EVALUATING SUGARCANE R&D PERFORMANCE: EVALUATION OF THREE BREEDING PROGRAMS

By

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Abstract

RESOURCES for sugarcane R&D are scarce, as they are for most agricultural R&D, and investors in R&D want a return on their investment in the form of productivity and profitability gains that arise from the adoption of new technologies. These realities motivate productive and efficient R&D programs that are a key driver of ongoing productivity improvement in sugarcane industries. Sound technical programs deliver ongoing industry benefits sustaining industry profitability and underpinning industry growth. In the context of these R&D programs, strategic and tactical decisions made during the management of R&D projects are vitally important with respect to the outcomes delivered by R&D, and their subsequent uptake by industry. We illustrate these principles using variety performance data from Australia, Brazil and South Africa. Our findings include evidence for rapid uptake of new varieties, significant improvements in yield of cane per hectare and financial benefits delivered to growers adopting these improved cane varieties. Differences existed between the R&D programs in terms of the benefits being delivered to the respective industries that could be directly connected with particular research strategies employed. R&D is an investment, not a cost, but it becomes a cost if benefits are not realised by industry.

Introduction

We undertook a study to quantify benefits being delivered to sugarcane industries in Australia (only Queensland), Brazil and South Africa by the breeding aspects of research, development and extension (RD&E) programs undertaken by BSES Limited (BSES), Centro de Tecnologia Canavieira (CTC) and the South African Sugarcane Research Institute (SASRI). The rationale for the study was as follows: investors in sugarcane research, growers, millers, governments and others, want a return on their investment. This return can be measured by the rate of uptake of new technologies and enhanced returns in the investors' businesses following the adoption of these new technologies. In the case of our institutions, the investors are also the customers for the services, new products and technologies developed by our RD&E programs. This brings into sharp focus the performance of the technologies in the hands of our customers and the return on investment to the growers, millers and others that support our programs.

In the Australian case, growers and millers interpret the plateau in industry outputs with respect to sugar yield as a failure of the R&D programs to deliver new technologies that enhance industry performance (Figure 1). This is despite comprehensive analyses (Cox and Stringer, 2007) that support the proposition that significant rates of genetic improvement are being achieved and, indeed, that the rate of genetic improvement is increasing.

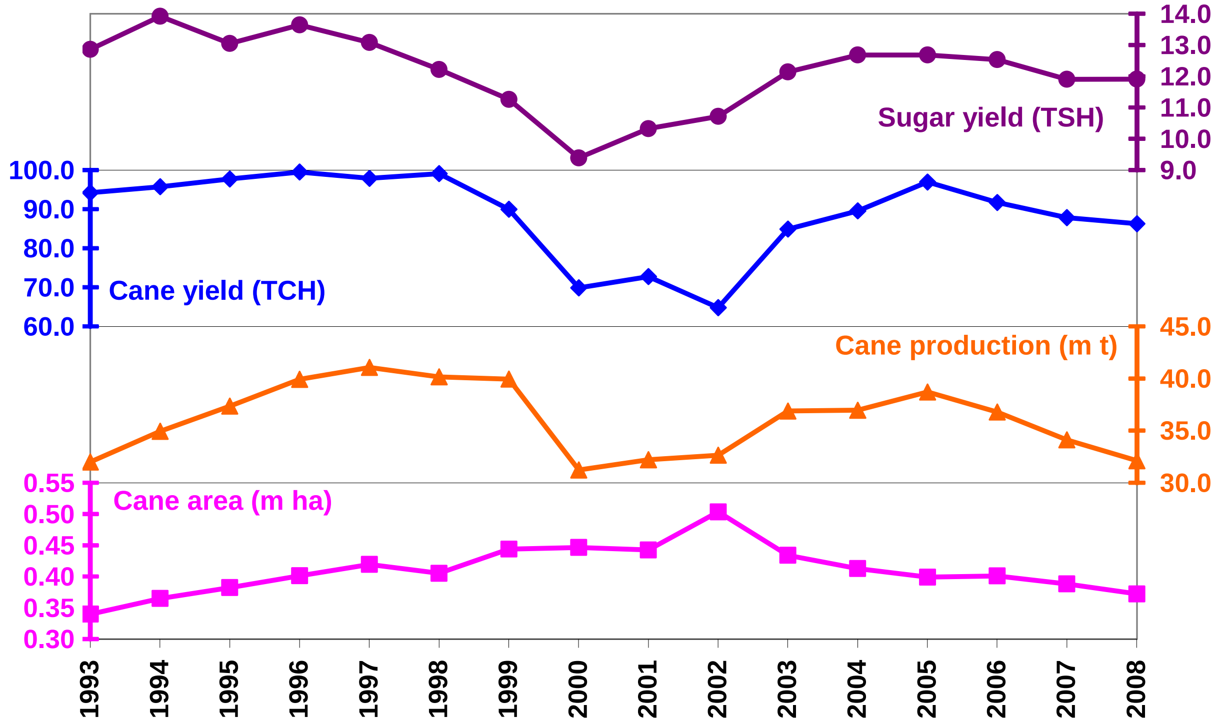

Fig. 1—Recent trends in sugarcane production in Australia (1993–2008) illustrated using data for cane area (ha), cane production (tonnes), cane yield (TCH) and sugar yield (TSH).

This contradiction should not be surprising. Agricultural systems are complex, and dissection of cause and effect with respect to the contribution being made by R&D to improved agricultural performance is not well developed.

Wynne and Gilmour (these Proceedings) consider first some financial metrics that can be used to estimate the performance of investments in agricultural R&D and, secondly, the relative merits of different benchmarking methods for assessing R&D performance.

A central tenet of their analyses is that broad industry statistics, such as illustrated in Figure 1, can not directly be used to evaluate RD&E performance. In short, if:

P = G + E + M; where

P = a measure of crop performance (e.g. tonnes sugar per hectare); and

G = an estimate of the genetic effect;

E = an estimate of the environmental effect; and

M = an estimate of the crop management effect (including the interaction effects between G and E); then

inferences about neither G, nor E, nor M can be made by simply measuring and interpreting P. More analytical work is required to dissect out the contribution being made by each effect and to better value how each have contributed to lowering input costs or increasing productivity.

Our study deliberately concentrates on dissecting out the value contributed to productivity improvements by genetic improvement. This is motivated by availability of data sets to perform a range of analyses relevant to objectively evaluate the value being created by genetic improvement programs being undertaken by our institutions.

Schroeder *et al.* (2009) have considered aspects of the contribution being made by farming systems to improved industry performance, but such considerations are not examined here.

The audiences for the studies we have undertaken are the Boards and Senior Management of our respective organisations, together with the growers, millers and other investors in the industries we serve. The study is a snapshot of some aspects of the performance of our R&D programs. The results for each program provide a relative reference point against which others can be assessed. It does not follow that a particular program should be judged superior to any other.

There is a strong temptation to make direct comparisons, but such interpretation is flawed since the strategic rationale that underpins each program is quite different. The results are specific to the settings in which each RD&E program is operating, and direct comparisons between programs should be avoided.

For example, if the research strategies and operations of BSES were transferred to Brazil, it does not follow that the same performance as is achieved in Australia will be evident in Brazil. Similarly, if the research strategies and operations of CTC are transferred to South Africa, it does not mean that results equivalent to those in Brazil will be realised.

Nevertheless, the relative performance provides an important benchmark against which the progress of each RD&E program can be assessed.

Materials and methods

Terminology

Because sugar content of cane is measured in different ways in each country, throughout the text we simply use the terms sugar content (SC), tonnes of sugar (TS) and tonnes of sugarcane per hectare (TSH) as substitutes for the country-specific measures of sugar content: CCS (Queensland), ATR (Brazil) and ERC (South Africa) unless there is a specific need to identify a specific measure. In all data presentations in tables and graphs, we specifically indicate the appropriate measure.

Data

Three data sets were compiled for each of Queensland, Brazil and South Africa to compare and contrast: (1) basic industry statistics; (2) variety adoption trends and (3) rates of genetic gain and value to growers and millers as a result of developing and releasing genetically improved varieties.

The industry statistics data set was historical industry data for 1996–2006 (inclusive) for tonnes of cane (TC) and sugar (TS) produced, and tonnes of cane (TCH) and sugar (TSH) per hectare.

The variety adoption data set was historical industry data for the tonnes of cane delivered of specific varieties to mills for Queensland (1970–2007), Brazil (1984–2007) and South Africa (1979–2007).

For Queensland (1970–2007) and Brazil (1998–2007), the data sets for estimating rate of genetic gain included data for the tonnes of cane delivered to mills of specific varieties, the sugar content of those varieties reported either as commercial cane sugar (CCS, Queensland) or total recoverable sugar (ATR, Brazil) and the number of hectares on which varieties were grown to derive TCH and TSH on an individual variety basis.

For South Africa, data were not available for the number of hectares on which individual varieties were grown, which precluded estimation of rates of genetic advance being made by sugarcane breeding using industry data. As a substitute, we used data from the SASRI variety improvement research program. The data set comprised yield data and estimated recoverable crystal / ha (t ERC/ha) for each released variety during the period 1980 – 2007.

Analytical methods

Industry production trends were examined for each country by plotting TCH and TSH over time. Variety adoption trends were examined by plotting percentage area planted to specific varieties over time. We calculated average duration in production (last year in commercial production—first year in commercial production) over all varieties, and examined the dominance of varieties by grouping varieties into categories according to the area they occupied in commercial production. For Queensland and Brazil, we calculated a weighted average age of varieties in commercial production over time using % area planted data where:

$$Age_i = P_i - \frac{\sum_{j=1}^{n}(C_j * A_{ij})}{n_i}$$

where:

Age_i = Average age of varieties in year i;

P_i = Year of production, where i = 1984,…, 2007;

C_j = Year of cross (Brazil) or year of first seedling in trials (Queensland) for variety j,

$j = 1, \ldots, n$;

A_{ij} = Percent area planted in year i to variety j;

n_i = Number of varieties in commercial production (i.e. A_{ij} >0.0%) in year i.

For calculating rates of genetic advance, we followed Cox *et al.* (2005). Briefly, this entailed the following steps. For Queensland and Brazil, where data were available for the number of hectares planted to each commercial variety, the area planted was weighted by its cube root. This has the effect of reducing the emphasis of new varieties recently in commercial production and planted to only small areas. TCH and TSH were then estimated as best linear unbiased predictors (BLUP) by fitting a mixed linear model with varieties as random effects using the software package ASREML (Gilmour, 1999). Average rates of gain over the study period were calculated by fitting a linear regression to the relationship: TCH or TSH versus year of variety release into commercial production. Rates of genetic advance were estimated for Q varieties originating from the BSES-CSIRO breeding program in Queensland, for SP and RB varieties originating from the Copersucar / CTC, and RIDESA breeding programs respectively in Brazil, and for N and NCo varieties originating from the SASRI breeding program in South Africa.

Thus:

The average rate of genetic improvement of all varieties was calculated as:

$$\Delta G = \frac{n * \sum_{i=1}^{n}(y_i * v_i) - \sum_{i=1}^{n} y_i * \sum_{i=1}^{n} v_i}{n * \sum_{i=1}^{n}(y_i^2) - (\sum_{i=1}^{n} y_i)^2}$$

where:

ΔG = Average rate of genetic advance for all varieties;

n = the number of varieties;

y_i = Year of release of variety i, where i = 1,…n; and

v_i = BLUP of the performance of variety i.

The value of varieties in commercial production was calculated assuming a financial model for the performance of a hypothetical 100 ha farming enterprise as generally set out in Table 1.

Table 1—Financial model for calculating the value of new varieties in commercial production.

Parameter	Farm using base (B) varieties	Farm using improved (I) varieties
Revenue	R(B) = 100*TCH(B)*SC(B)*SP	R(I) = 100*TCH(I)*SC(I)*SP
Expenditure	E(B) = 100*TCH(B)*PC(B)	E(I) = 100*TCH(I)*PC(I)
Earnings before interest and tax (EBIT)	EBIT(B) = R(B) – E(B)	EBIT(I) = R(I) – E(I)
Benefit of improved varieties ($/ha)		=(EBIT(I)-EBIT(B))/100

where:

Hypothetical farm size = 100 ha

TCH=Average yield on farm of either base (B) or improved (I) varieties;

SC=Average sugar content on farm of either base (B) or improved (I) varieties;

SP=Sugar price, assumed to be US$300/tonne

PC=Average production cost per hectare of hypothetical farm growing base (B) or improved varieties (I)

The following base assumptions were used for all three countries:

- Average grower production cost = US$20 / t cane
- Harvest and transport cost = US$6.50 / t cane
- Miller crushing cost = US$15 / t cane
- Sugar price = US$300 / t sugar

In addition, the following country-specific assumptions were made:

Parameter	Queensland	Brazil	South Africa
Base germplasm	< 1996 smut susceptible	< 1996	< 1996
Improved germplasm	>= 1996 smut resistant	>=1996	>= 1996
Cane production	32 Mt	309 Mt	20 Mt
TCH base	96.6	90.4	99.5
TCH improved	103.8	94.5	101.7
SC base	13.5	14.2	13.4
SC improved	14.1	13.9	13.9

The benefit estimates were used to determine reasonable fees that could be charged of growers and millers on the following basis:

Proportion of EBIT benefit retained by growing and milling sectors (W) = 80%;

Proportion of EBIT benefit retained by breeding organisation (X) = 100–W = 20%.

Then:

Apportionment of EBIT benefit share to breeding organisation as a grower fee (G) = 64%*X;

Apportionment of EBIT benefit share to breeding organisation as a miller fee (M) = 36%*X.

The revenue stream due to each breeding organisation was then calculated using the respective cane production base for each organisation such that:

Revenue (BSES) = $(G_B+M_B)*32*10^6$;

Revenue (CTC) = $(G_C+M_C)*309*10^6$;

Revenue (SASRI) = $(G_S+M_S)*20*10^6$.

Where the subscripts, B, C and S, refer to the respective breeding organisations: BSES, CTC and SASRI.

Results and discussion

Industry production trends

The results for the annual trend in tonnes of cane production per hectare over the period 1996 to 2006 (Figure 2) indicate that there has been an increase in productivity of 0.68 TCH in Brazil, and a decline in South Africa of 0.43 TCH. In Queensland, average productivity is higher than in either Brazil or South Africa, but the average is more volatile connected with weather events (too wet and too dry) and disease (illustrated by the 1999–2000 orange rust epidemic).

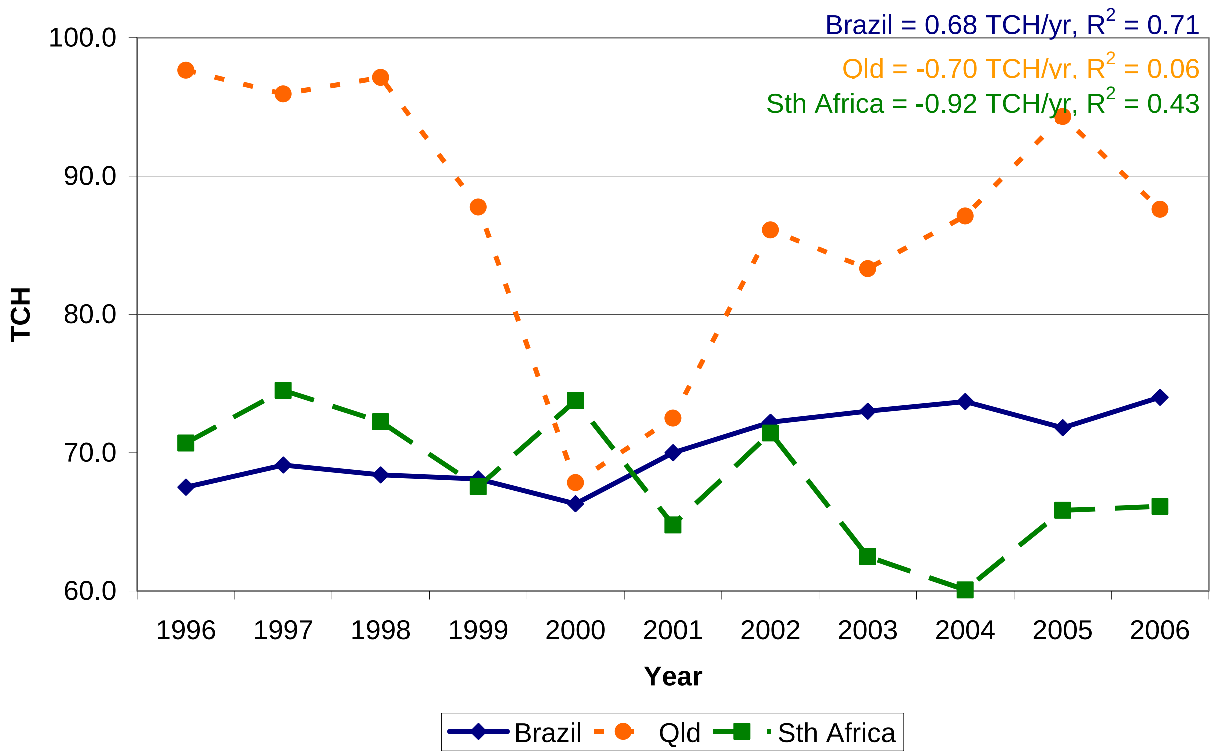

Fig. 2—Annual trend for tonnes of cane per hectare (TCH) in Brazil, Queensland and South Africa.

Average, industry-wide sucrose content in both Brazil and South Africa has increased from 1996 to 2006, although the relationship for South Africa is weaker than that for Brazil (Figure 3). For Queensland, sucrose content has been volatile.

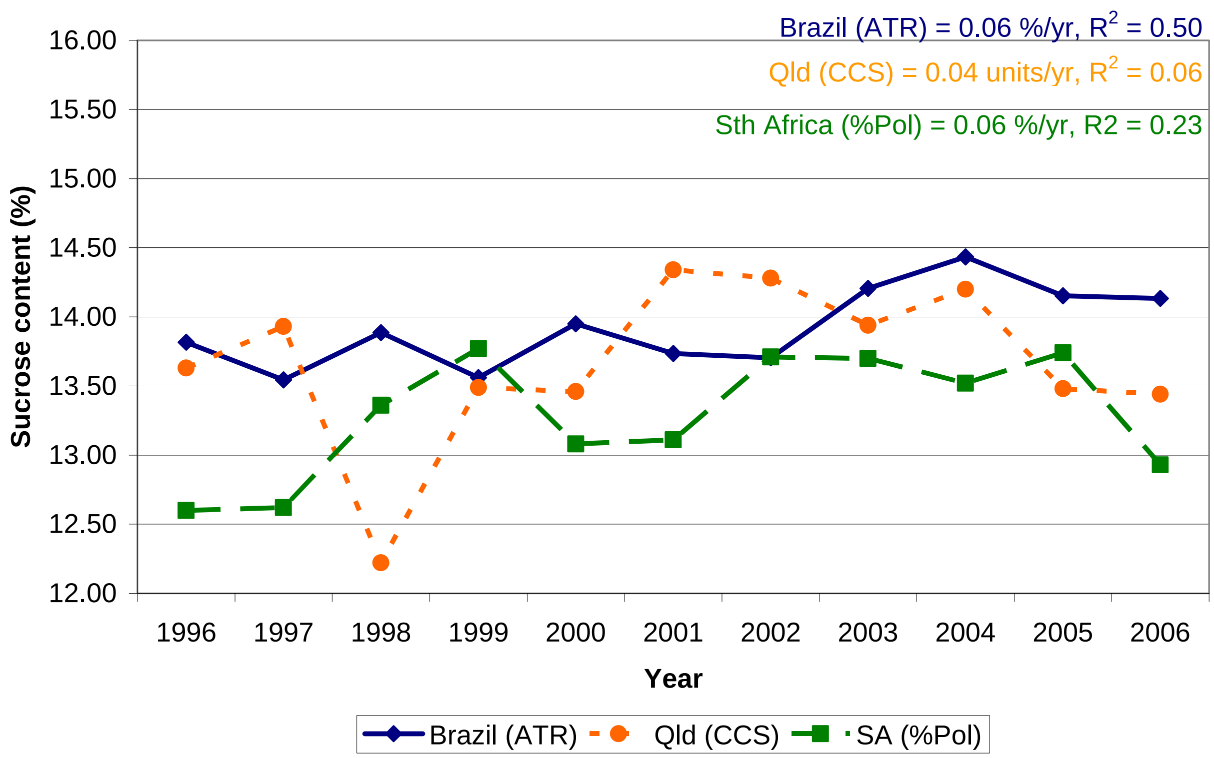

Fig. 3—Annual trend for sucrose content in Queensland, Brazil and South Africa.

For TSH, the results follow the tonnes of cane per hectare results with Brazil having an annual increase in average tonnes of sugar per hectare of 0.14 TSH/year whereas, for South Africa, there has been a decline in average TSH by 0.08 TSH/year (Figure 4). For Queensland, TSH has been higher than both Brazil and South Africa. However, it has also been volatile and declined by an average of 0.05 TSH/year over the period.

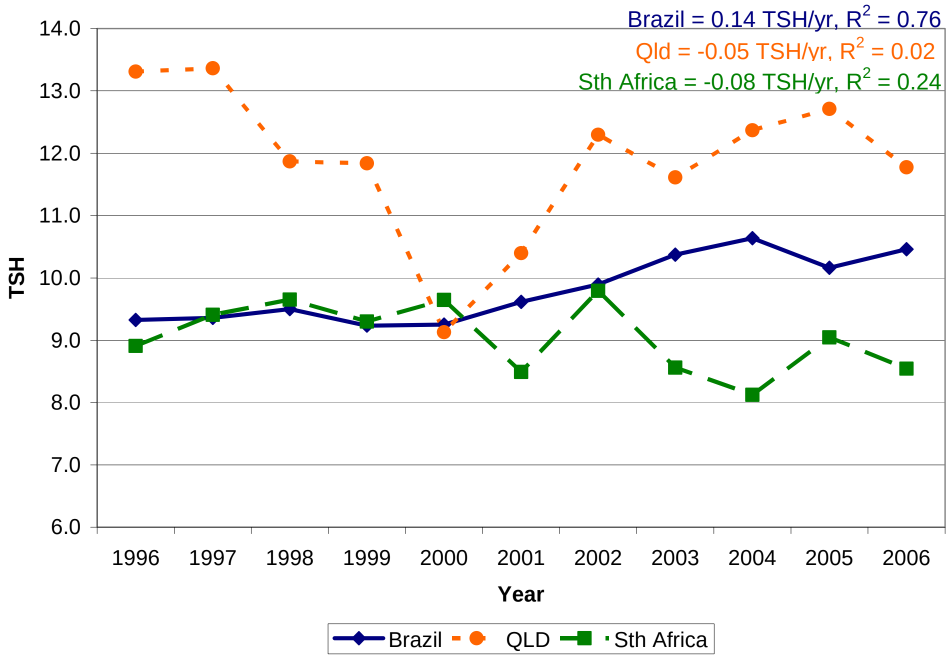

Fig. 4—Annual trend for tonnes of sugar per hectare for Queensland, Brazil and South Africa.

Variety adoption trends

The variety adoption trend data for Queensland (Figure 5) indicate that varieties typically have a commercial production life of approximately 20 years comprising four five-year crop cycles. There is no distinct evidence of the duration of varieties in commercial production changing over the 37-year period from 1970 to 2007.

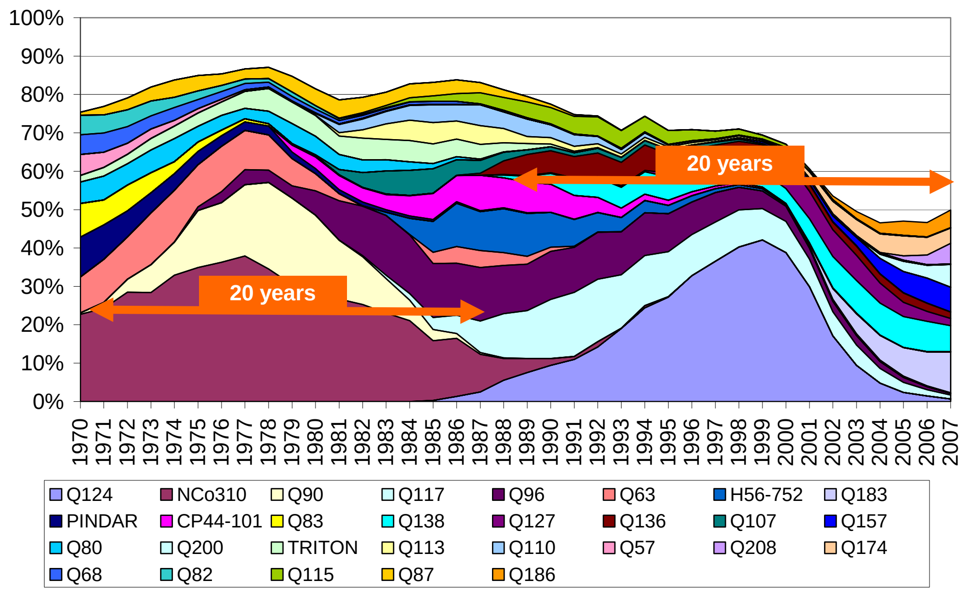

Fig. 5—Trend in adoption and disadoption of varieties in Queensland.

For Brazil (Figure 6), average duration of varieties in commercial production is approximately 15 years and, like in Queensland, there is no evidence that this has changed significantly from 1984 to 2007. The data are consistent with varieties being grown for three crop cycles using a system of a plant crop and four ratoons.

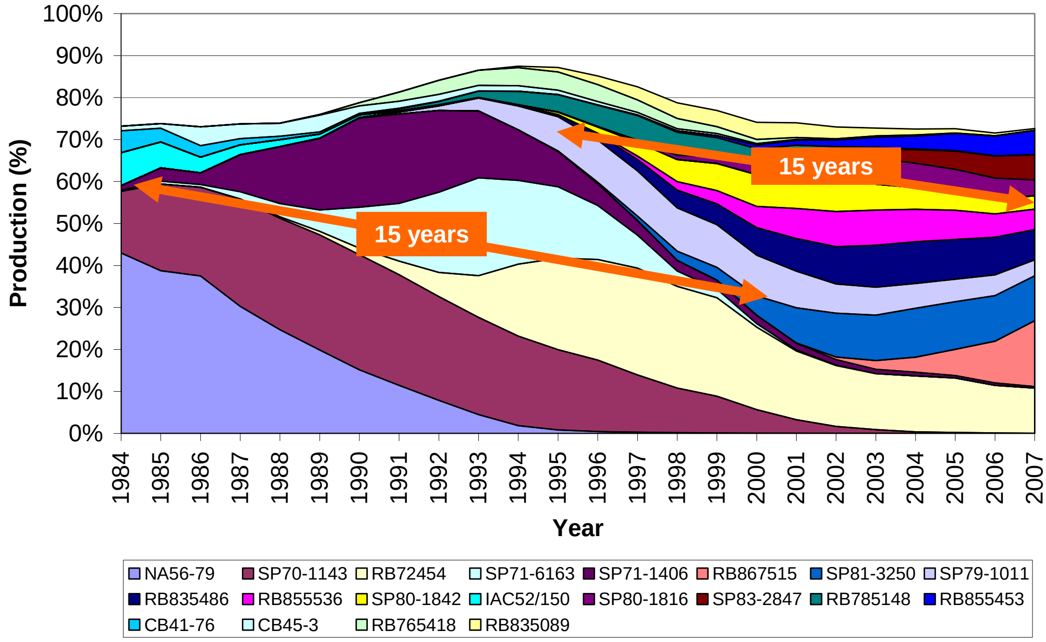

Fig. 6—Trend in adoption and disadoption of varieties in Brazil.

In South Africa (Figure 7), the variety composition plots are dominated by two varieties NCo376 and N12. The data suggest that varieties have a very long life in commercial production, exceeding 25 years in some cases. This is consistent with the long crop cycles ranging from two to four cycles of plant crops and 7–10 ratoons.

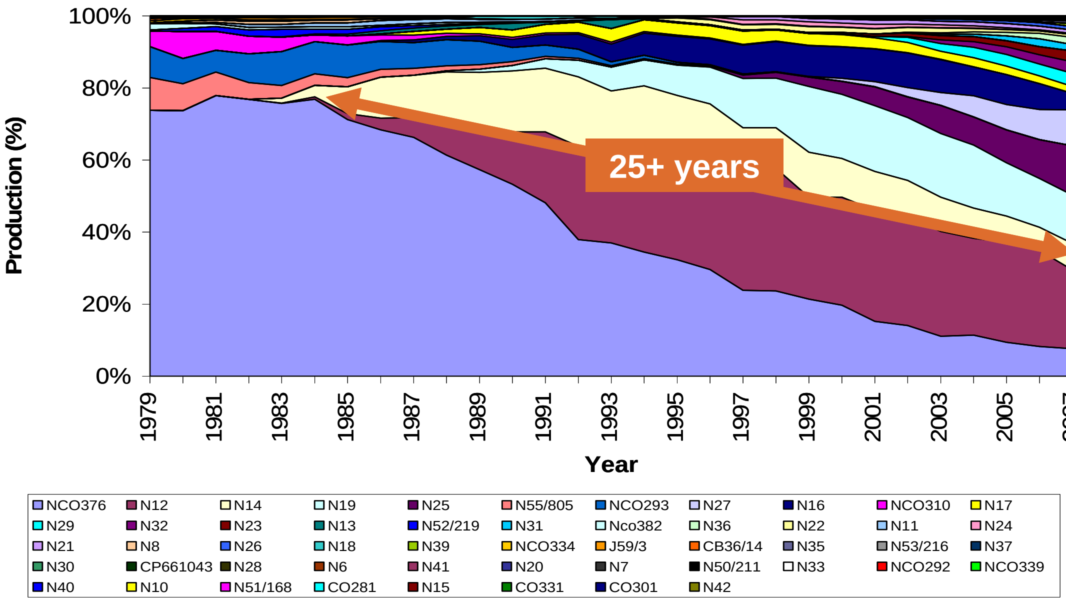

Fig. 7—Trend in adoption and disadoption of varieties in South Africa.

The average crop age results illustrate the domination of the Queensland crop through the late 1990s by the variety Q124, followed by the disadoption of that variety following a race change in the orange rust population (Figure 8). In Brazil, there is evidence for average crop age increasing. This probably reflects a preference to plant older varieties in new production areas because of the availability of seed cane and the known performance characteristics of those varieties.

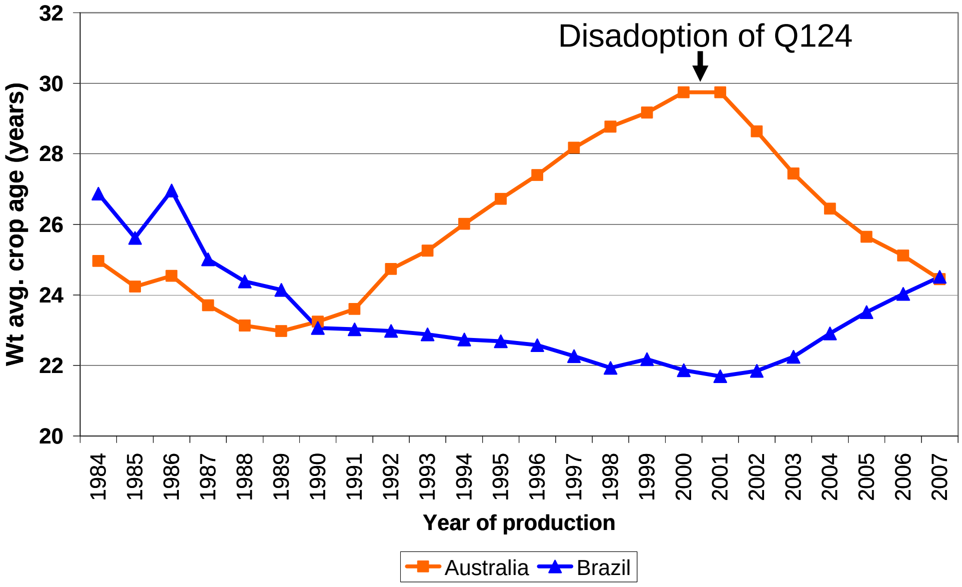

Fig. 8—Weighted average crop age for Queensland and Brazil.

There have been marked differences between Queensland, Brazil and South Africa in the uptake of PBR-protected varieties (Figure 9). The data indicate that uptake in Queensland was, initially, slower than in Brazil, but that since about 2003, the rate of uptake in Queensland has greatly surpassed the rate of uptake of Brazilian PBR protected varieties. Generally, the uptake of new varieties in South Africa has been very slow, mainly due to the traditionally long crop cycles (Figure 6c, see below).

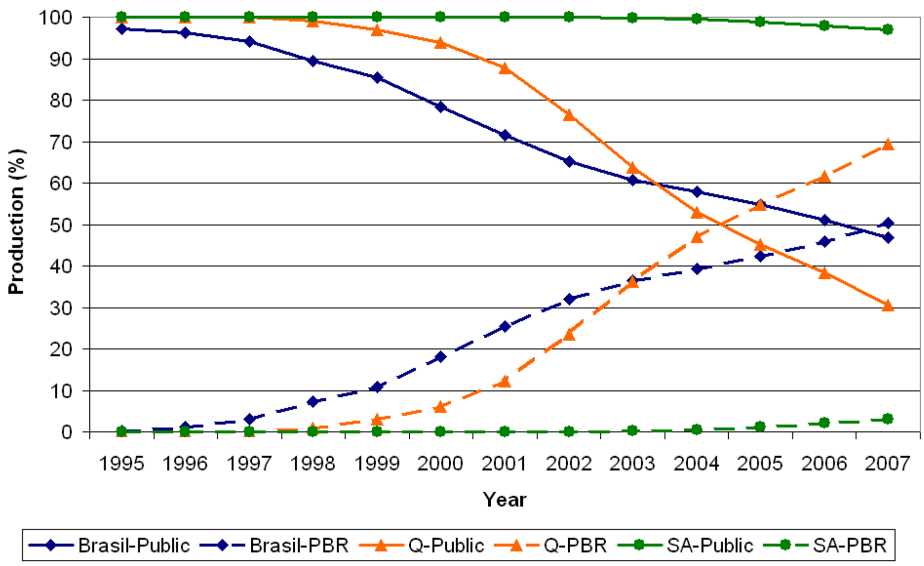

Fig. 9—Rate of uptake of PBR-protected varieties in Queensland, Brazil and South Africa.

The annual average rate of genetic gain for TCH, SC and TS (Table 2) indicates that there has been significant genetic advance for TCH by varieties from the SP program and to a lesser extent, the RB program. For TCH, the Q program has had a similar rate of genetic gain to the RB program in Brazil. For South Africa, there are four subprograms that had markedly different rates of genetic advance for TCH ranging from 1.18 TCH/year for CS12 (Coastal, 12 month harvesting cycle) to 0.06 TCH for CS18 (Coastal, 18 month harvesting cycle). For SC, the data indicate improvement for Q varieties, but neutral to slightly negative progress for SP and RB varieties. For South African varieties, there are variable results for SC ranging from 0.05%/year improvement in MD24 (Midlands, 24 month harvesting cycle) to –0.08%/year regression in CS12.

The key outcome from these results is that results for improvement of TS/year were equal for varieties from the SP and Q programs (0.281 TSH/year), with modest gains also being made by the RB program. Small genetic gains were made by varieties from the South African subprograms ranging from 0.015 TSH for CS18 to 0.081 TSH for MD24. It is important to note here that the extent and nature of the data used for the analyses varied considerably from country to country. Consequently, it was difficult to make fair comparisons between countries. Further, the South African sugar industry is unique in that there are four sub-programs where selection occurs to meet the requirements for the variable agro-climatic regions. These main agro-climatic regions include the Northern Irrigated region (NI12) where the sugarcane is irrigated and harvested at 12 months of age, the Coastal long cutting cycle region (CS18) where the cane is rainfed and harvested at 18 months of age, the Coastal short cutting cycle region (CS12) where cane is rainfed and harvested at 12 months of age and then the Midlands region (MD24) where cane is rainfed and harvested at 24 months of age.

Table 2—Rate of genetic gain for tonnes of cane per hectare, sugar content and tonnes of sugar per hectare for Queensland (Q), Brazil (SP, RB) and South Africa (CS12, CS18, NI12, MD24).

Data set	ΔTCH/yr	ΔSC/yr	ΔTS/yr	ΔTC/TS/yr	Start	End	No years
CS12	1.18	–0.08	0.070	0.06	1997	2007	10
CS18	0.06	0.01	0.015	–0.01	1982	2007	25
NI12	0.82	–0.03	0.050	0.03	1997	2007	10
MD24	0.17	0.05	0.081	–0.04	1997	2007	10
SP	2.13	–0.01	0.281	0.01	1983	2002	19
RB	1.17	–0.02	0.149	0.01	1989	2002	13
Q	1.33	0.04	0.281	–0.08	1983	2006	23

These results are supported by Figures 10, 11 and 12, which show the nature of the relationship between TCH and SC for varieties released by each of the programs over the period of study. In the case of Q varieties, the data indicate simultaneous improvement of both TCH and SC (Figure 10). For the SP and RB programs in Brazil (Figure 11), the data indicate that there has been a tremendous improvement in TCH over the period of study while Pol% has been held in a narrow range without achieving a significant SC improvement in new high yielding varieties.

For South Africa (Figure 12), the data clearly indicate a strong negative correlation between TCH and SC, suggesting that improvement is being made in SC of new varieties, albeit at the expense of TCH. We believe that this may be because the South African varieties have a significantly greater contribution of *Saccharum spontaneum*, which contributes to the higher stalk populations and good ratooning ability of sugarcane varieties and which makes joint improvement of both TCH and SC difficult. It is likely that increased selection pressure for higher quality and sucrose content has been at the expense of selecting for higher cane yield.

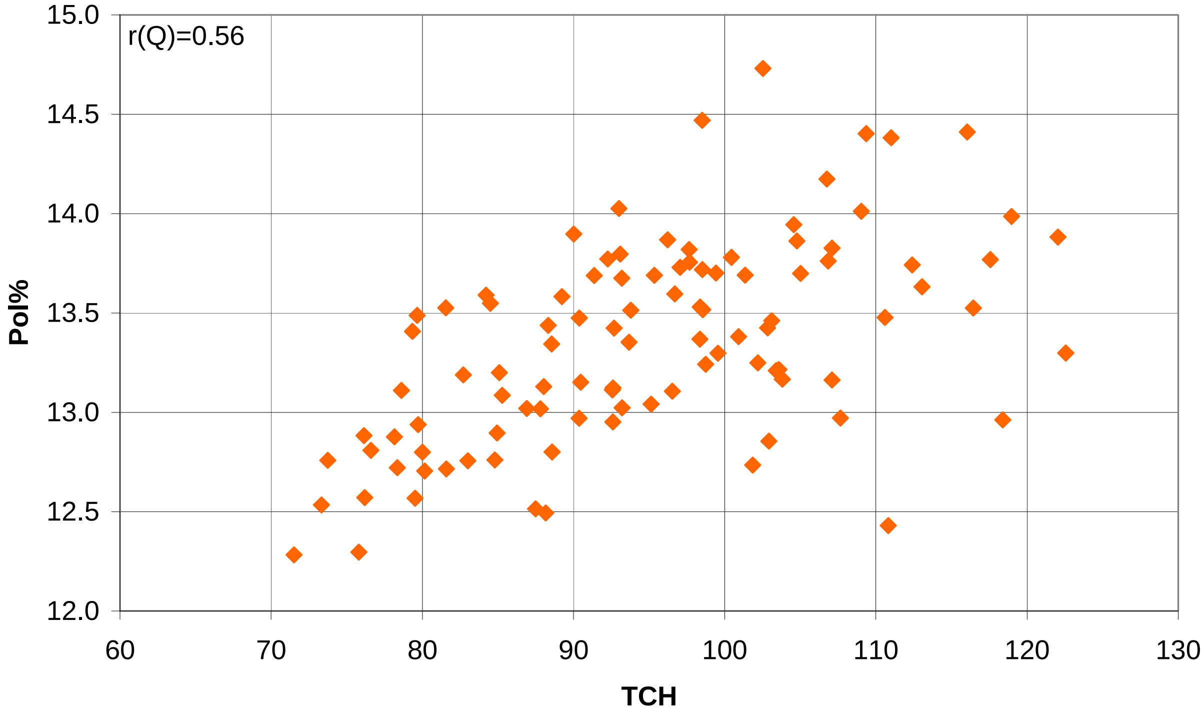

Fig. 10—Relationship between tonnes of cane per hectare (TCH) and Pol% for varieties released in Queensland by the BSES-CSIRO breeding programs from 1962 to 2006.

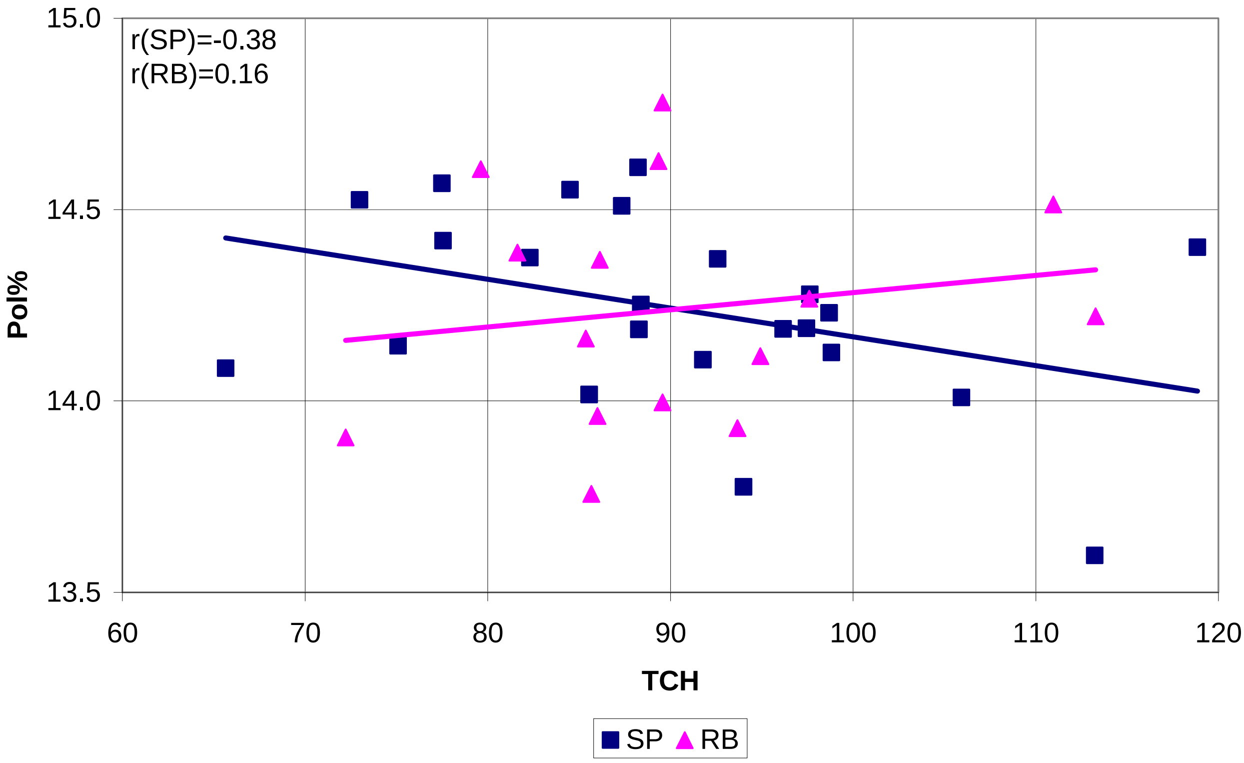

Fig. 11—Relationship between tonnes of cane per hectare (TCH) and Pol% for varieties released in Brazil by the Copersucar/CTC (1983–2001) and RIDESA (1989–2001) breeding programs.

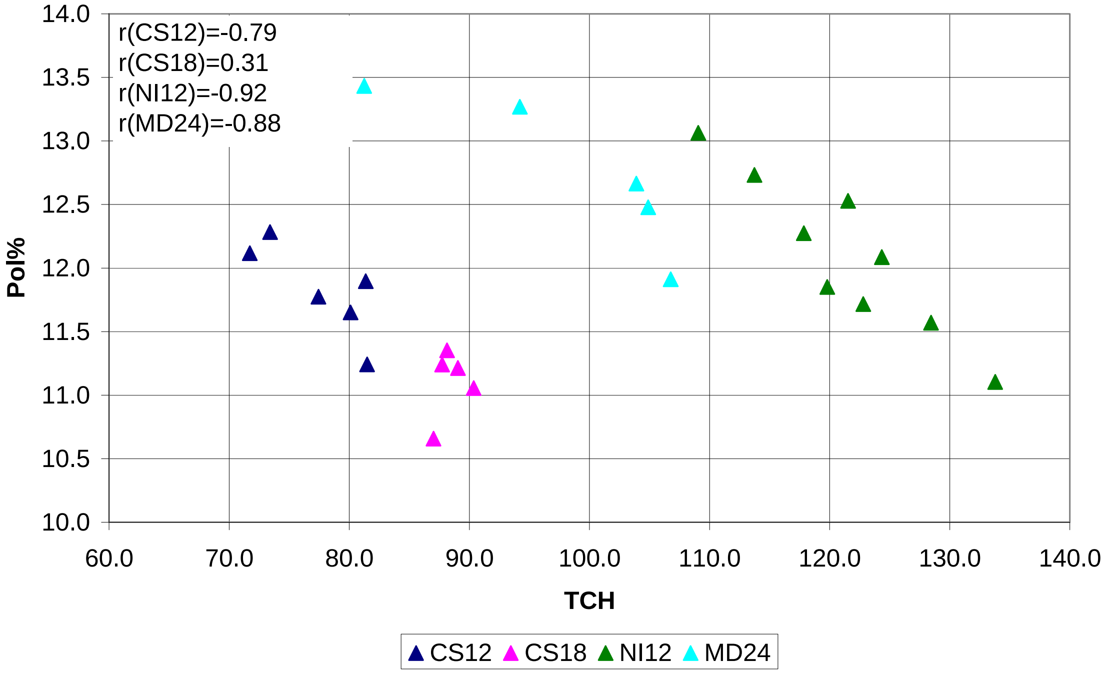

Fig. 12—Relationship between tonnes of cane per hectare (TCH) and Pol% for varieties released in South Africa by the SASRI breeding programs from 1955 to 2008.

Value of varieties in commercial production

The results summarising reasonable fees that each breeding organisation could charge on the basis that 20% of the EBIT benefit delivered by those varieties is captured by the breeding organisation are shown in Table 3.

Table 3—Summary of fees that could be reasonably charged assuming 20% of the EBIT value is captured by the breeding organisation. (Currency values are US dollars).

Institution	TCH benefit	SC benefit (%)	Grower fee ($/t)	Miller fee ($/t)	Total fee ($/t)	Annual revenue ($m)
BSES	16.5	0.4	0.88	0.35	1.23	43
CTC	4.1	–0.3	0.16	0.09	0.25	77
SASRI	2.2	0.5	0.18	0.10	0.28	6

The results indicate that each organisation is delivering significant value to the respective industries they serve through variety improvement alone, relative to fees currently being paid by organisation members. We estimated that reasonable fees ranged from $0.25/tonne of cane for CTC to $1.23/tonne of cane for BSES. If such fees were implemented, reasonable revenue streams could be generated by each organisation ranging from $6m per annum for SASRI to $77m per annum for CTC.

We emphasise that it is not the purpose of this paper to set out fees that our respective organisations could reasonably charge industry members for accessing research services. Many factors other than the research organisation capturing a proportion of the value delivered will impact on decisions to set fees at a particular level. The methodology set out here can be used to inform that decision in an objective way. This proposition is reasonable under the assumption that the technology, in this case, new varieties, is adopted commercially.

Conclusions

In this paper, we have set out a range of data that provide an insight into the performance of our respective research organisations with respect to the value being delivered to the sugarcane industries we serve. We chose to focus on variety improvement because of the availability of data for such a study and the ability to design an objective framework for estimating the impact of those varieties in commercial production, namely adoption of new varieties, rates of genetic advance and value delivered by new varieties in commercial production.

The study has illustrated that value is being delivered to the industries we serve by our respective organisations. There are clear differences between organisations in the quantum of value delivered, and in the rate of uptake of new varieties. It would be incorrect to conclude that these differences are a function solely of differences between the organisations. Each organisation operates in relation to specific resources to meet the strategic needs of their respective industries and into which new technologies are delivered for commercial production. What the study has done is demonstrate that research strategy and industry setting can have a major impact on realising the value being delivered by research investments. This is clearly illustrated by the contrasts with respect to joint improvement of TCH and SC, and the marked differences in the rate of uptake of new varieties.

The study was proposed by the respective Chief Executives of our organisations as an opportunity to benchmark the performance of each organisation against one another. We conclude that the study has been somewhat useful for this purpose. In the future, the approach could usefully be extended to relevant comparisons in other research areas, particularly the performance of farming systems research programs and the effectiveness of extension programs.

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REFERENCES

Cox, M.C., Stringer, J.K. and Cervellin, R. (2005). Productivity increases from new varieties in the Queensland sugar industry. Proc. Aust. Soc. Sugar Cane Technol., 27: 124–132.

Cox, M.C. and Stringer, J.K. (2007). Benchmarking genetic gains from new cultivars in Queensland using productivity data. Proc Int. Soc Sugar Cane Technol. 26: 624–631.

Gilmour, A.R. (1999). ASReml estimates variance components under a general linear mixed model by residual maximum likelihood (REML). NSW Agriculture: Orange. 210 p.

Schroeder, B.L., Cameron, T., Linedale, A.I. and Allsopp, P.G. (2008). Realised value of RD&E in the Australian sugar industry: economic benefits of the changing farming system. Proc. Aust. Soc. Sugar Cane Technol. 31: 221–229.

Wynne, A.T. and Gilmour R.F. (2010). Economic benefits of research: measuring and reporting. Proc Int. Soc. Sugar Cane Technol. (These Proceedings).

EVALUER LA PERFORMANCE DE LA R&D CANNE A SUCRE: COMPARAISON DE ROIS PROGRAMMES DE SELECTION

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MOTS-CLES: Performance de la R&D,
Étalonnage Concurrentiel, Évaluation Technologique,
Adoption de la Technologie.

Résumé

LES RESSOURCES pour la R&D en canne à sucre sont rares, car elles sont principalement pour la R&D agricole et les investisseurs en R&D veulent un retour sur leur investissement en termes de gains de productivité et profitabilité liées à l'adoption de nouvelles technologies. Ces réalités stimulent la mise en œuvre de programmes R&D productifs et efficients qui sont un élément moteur pour la l'amélioration continuelle de la productivité dans les industries de canne à sucre. Les programmes techniques bien adaptés apportent des bénéfices industriels permanents soutenant la profitabilité de l'industrie ainsi que sa croissance. Dans le contexte de ces programmes R&D, les décisions stratégiques et tactiques prises durant la gestion des projets R&D sont d'une importance vitale pour les produits et résultats fournis par la R&D et leur adoption par l'industrie. Nous illustrons ces principes en utilisant des données de performance des variétés en Australie, Brésil et Afrique du Sud. Nos conclusions inclus l'évidence pour une adoption rapide de ces nouvelles variétés, des améliorations significatives de rendements en canne par hectare et des bénéfices financiers pour les planteurs adoptant ces variétés de canne améliorées. Des différences existent entre les programmes R&D en termes de bénéfices à fournir aux industries respectives qui pourraient être directement connectées à des stratégies de recherche particulières. La R&D est un investissement et non un coût, mais elle devient un coût si les bénéfices ne sont pas réalisés par l'industrie.

EVALUACIÓN DEL DESEMPEÑO DE LA INVESTIGACIÓN Y DESARROLLO EN CAÑA DE AZÚCAR: COMPARACIÓN DE TRES PROGRAMAS DE MEJORAMIENTO

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Resumen

LOS RECURSOS para realizar investigación y desarrollo (I +D) en caña de azúcar son escasos, como generalmente ocurre en el área agrícola, y los inversionistas en I + D, esperan un retorno de sus inversiones en forma de mejoras en la productividad y ganancias que deriven de la adopción de nuevas tecnologías. Estas realidades, motivan a los programas de I + D a ser productivos y eficientes y los convierten en motores clave para las mejoras en productividad que se dan en las industrias azucareras. Programas técnicos sólidos resultan en beneficios constantes que mantienen la rentabilidad de la industria y ayudan a su crecimiento. En el contexto de estos programas de Investigación y Desarrollo, las decisiones tácticas y estratégicas que se tomen durante la gestión de los proyectos de I + D son de vital importancia con respecto a los resultados obtenidos y su adopción por parte de la industria. Nosotros ilustramos estos principios usando datos del desempeño de variedades en Australia, Brasil y Sudáfrica. Nuestros resultados incluyen evidencia de la rápida adopción de las nuevas variedades, mejoras significativas en el rendimiento de la caña por hectárea y beneficios financieros que obtuvieron los productores que adoptaron estas variedades mejoradas de caña. Se determinó que hay diferencias entre los programas de I+D en términos de los beneficios que se para a las industrias respectivas y que podrían estar relacionados con el uso de estrategias de investigación particulares. I + D es una inversión, no un costo, pero se convierte en costo, si los beneficios no son conocidos por la industria.