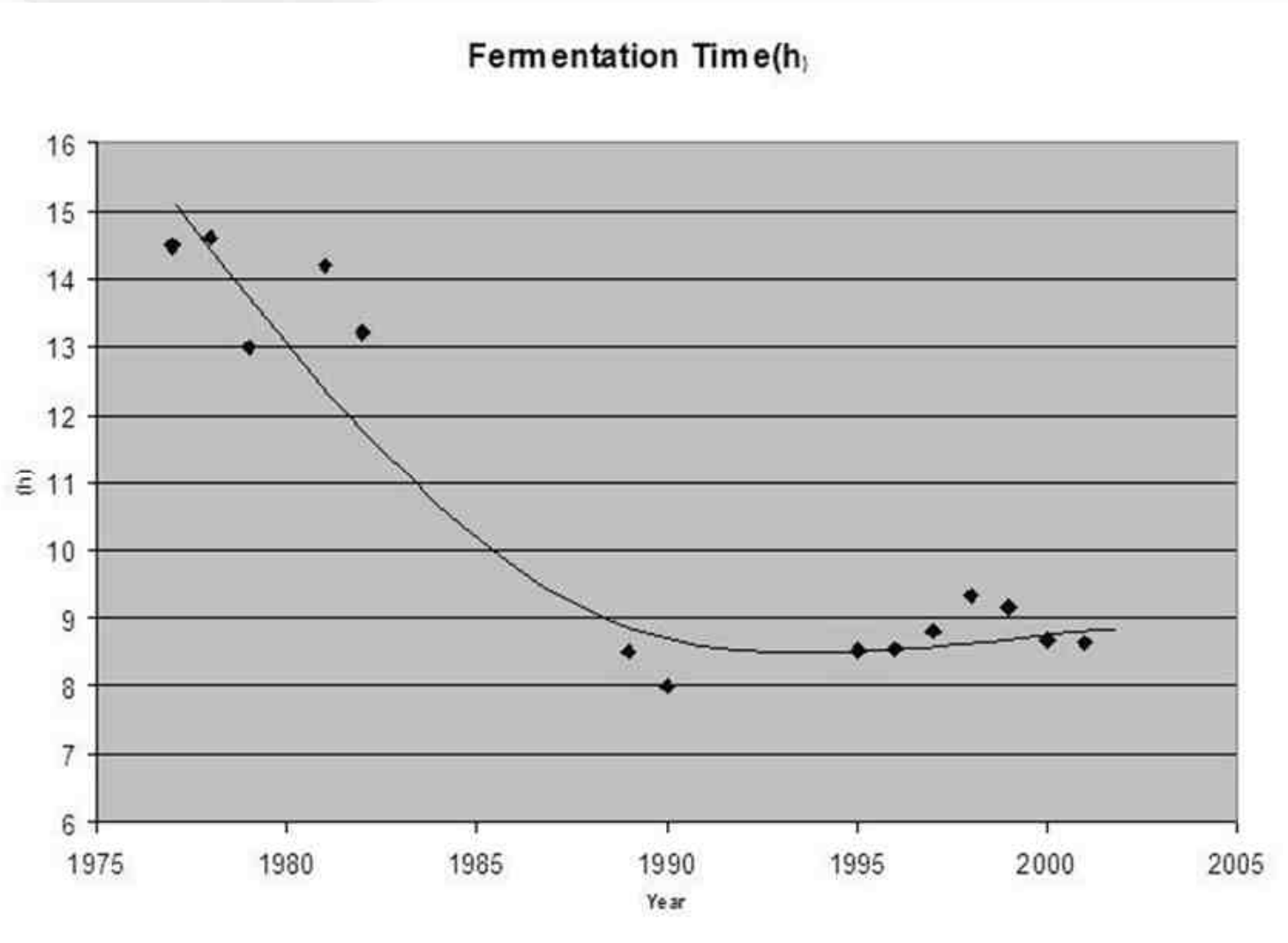


Evolution of fermentation process

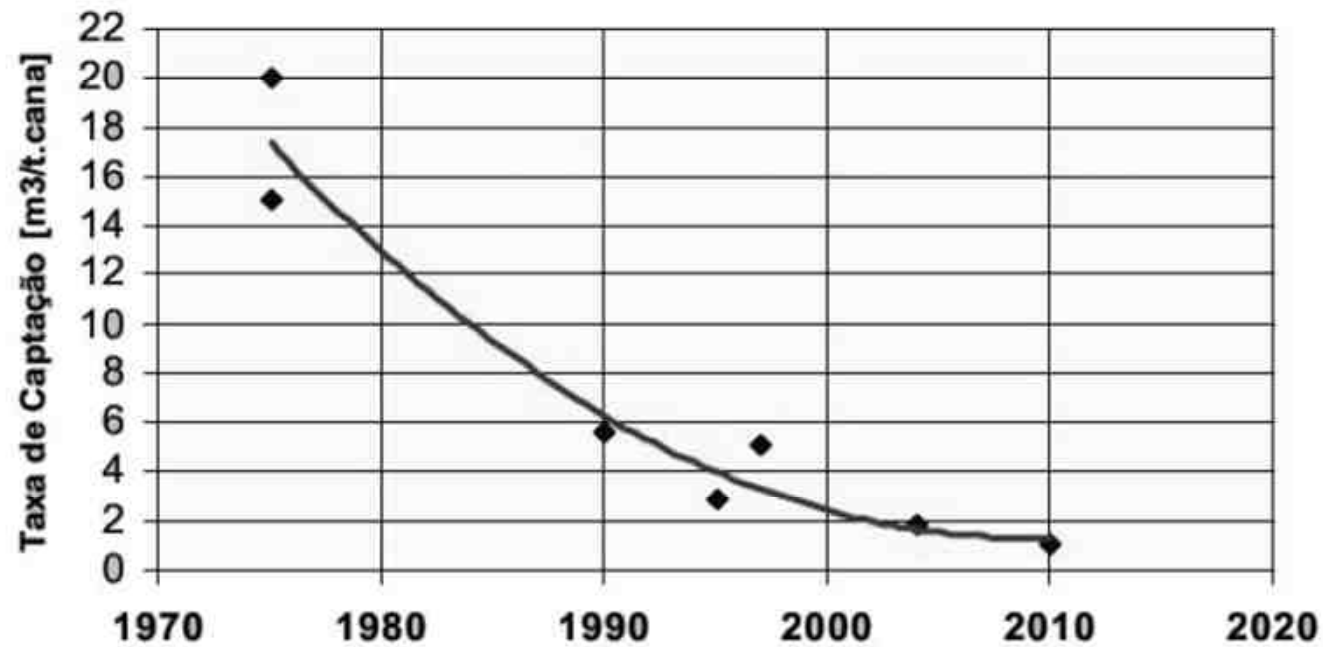
Ethanol Stoichiometric Yield(%)



Evolution of fermentation process

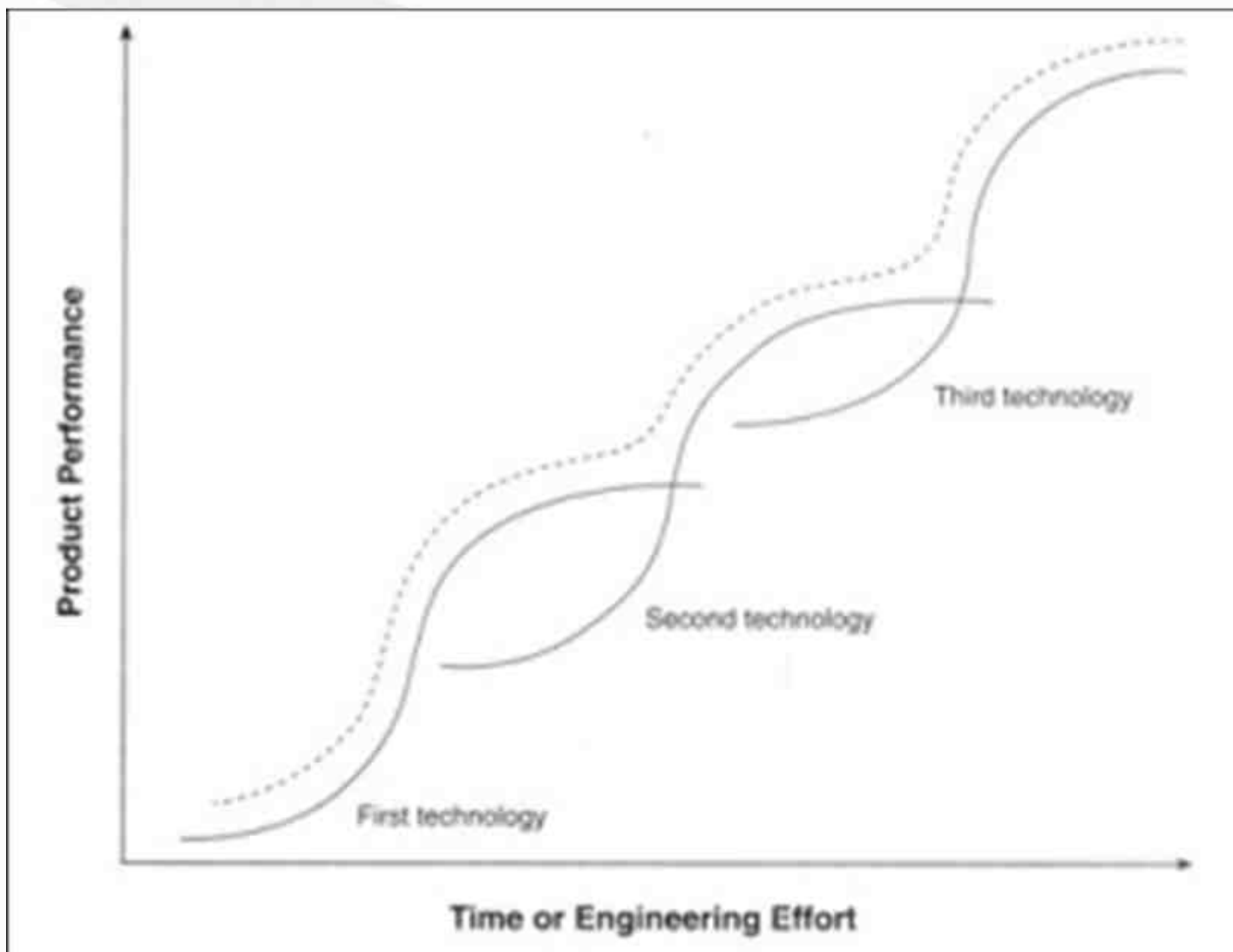


Water Use

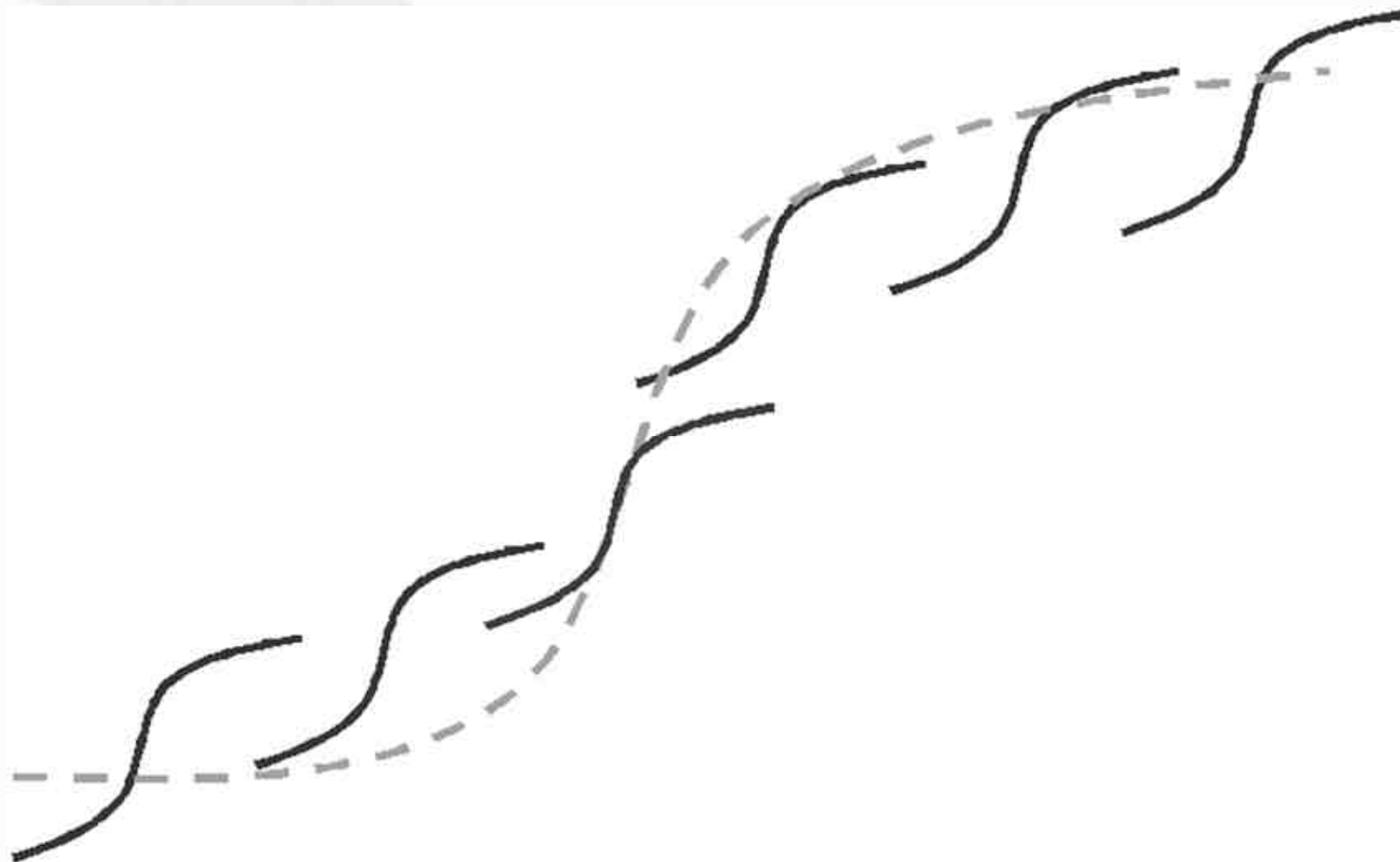


Fonte: Elia Neto - CTC (2009)

Future: continuous improvement ?

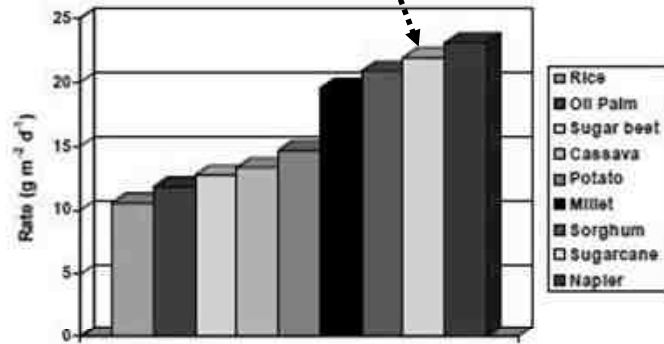


Future: limited improvement ?



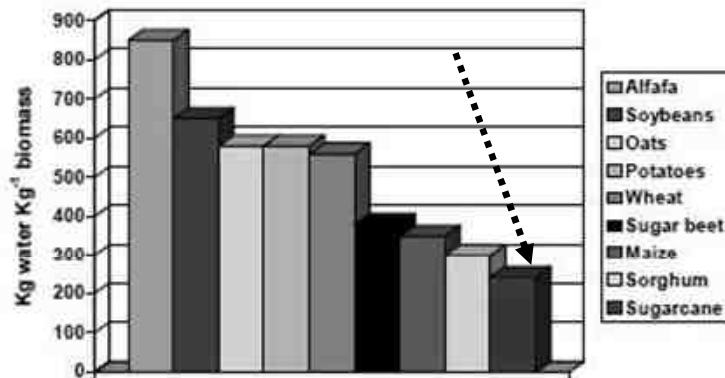
Energy Cane

The Crop



Sugarcane Biomass Production

- On average 22 g/m²/d but can be as high as 55 g/m²/d → 80,3 ton / ha . year
- For C3 plants only 13 g/m²/d



Sugarcane Water use efficiency

- 240 litres per kg of aerial biomass
- Almost double that for sugar beet and other C3

How much Biomass is possible?

- RUE = 1.75g MJ⁻¹ - 2.3 g MJ⁻¹
(Muchow et al 1994; Sinclair & Horie 1989)
- 280 t dry mass hectare⁻¹ year⁻¹ ▲
(Moore et al 2000)

Record crop of 86 tons dry mass hectare⁻¹ year⁻¹ is only 40% of theoretical maximum

Frikkie Botha
August 2009

FRACTION OF
EINSTEIN
SPEED
(VELOCITY OF LIGHT)

Doubling Times of Various Technological Performances in Months

Intel anuncia transistores de 22 nanômetros com arquitetura revolucionária

André Machado

DE SEU VOTO MÉDIA: 5,0

Share 15

Tweet 27

Recomendar 15 recomendações. Cadastre-se para ver o que seus amigos recomendam.



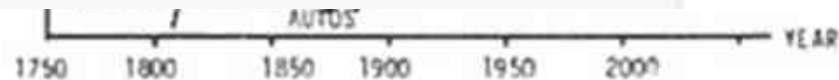
Clique para ampliar

RIO. A Lei de Moore - que diz que o número de transistores que podem ser colocados num chip dobra a cada dois anos, aproximadamente - vai ganhar pelo menos mais uma década de vida. A Intel acabou de lançar uma nova tecnologia diminuindo o tamanho dos transistores de 32 para 22 nanômetros (o equivalente a um quarto do tamanho do vírus da gripe, segundo Joab Paiva, gerente de habilitação de mercados da Intel Brasil) e mudando sua arquitetura

de modo que eles permitirão maior desempenho e menor consumo de energia, crucial para a mobilidade dos tempos atuais.

INTERSTELLAR SPACECRAFT

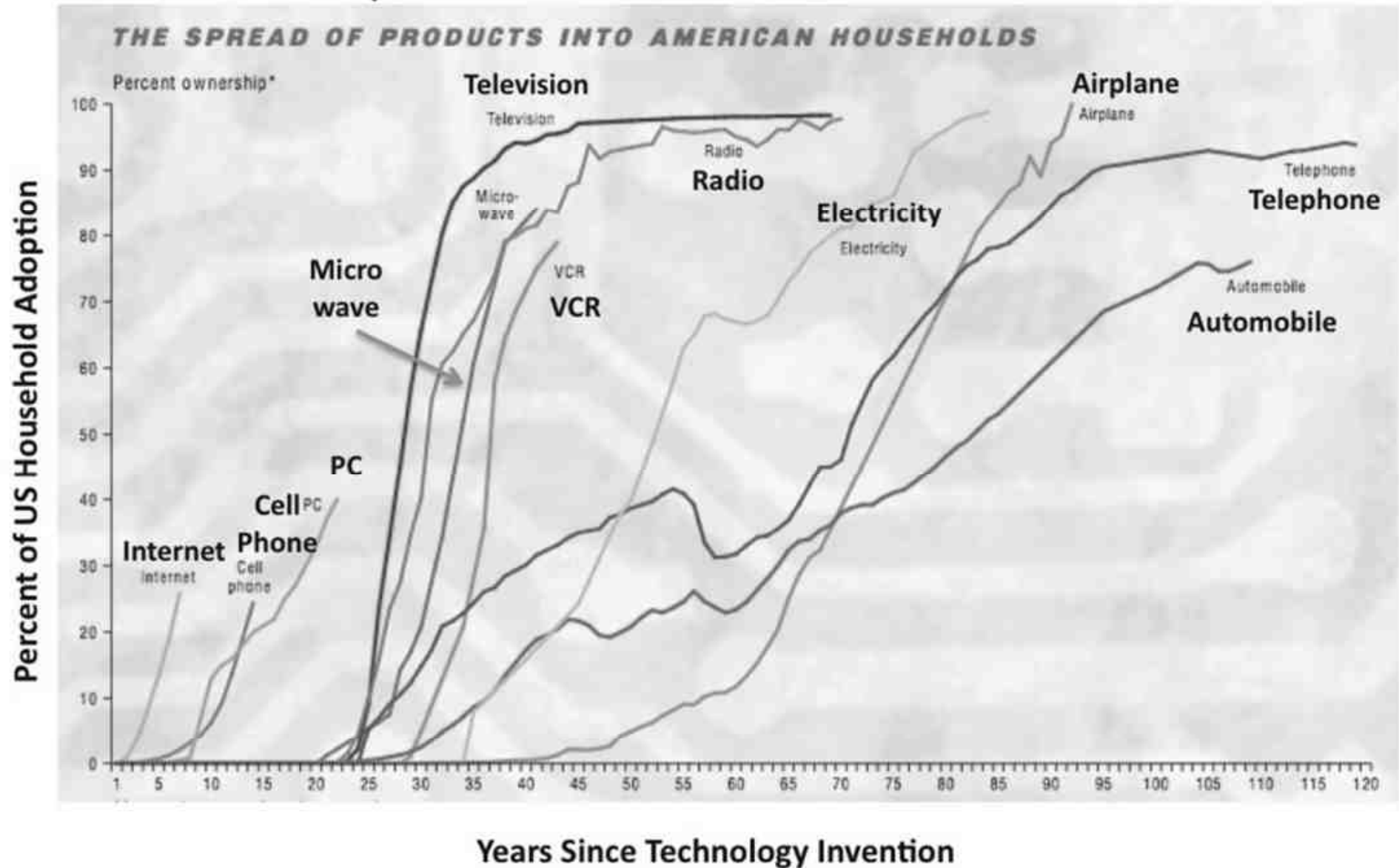
itic throughput	wavelengths per fiber	9
network	\$/bit	9
	bits per second	10
nication	bits per dollar	12
c areal storage	gigabit/in2	12
cameras	pixels per dollar	12
rocessor	\$ per cycle	13
omputer power	flops	14
	MiB/\$	16
	bits per dollar	18
quencing	\$ per base pair	18
or	\$ per transistor	18
wer consumption	watts/cm2	18
	per array	19
re Storage	Gigabyte per \$	20
	MIPS	21
quencing	\$ per base pair	22
re data speeds	bits/sec	22
rocessor	transistors per	24
rocessor	MHz/\$	27
th	kilobits per second per \$	30
rocessor	hrtz	36



SOURCE: D.G. SAMARAS (USAF)

Fig. 1. Speed trend curve

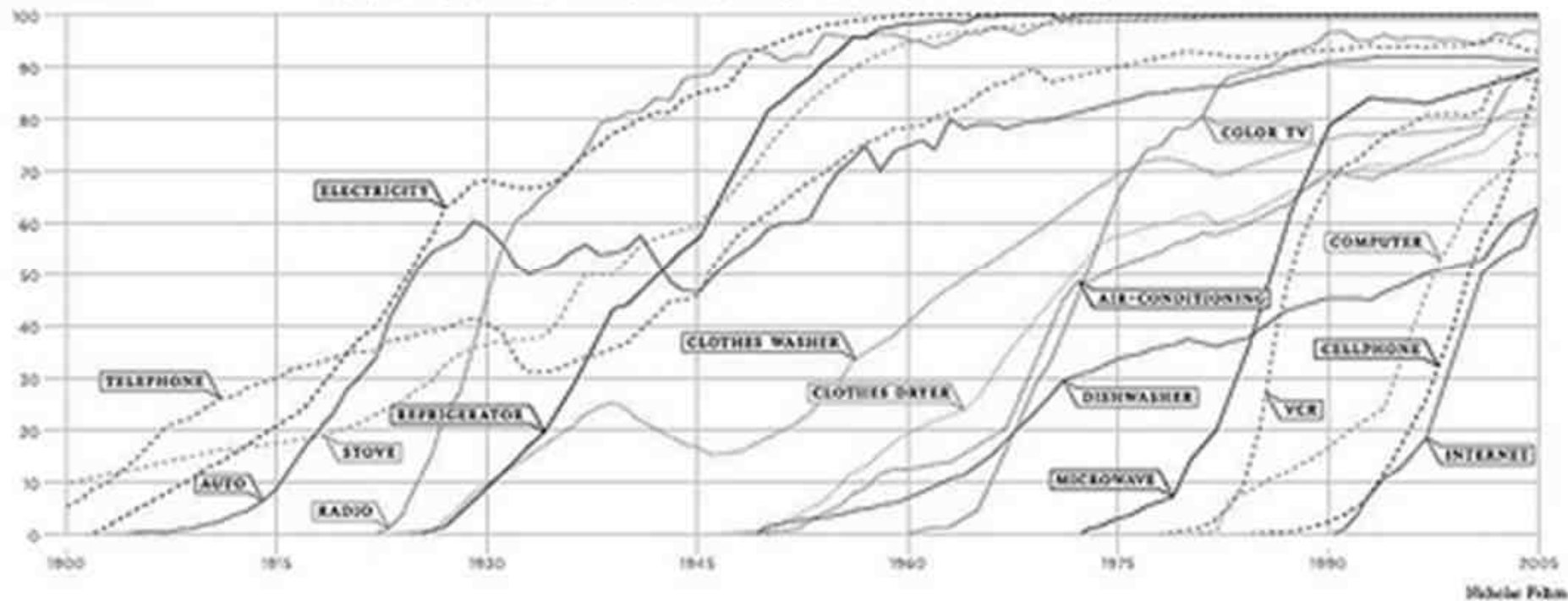
The Spread of Products into American Households



Sources: U.S. Bureau of the Census (1970 and various years);
Cellular Telecommunications Industry Association (1996);
The World Almanac and Book of Facts (1997).

PERCENT OF
U.S. HOUSEHOLDS

CONSUMPTION SPREADS FASTER TODAY



Breakthrough: 2nd generation ethanol

Synergistic Action of Fungal Cellulases



2nd Generation Ethanol:
till 200 liters/t bagasse
with partners

Fig. 3. Artistic concept of an exoglucanase acting on crystalline cellulose. In this diagram (left) recognizes and binds to the cellulose. It is understood, a single chain of cellulose is shown. The active-site tunnel of the catalytic domain proceeds along a cellulose chain cleaving it until the chain ends or the enzyme becomes inactivated.

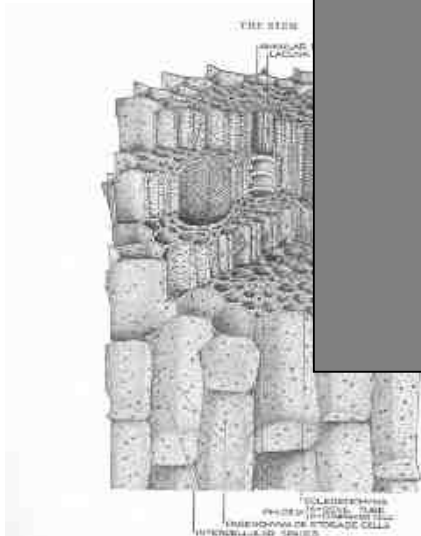


Fig. 15. The structure of a plant cell wall. The diagram shows the arrangement of cellulose microfibrils and lignin. (After Mansfield, 2001).

(C6):	1,111 kg/kg
ose(C5):	1,136 kg/kg
etanol:	0,6475 l/kg
etanol:	0,6475 l/kg

Rendimento Máximo Teórico: 1 TON BAGAÇO (50% Água) -> 259 litros ETANOL

Rendimento Real: Rend. Teórico x Ef. Hidrólise x Ef. Fermentação x Ef. Destilação < 200 litros / ton bagaço

