Sugar Research Australia™

# SRA Performance Report

## 2014–15

# Australian sugar industry

## Quick facts

**Australia's sugar industry accounts for only 2% of world sugar production but is the world's 3rd largest exporter of raw sugar.**

There are about **4,000** cane farming businesses

They supply **24 mills** owned by **8 milling companies**

**80%** of Australian sugar is exported, with a yearly value of nearly **$1.5 billion.**

**75%** of Australia's sugar exports are to South Korea, Japan and Indonesia.

The industry controls **$7.4 billion** in land and **$4.5 billion** in infrastructure assets.

Over **32 million** tonnes of sugarcane was crushed during the 2014 season, producing **4.6 million** tonnes of sugar.

To meet the industry target of **36 million tonnes or more** by 2017, Australia's sugarcane production will have to increase by more than **11%**.

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# Executive summary

## SRA's RD&E investments are yielding positive returns for investors.

Independent analyses of a selection of SRA projects produced an aggregated Benefit-Cost Ratio of **4 to 1**.

Significant milestone for SRA achieved with the release of the **first SRA-branded varieties** SRA1, SRA2 and SRA3

## SRA scores highly in its first-ever Grower Survey

**66%** of growers rated SRA high in terms of their perception of value/influence of SRA's products and services.

SRA's RD&E information products and services were rated, on average, **3.6 out of 5**.

Australia's cane yield (t/ha) continues to out-perform that of the world's top four sugarcane producing countries.

SRA's Genetically-Modified (GM) program for the development of Herbicide-Tolerant (HT) sugarcane continues to meet all milestones, as set by our commercial partner – although, it should be noted that there is currently no GM sugarcane in production in Australia.

**Yellow Canopy Syndrome (YCS) is #1 priority**

Research has brought us one-step closer to identifying the cause of YCS by eliminating Nigrospora fungus, linear bugs, sugarcane yellow virus and soil nutrient deficiency as causal factors.

**Sustained genetic improvement in SRA's breeding program shows the health of the SRA breeding program.**

Highest rate of genetic gain ever achieved at a 30-year rolling average of 192 kg of sugar per hectare per year gain.

Critical YCS research supported by the development of sugarcane metabolome and transcriptome databases.

SRA's breeding program has led to more than **90%** of Australia's sugarcane crop now being resistant to smut.

**Approximately 50% of sugarcane growers have attended SRA events.**

Providing improved understanding of new research, technology and best management practices.

**58% of growers have changed farming practices over past 2 years, with 40% acknowledging SRA as a key influencer of practice change.**

**63% of growers are using SIX EASY STEPS™ to calculate their fertiliser use.**

Nitrogen-Use Efficiency Review supports the principles of SIX EASY STEPS™ as a robust BMP framework for industry.

Breakthrough research identified the cause of Ramu Stunt Disease to be a virus transmitted by a planthopper.

Pest and disease resistance ratings developed for germplasm against exotic borers, Downy Mildew and Ramu Stunt.

**Major scientific discovery by SRA with DNA sequencing used to identify a new type of pathogen as a causal agent of chlorotic streak.**

**Something that has baffled the world sugarcane community for 80 years.**

# Introduction

SRA is an industry-owned company that was established in 2013 by Australia's sugarcane growers and millers to deliver cost-effective Research, Development and Extension (RD&E) services for the benefit of the Australian sugar industry and the broader community.

SRA's main source of funds come from a statutory levy paid by sugarcane growers and millers and investments from the Commonwealth and Queensland governments.

SRA's 2013/14-2017/18 Strategic Plan outlines the Key Focus Areas (KFAs) that currently guide SRA's RD&E investment, activities and services in order to address the priority issues of our investors. The 2014/15 Annual Operational Plan set the key deliverables, RD&E project portfolio and performance measures that SRA worked towards during the past year. Both of these key planning documents are available on SRA's website at http://www.sugarresearch.com.au/page/About_SRA/Corporate_publications/.

This inaugural SRA Performance Report provides an overview of SRA's performance in delivering on our planned objectives for 2014/15.

The Performance Report is a work-in-progress. The intent is for the report to stimulate discussion and generate feedback from SRA's industry and government investors. In particular, SRA is seeking investor feedback on the content and structure of the report so that SRA can ensure the report is meaningful and appropriately demonstrates the value our RD&E is providing to our investors.

SRA recognises there are some gaps in terms of the information detailed in this report. Future iterations of the report will incorporate additional RD&E performance related data as it becomes available. A number of performance measurement mechanisms have been, or are in the process of being, established to capture and assess the delivery, output and outcomes of SRA's RD&E investment, activities and services. These mechanisms include regular SRA member, Delegate and levy payer surveys, as well as an organisational performance monitoring and evaluation program to keep SRA's Board informed on progress against planned objectives and outcome delivery.

SRA and the Queensland Department of Agriculture and Fisheries' have co-sponsored a comprehensive survey to capture current productivity and profitability information from a statistically-representative cross-section of Australian sugarcane growing businesses. The survey collection process was conducted by ABARES earlier in 2015 and the comprehensive *Australian Sugarcane Growing Farms: An Economic Survey* report will be released by ABARES in September 2015. The report will provide data at industry, regional and varying farm size levels.

The ABARES report will provide baselines for future SRA reporting on the impact of RD&E on industry practice change, productivity and profitability.

SRA's 2014/15 Annual Report, which will be published in October 2015, will further outline the RD&E activities and outcomes delivered by SRA during the past year.

SRA welcomes investor feedback on this Performance Report. If you would like to provide any comments or recommendations for improvement of this Report, please address them to Ms Leigh Clement, SRA's Manager Corporate Planning and Reporting, via email, post or telephone to:

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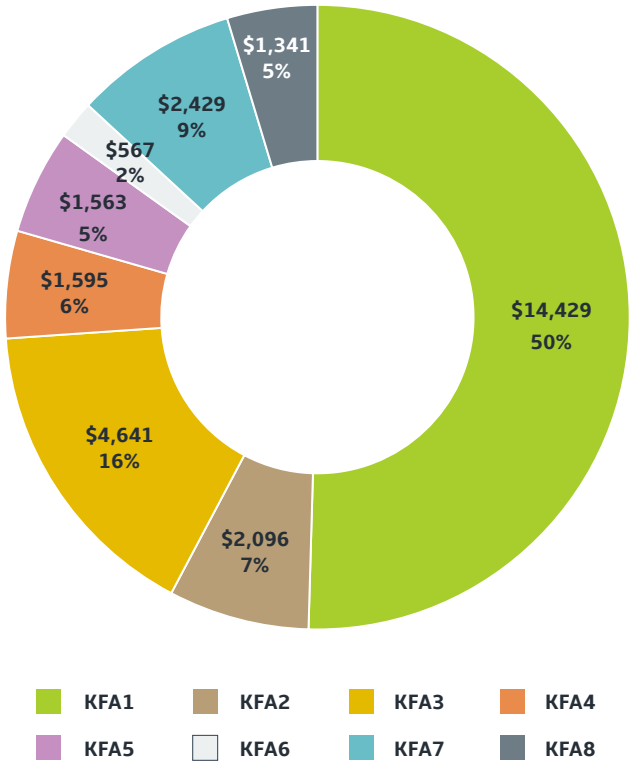
# Performance against plan for 2014/15

## SRA RD&E Investment allocation 2014/15 ('000)




SRA's 2013/14-2017/18 Strategic Plan (summary provided in Appendix 2) details the planned investment allocations for each of the KFAs.

As reported in the table below, the current rolling average shows some movement away from the planned investment allocations. These variances reflect increased investment and focus on the SRA Board identified critical Impact Areas of:

- plant breeding;
- identification of causal factor/s and management strategies for Yellow Canopy Syndrome (YCS);
- extension and adoption; and
- harvesting losses and adoption of harvesting best practice.

SRA will monitor investment allocations over the remaining Strategic Plan period and will prioritise future RD&E investment, where deemed necessary, to meet investors' critical needs. Note, the actual investment reported below includes both contestable and SRA core RD&E.

| Key Focus Area (KFA) | 2013/14 Actual | 2014/15 Actual | Rolling Average | Plan[1] |
|---|---|---|---|---|
| KFA1: Optimally-adapted varieties, plant breeding and release | 51% | 50% | 51% | 45% |
| KFA2: Soil health and nutrition management | 5% | 7% | 6% | 5-10% |
| KFA3: Pest, disease and weed management | 14% | 16% | 15% | 5-10% |
| KFA4: Farming systems and production management | 8% | 6% | 7% | 15-20% |
| KFA5: Milling efficiency and technology | 5% | 5% | 5% | 10-15% |
| KFA6: Product diversification and value addition | 5% | 2% | 3% | 5-10% |
| KFA7: Knowledge and technology transfer and adoption | 9% | 9% | 9% | 1-5% |
| KFA8: Capability development, attraction and retention | 5% | 5% | 4% | 1-5% |

**1** Colour denotes status of rolling average against planned allocation.

**Within +/- 5% of plan** **Within +/- 6 to 15% of plan** **Within +/- 16% or more of plan**

| 2014/15 Annual Operational Plan Measures | Result | Comments |
|---|---|---|
| **KFA1: Optimally-adapted varieties, plant breeding and release** | | |
| Release of improved varieties, with targeted 3 varieties per 5-year period. | ● | 3 varieties released in 2015. |
| Percent production from new varieties. | ● | Decreased with dominance of Q208(f) and KQ228(f). |
| Rate of genetic gain (TCH, CCS, TSH). | ● | A 30-year rolling average of 192 kg sugar/ha/year gain - the highest achieved. |
| Weighted average disease ratings for varieties in each region. | ● | >90% of crop resistant to smut, >97% at least intermediate resistance to pachymetra root rot. |
| **KFA 2: Soil health and nutrient management** | | |
| Soil health indicators developed for sustainable sugarcane production. | ● | District-specific soil guides released for Isis and Mackay regions. |
| Tools and/or varieties identified for increasing nutrient use-efficiency. | ● | R&D review conducted with future funding to be based on review outcomes and further industry consultation. Soil health guidelines and workshops delivered. |
| Tools developed for minimising chemical and nutrient losses and understanding water quality. | ● | Guidelines, workshops and industry updates provided. Research program developed with EHP to examine nutrient efficiency. |
| SIX EASY STEPS™ reviewed with improvements where necessary. | ● | Review of nitrogen-use efficiency completed, with report supporting SIX EASY STEPS™ as providing industry with a robust BMP framework. |
| **KFA 3: Pest, disease and weed management** | | |
| Effective pest, disease and weed diagnostic capabilities and awareness and training programs. | ● | DNA diagnostics developed for Ramu stunt. |
| Development and adoption of packages for integrated management of key pests, diseases and weeds. | ● | New technology (e.g. suSCon® maxi Intel), guidelines and workshops provided. |
| Weighted average disease ratings for varieties in each region. | ● | >90% of crop resistant to smut, >97% at least intermediate resistance to pachymetra root rot. |
| Up-to-date dossiers to support contingency plans to minimise threats and impacts of key exotics. | ● | Dossiers, awareness and training programs revised for borers, Ramu stunt and downy mildew. |
| Capability to provide entomology, pathology and weed expertise. | ● | All industry requests dealt with within 48 hours. |
| **KFA 4: Farming systems and production management** | | |
| Methodology for more rapid and efficient bulking of sugarcane varieties. | ● | Slow progress as DuPont is still developing the business model to take the technology to 'pilot scale' testing. |
| Adoption of a better sugarcane planting technology. | ● | 37% increase between 2014 and 2015 in tissue culture ordered to propagate clean seed. |
| Improved crop performance over longer cropping cycles. | ● | Precision agriculture and technology aiding farm management and production, e.g. yield forecasting using satellite imagery. |
| Better crop management under conditions of water stress. | ● | System developed to compare varieties' water logging tolerances. |
| Guidelines for implementation of precision agriculture developed. | ● | Precision Agriculture manual produced. |
| Adoption of precision agriculture technology and techniques. | ● | Active usage in some areas, slow adoption in others. |
| Adoption of harvesting best-practice. | ● | Trial demonstrations underway. Impact area for increased focus in 2015/16. |

| 2014/15 Annual Operational Plan Measures | Result | Comments |
|---|---|---|
| **KFA 5: Milling efficiency and technology** | | |
| Adoption of improved or novel milling processes and technology. | Unknown | Adoption measurement and monitoring yet to be established. |
| **KFA 6: Product diversification and value addition** | | |
| Sugar industry supply chain analysis completed. |  | Highest priority identified as harvest losses, planning underway to further quantify losses and promote adoption of Harvesting Best Practice. |
| Identification of new opportunities in product diversification and innovation. |  | Some technologies identified and feasibility tested, but remains low industry priority. |
| **KFA 7: Knowledge and technology transfer and adoption** | | |
| Joint planning of research translation and extension programs with other stakeholders. |  | Joint plans under development. |
| Effective delivery of extension messages. |  | Ongoing publication, communication and extension of R&D. |
| Increased awareness of technological innovations, locally and internationally. |  | Practical manuals, guidelines, webinars and factsheets released. |
| Research outputs' key RD&E messages are promoted in a timely manner through various channels. |  | SRA and industry communication tools and channels improved. |
| Increased support for and participation in SRA delivery networks, events and extension programs. |  | Baselines set 2014/15. |
| **KFA 8: Capability development, attraction and retention** | | |
| SRA participation and investment in relevant collaborative and cross-sectoral RD&E programs. |  | Participation in numerous programs, e.g. climate change, soils, water use, plant biosecurity, and biofuels and bioenergy. |
| Increased availability of skilled industry personnel. |  | Scholarship, training and extension programs provided. |
| SRA sponsored Young Industry Participants' Forum held annually. |  | SRA sponsored activity and support for Australian Cane Farmers Association's (ACFA's) Next Gen program. |
| Development and uptake of new and existing knowledge transfer or training programs or resources. |  | Various extension programs, guidelines and tools developed. |
| Scholarships awarded to current and future industry participants. |  | Scholarship, grant and support programs provided. |

## Summary performance to plan

**73%** of measures have been achieved

**24%** are on track with progress/improvement made but objective not yet fully achieved

**3%** has not been achieved and significant action is required to reach objective

# Snapshot of RD&E delivered in 2014/15

## KFA1: Optimally adapted varieties, plant breeding and release

- First of SRA varieties released – SRA1, SRA2 and SRA3.
- New variety exchange program signed with Sri Lanka to increase genetic diversity in SRA's breeding program.
- Generated sugarcane genomic sequence relevant to traits important to industry.
- SRA Board adopted recommendations of an independent review to enhance plant breeding in the Herbert region.
- GM program for the development of herbicide-tolerant sugarcane continues to meet all milestones, as set by SRA's commercial partner.

## KFA2: Soil health and nutrient management

- Review of nitrogen-use efficiency in sugarcane completed, with the report recommendations supporting adoption of SIX EASY STEPS™.
- Conducted workshops in all sugarcane regions to improve industry understanding of environmental risks associated with recycling of milling by-products on-farm.
- Released soil guides for Mackay and Isis regions, with more guides in the pipe-line to assist growers in managing production for specific soil types.
- An applicator has been built by a grower group at Maryborough to allow soil amelioration (mill mud, compost) to be applied sub-surface at a commercial scale, to improve productivity of marginal soils.
- Participated in the development of a cross-sectoral national Soils Strategy that aims to increase farm productivity and profitability through enhanced soil mapping, management and understanding the role of soils in natural ecosystems.

## KFA3: Pest, disease and weed management

- Yellow Canopy Syndrome (YCS) is SRA's #1 priority – we have eliminated Nigrospora fungus, linear bugs, sugarcane yellow leaf virus and soil nutrient deficiency as causal factors, bringing us one step closer to determining the cause and developing management solutions.
- Research breakthrough showing the cause of Ramu Stunt Disease, a high-priority biosecurity issue, to be a virus transmitted by a planthopper.
- DNA sequencing has identified a new type of pathogen as a causal agent of chlorotic streak – something that has baffled the world sugarcane community for 80 years.
- Developed national diagnostic protocols for high-priority pests and diseases, e.g. a new diagnostic for ratoon stunting disease.
- In collaboration with CropCare Australia, SuSCon® maxi Intel has been registered for extended cane grub control.

## KFA4: Farming systems and production management

- Satellite imagery used to develop predictions of average yield for regions during the 2014 growing season.
- System developed to compare the tolerance to water logging of different cane varieties.
- Released High-Yielding Cane, Irrigation and Harvesting Best Practice Manuals to highlight current research, innovations and best management practice.
- Conducted harvesting performance trials in a number of regions to quantify the effects on crop yield of differing harvester operational parameters, including performance at different ground speeds, fan speeds and basecutter heights. Trials will be repeated to determine impact over time.
- Ongoing participation in cross-sectoral programs relating to managing climate variability, including research and the development of climate forecasting tools to aid on-farm production management.

## KFA5: Milling efficiency and technology

- A 'whole of factory' model (SysCAD) developed to provide dynamic simulation to assess advanced control options for improved operational efficiency in mills.
- Completed review of wet scrubber technology in the sugar and non-sugar industries.
- Improved modelling capability to more accurately represent the various processes occurring in a tangential entry fixed-vane wet scrubber.
- Completed performance assessment of vacuum belt press filters to process mill mud compared to common factory rotary vacuum filters, with project results being useful to any mill considering replacing an existing filter or installing new ones.
- Developed training resources for traffic officer to improve efficiency of cane traffic operations.

## KFA6: Product diversification and value addition

- New technologies have been developed to produce biofuels, platform chemicals and other value-added products from the thermochemical processing of bagasse.
- Novel materials have been identified as catalysts for the production of furan derivatives from sugar waste components.
- Research has demonstrated that zeolites, which have many and varied industrial uses, could be produced from bagasse ash.
- Secured funding to lead a cross-sectoral $6 million project researching bio-refineries for higher-value animal feed, chemicals and fuel.

## KFA7: Knowledge and technology transfer and adoption

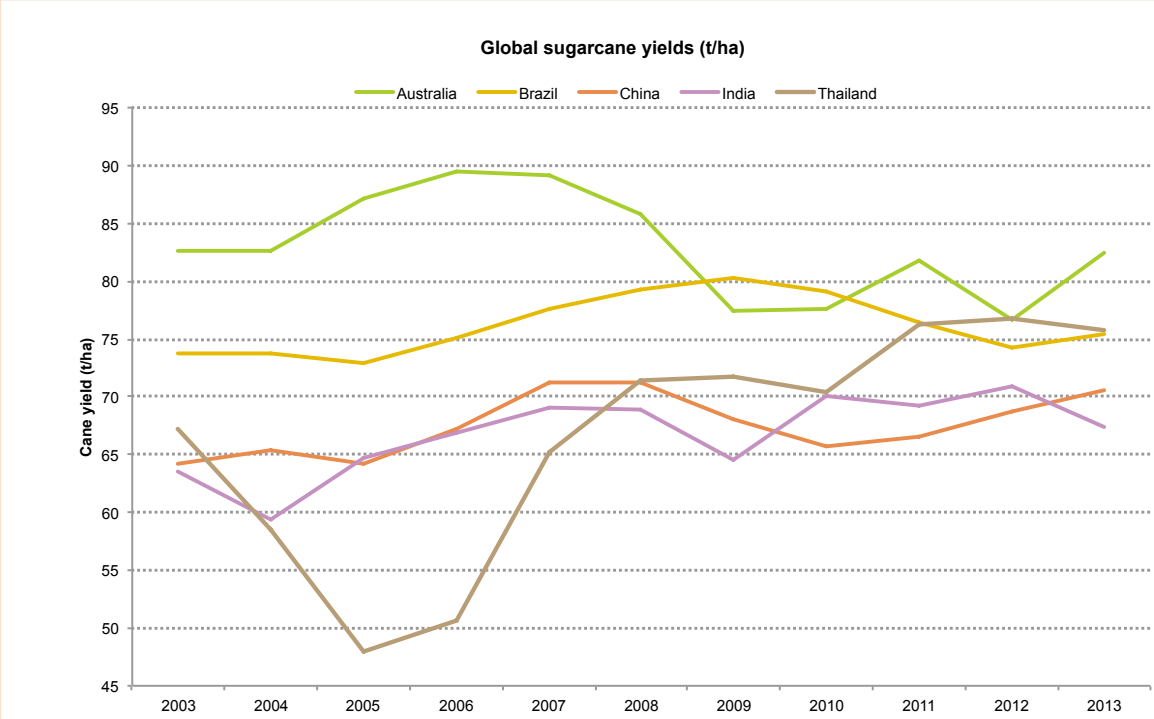
- Launched the 1st research e-library for the sugar industry, providing access to close to 1,000 research reports and publications.
- Regularly published on-line, email and hard-copy manuals, guidelines, newsletters, industry magazines (such as Cane*Connection* and Milling*Matters*), factsheets, video clips (CaneClips on YouTube) and webinars highlighting RD&E activities and outcomes.
- Developed an industry-first on-line events calendar, highlighting key industry events, workshops, field days, regional meetings and conferences.
- Facilitated approximately 50 industry events, including: on-farm field walks and demonstrations; industry forums and updates; workshops; and milling webinars.
- Secured funding, in collaboration with other Research and Development Corporations, to undertake two new research projects which aim to consolidate targeted and practical extension services and identify mechanisms to stimulate private sector extension.

## KFA8: Capability development, attraction and retention

- 4 new PhD scholarships and 2 early/mid-career awards were provided.
- 16 new travel and learning awards were provided.
- On-line training tools for factory supervisors and operators were developed and delivered to mills.
- Sponsored a scholarship for a senior sugar industry leader to attend the Training Rural Australians in Leadership (TRAIL) Blazers course.
- Invested with other Research and Development Corporations to leverage capability and achieve outcomes of common good in key areas, including: biosecurity; water-use; soils; and biofuels and bioenergy.

# RD&E outcomes

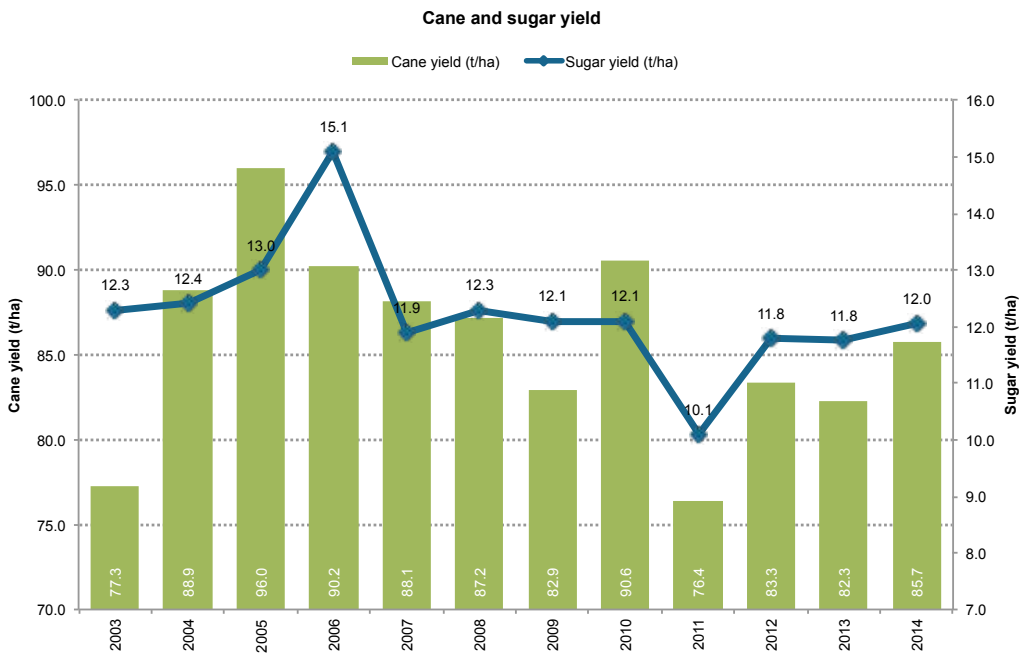
## Productivity | Global yields




Australia is the 7th largest sugarcane producer in the world but continues to be the world leader in terms of sugarcane yields. Australia's yields are recovering after the impact of significant weather events during 2008-2011.

*Source: Food and Agriculture Organisation of the United Nations, Statistics Division, http://faostat3.fao.org/home/E; Sugar Year Book 2014, International Sugar Organisation, London, 2014.*

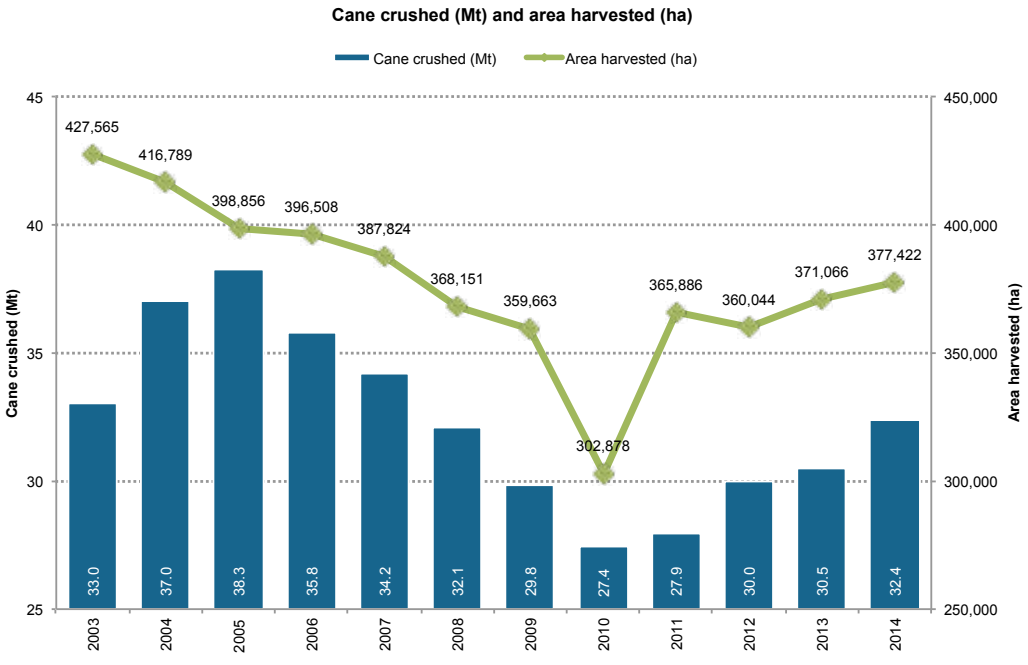
## Productivity Australian cane & sugar yield




SRA's breeding program focusses on delivering the best economic value from both Commercial Cane Sugar (CCS) and cane yield.

*Source: Australian Sugar Milling Council; Australian Sugar Year Book, Rural Press Ltd, Brisbane.*

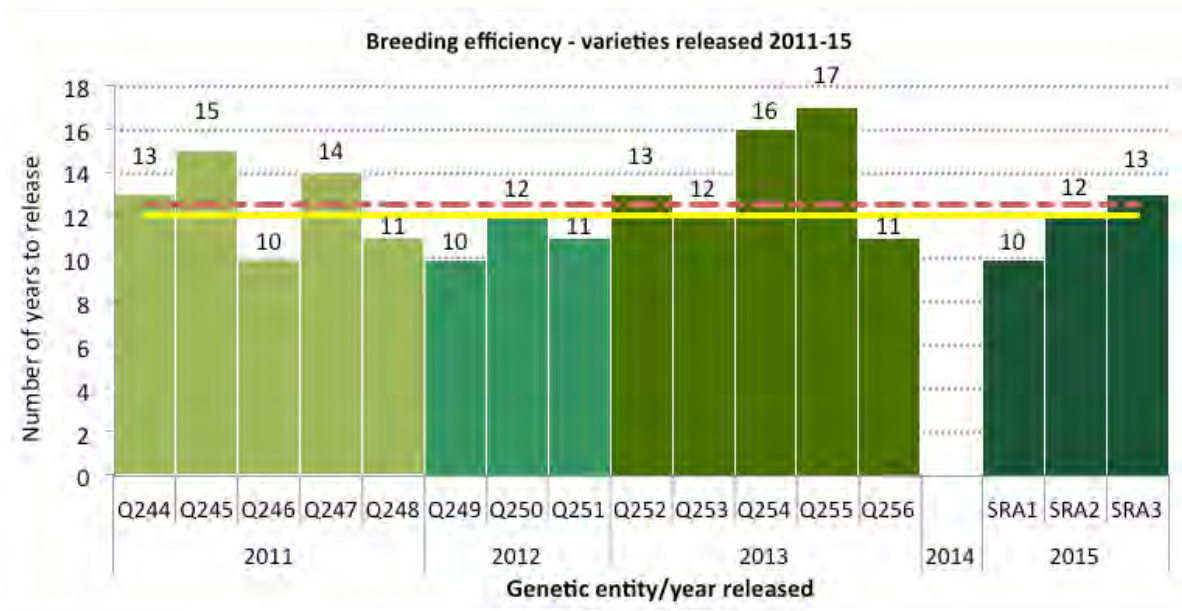
## Productivity Australian cane crushed




Following a couple of seasons of relatively static production, cane production increased by 5% in 2014 and is forecast to continue to steadily increase towards the industry goal of 36Mt. Area harvested has steadily increased after the impact of weather in 2010 and timber plantation land returning to cane.

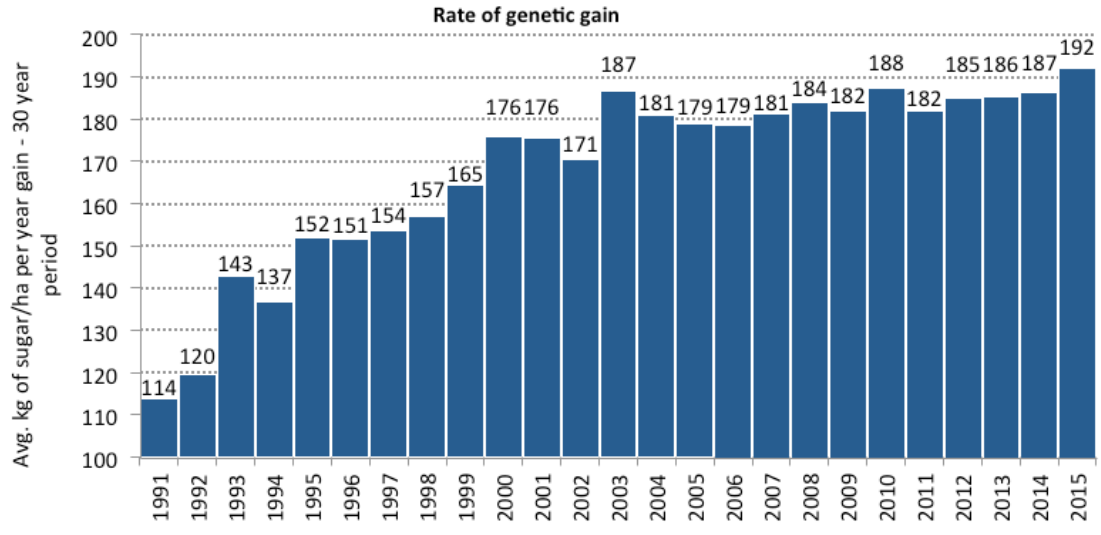
*Source: Australian Sugar Milling Council.*

## Varieties & plant breeding | Breeding efficiency




The time taken for a variety to be released is one measure of breeding efficiency. The benchmark standard used is 12 years (yellow line). This is a balance between releasing a new variety for industry to test commercially and accumulating trial performance data. The average time to release is 12.5 years (red line). No new varieties were released in 2014 as the industry Variety Approval Committees held over decisions until 2015 to await additional data to inform decisions. The paucity also reflects the 2007-09 culling of much of the selection program because of smut susceptibility. *Source: SRA.*

## Varieties & plant breeding | Rate of genetic gain




The rate of genetic gain is based on a 30-year rolling average of measured potential gain in different production traits – in this case sugar/ha. It is a measure of the 'health' of SRA's breeding program. Continued positive gains (i.e. >0) mean that the program is becoming more efficient in selecting high-value varieties.

*Source: SRA.*

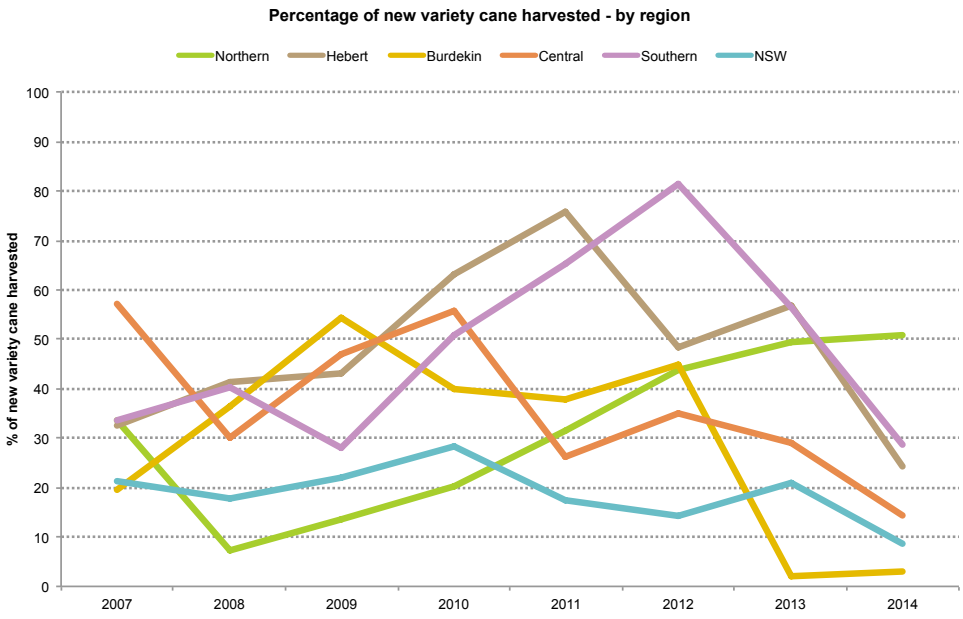
## Varieties & plant breeding — Trial activity by region 2015


CAT – Clonal Assessment Trial
FAT – Final Assessment Trial
MaxProp – Maximum Propagation

The numbers represent the number of clones in each breeding trial stage. The large number of CATs in the Southern region reflects the SmutBuster program, whilst the Burdekin FATs program reflects the integrated breeding program with Wilmar Sugar.

*Source: SRA.*

## Varieties & plant breeding — New varieties in production (by region)

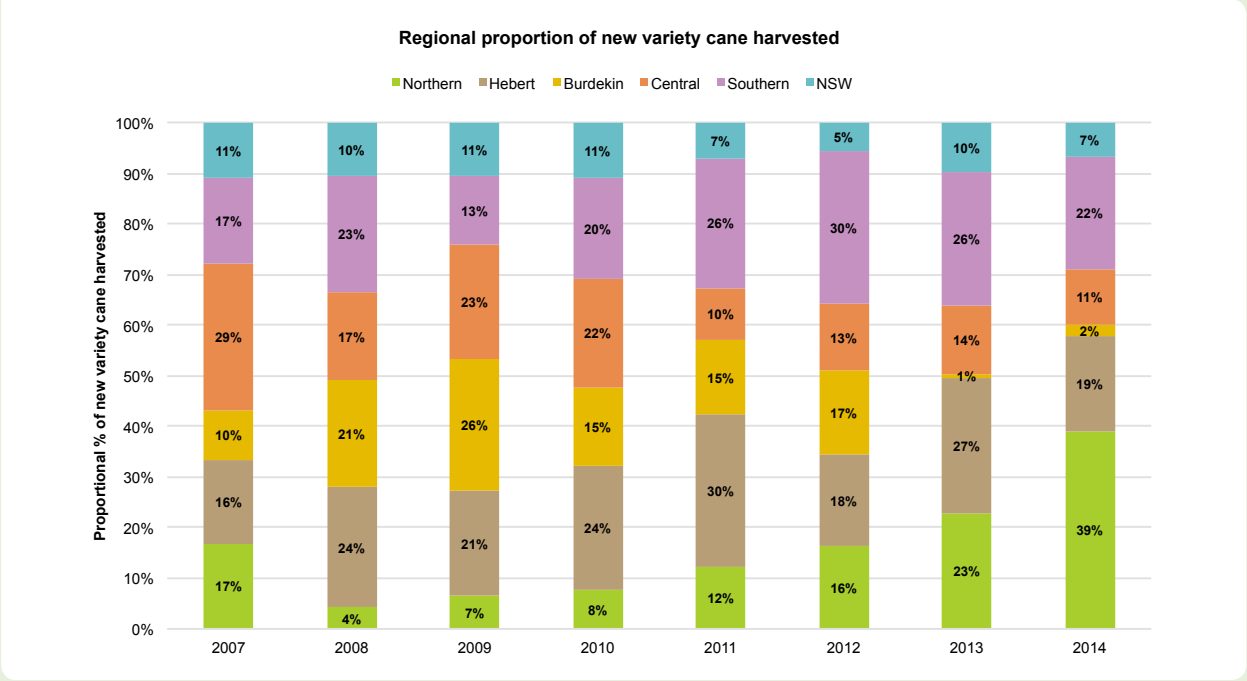



New varieties are those that have been released in the previous 7 years. It takes time for these to be bulked-up and used. The uptake reflects the perceived extra value of the new variety over older varieties. The drop in 2013 was influenced by smut impacts on varieties and breeding stocks and the move of Q208$^{\phi}$ and KQ228$^{\phi}$ to 'old varieties'.

*Source: Mill statistics; SRA.*

# Varieties & plant breeding

## New varieties in production (overall)

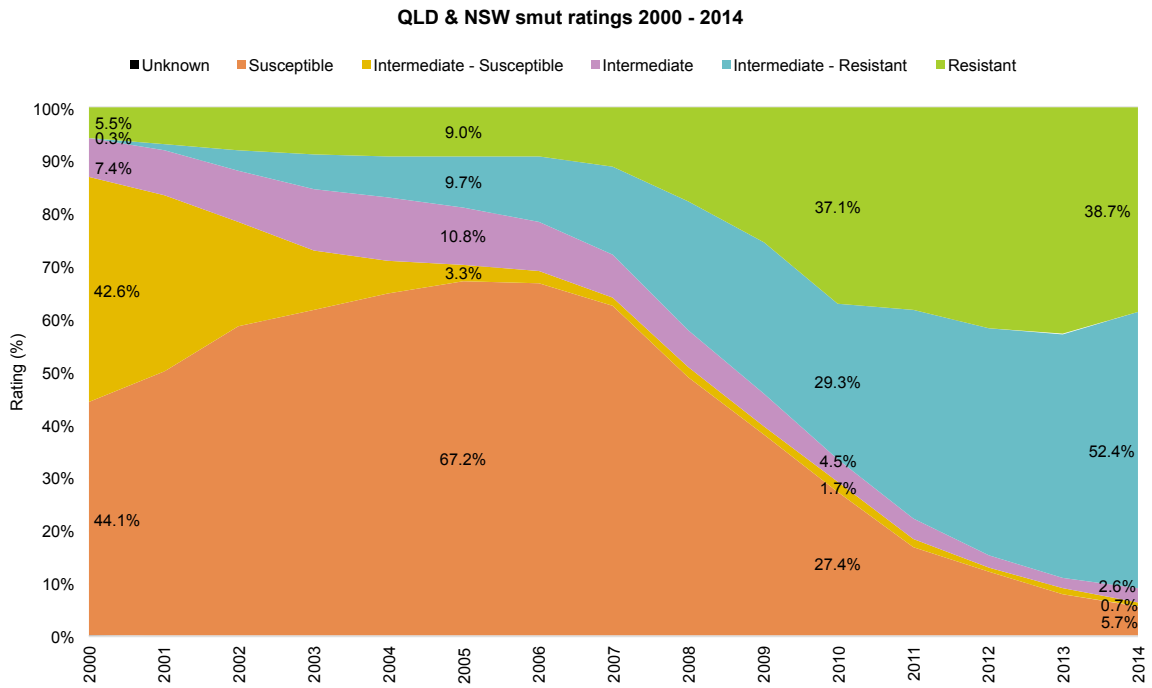



This graph averages the use of new varieties (those that have been released in the previous 7 years) across regions to show how new varieties have penetrated the market. *Source: Mill statistics; SRA.*

# R&D Highlights

- Released new SRA varieties – SRA1 and SRA2 for the Southern and NSW regions; and SRA3 in the Herbert region.
- Released 7 current Q canes in additional regions.
- A new variety exchange program signed with Sri Lanka to increase genetic diversity in SRA's breeding program.
- Propagated 13 advanced variety clones for possible release in 2015/16.
- 54 clones from the SmutBuster program repeated or propagated in a series of Final Assessment Trials (FATs) across all regions, demonstrating the significant benefit of recovering valuable genes from smut-susceptible lines.
- 41 introgression clones planted into FATs in Burdekin, Central, Southern and NSW regions in 2015.
- 60 introgression clones propagated for possible inclusion in FATs in Northern and Herbert regions in 2016.
- 877 field crosses and 992 photoperiod facility crosses made in 2014.
- New approach for the economic weighting of traits for SRA's plant breeding program endorsed by industry.
- Generated sugarcane genomic sequence relevant to traits important to the industry.
- Sugarcane Single Nucleotide Polymorphism (SNP) chip containing 345,704 SNP markers developed in collaboration with Syngenta.
- Quantified the extent of genetic variation of a diverse set of commercial sugarcane clones for nitrogen-use efficiency through systematic testing under field conditions.
- Completed Herbert Plant Breeding Review with recommendations to be implemented to enhance plant breeding activities that will yield positive results not just for the Herbert region but the entire industry over time.
- Preliminary analysis has been undertaken on cane yield data to determine the key drivers of productivity in the Herbert region and develop a decision support system to optimise variety recommendations and increase productivity at farm, mill and industry level.
- GM program for development of herbicide-tolerant sugarcane continues to meet all milestones, as set by SRA's commercial partner.

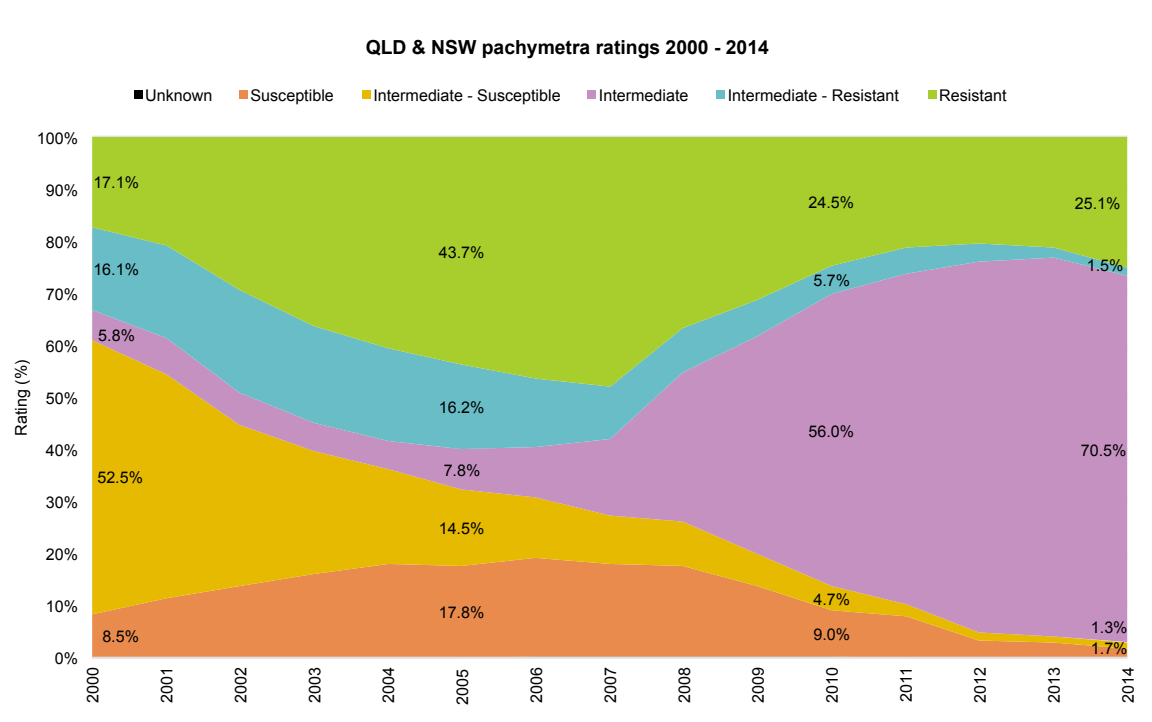
## Pest & disease management — New varieties smut disease ratings




There has been an almost complete replacement of smut-susceptible varieties with intermediate-resistant varieties since smut was found in 2006.

*Source: Mill statistics; SRA.*

## Pest & disease management — New varieties pachymetra root rot ratings




Most varieties now grown have at least intermediate resistance to pachymetra root rot. Moving the mix to even more resistance is a priority in the SRA breeding program. Complementing SRA's breeding program is the increasing use by industry of SRA's diagnostic services, with a 69% increase in testing since SRA's establishment. *Source: Mill statistics; SRA.*

## R&D Highlights

- Sugarcane metabolome and transcriptome databases developed for YCS research.
- In collaboration with Crop Care Australia, suSCon® maxi Intel has been registered for control of common cane grub species.
- Satellite imagery is being used to detect the extent of cane grub damage in a region, allowing risk maps to be developed to enable growers to improve their management decisions. SRA's validation work yielded overall damage detection accuracies of at least 90%.
- Advanced introgression clones with high levels of resistance to pachymetra root rot and nematodes have been identified and are being used as parents to introduce new sources of resistance to these diseases.
- Next-generation DNA sequencing has been used to identify a protozoan that is consistently associated with chlorotic streak.
- Assessment of the performance of new leaf sheath biopsy DNA diagnostic for ratoon stunting disease is progressing.
- Resistance ratings for important Australian germplasm and varieties against exotic borers, Downy Mildew and Ramu Stunt disease have been identified and developed to improve industry preparedness against the incursion of exotic disease threats.
- An electronic nose, named DiagNose, classified 86% of ratoon stunting disease infected samples correctly at the CSIRO laboratory in Canberra. It will be developed in Southern Queensland later in 2015 to validate results under field conditions. This testing method, if successful, will give faster turn-around time and lower running costs than alternative detection systems.
- Up-to-date dossiers have been prepared to support contingency plans to minimise threats and impacts of key exotics as well as awareness and training programs.

## Engagement — SRA information, products & services

SRA provided the following information products, services and extension activities during 2014/15:

- Milling*Matters* magazine.
- 6 milling webinars showcasing advances in milling research and technology, including wet scrubbers; evaporators; locomotive GPS; and traffic officer operations.
- Regional milling research seminars.
- 8 practical guides or manuals, including: regional Variety Guides; Soil Guides; Harvesting Manual; Irrigation Manual; and High-Yielding Cane Booklet.
- 4 editions of Cane*Connection*.
- Regular email and on-line *SRA Updates* highlighting recent SRA activities and R&D developments.
- Regional grower updates, SRA industry updates and SRA Board meetings.
- Regional YCS updates.
- Regional harvesting forums.
- 8 regional field walks and bus tours.
- Workshops, including: Soil Health; High-yielding Cane; Sugar Advisors; Herbicide Application and Technology; and Introductory and Advanced Disease and Identification Workshops.
- Sponsorship of industry conferences, including: Young Industry Participants' Forum; Step-Up Conference; Women in Sugar Conference; Australian Society of Sugarcane Technologists (ASSCT) Conference; and Canetrends Bundaberg.

Approximately 50% of growers have attended SRA updates, field days, workshops or conferences to gain information on developments in research, technology and best management practices.

61% of growers use QCANESelect at least once per year, with usage more widespread in the Herbert and Burdekin regions – providing growers with an on-line variety identification and decision-making tool.

63% of growers are using SIX EASY STEPS™ to calculate their fertiliser use – enabling growers to appropriately optimise their nutrient inputs whilst enhancing environmental outcomes.

74% of growers have accessed SRA factsheets to learn more about industry issues and recommended management practices.

SRA management and Board regularly attended industry representative bodies' Board meetings.

In response to industry concerns with respect to extension services, SRA instigated a review of its extension and adoption model in 2014/15 and will continue to work with levy payers and extension service providers to facilitate an extension framework that will ensure appropriate research and adoption pathways are established across all regions.

SRA's Development and Adoption Officers will continue to strengthen relationships with industry Productivity Services organisations and regional grower groups to facilitate the transfer of research knowledge and outcomes to growers and millers.

SRA will continue to plan and collaborate with industry advisors and extension officers on the communication, demonstration and promotion of new technology and research outputs that will benefit the industry.

*Source: SRA; SRA Grower Survey June 2015.*

## Engagement — Satisfaction with SRA information, products & services

Satisfaction with the type, quality and usefulness of SRA's RD&E information products and services was rated, on average, 3.6 out of a possible 5 points.

SRA's updates, field days, workshops and conferences were rated at 3.8 points and SRA's technical manuals and online tools were rated at 3.7 points.

*Source: SRA; SRA Grower Survey June 2015.*

## Adoption Practice change: SRA grower survey results

| SRA influenced practice change | Total | Region | | | | | |
|---|---|---|---|---|---|---|---|
| | | Southern | Central | NSW | Herbert | Burdekin | Northern |
| Changed farming practices over past 2 years | 58% | 53% | 54% | 43% | 72% | 65% | 58% |
| SRA influenced practice change | 40% | 31% | 36% | 37% | 52% | 53% | 40% |

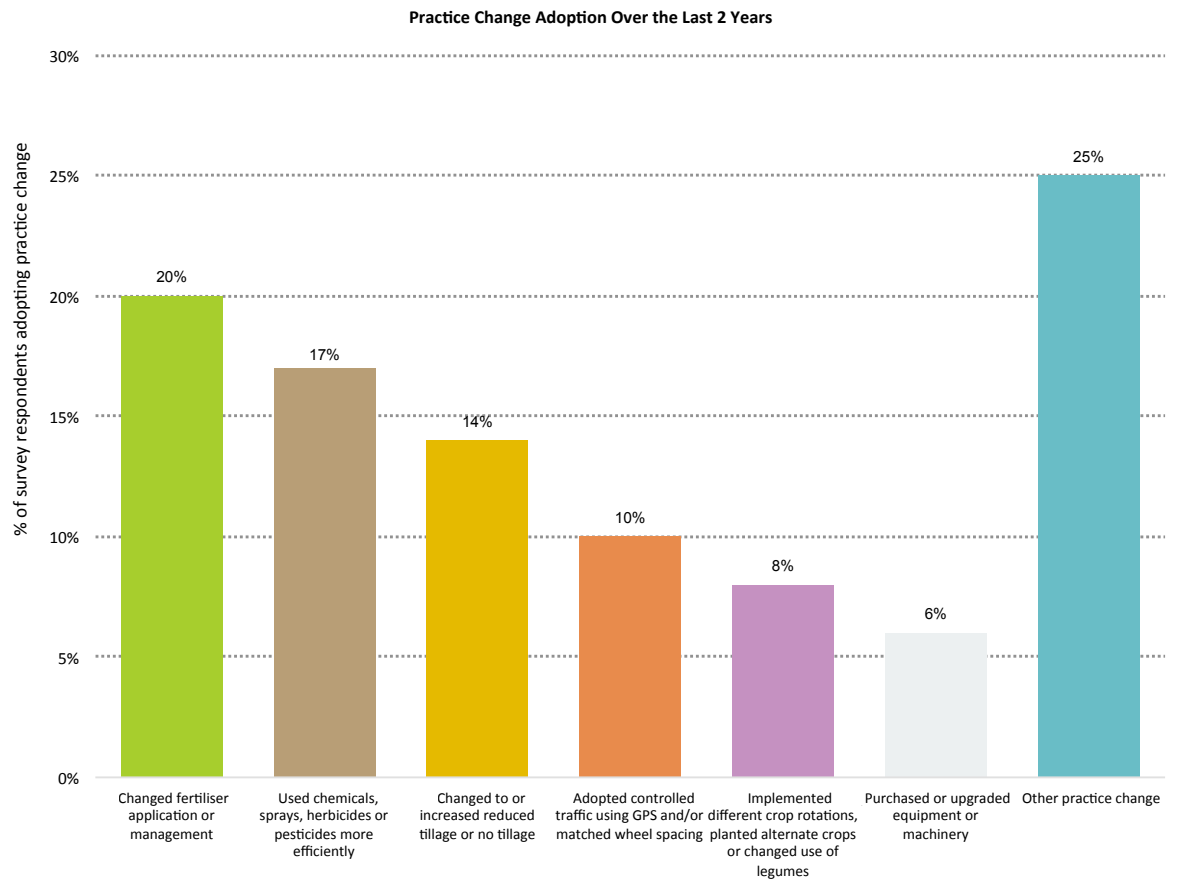
58% of the 400 growers surveyed by SRA have reported to have changed farming practices, techniques or methods over the past 2 years.

In addition to SRA, growers identified neighbours, family, other growers, own experience and trials as the other key influences of practice change.

Among respondents not making changes over the past 2 years, satisfaction with the status quo and/or availability of financial resources to change were given as the reasons or barriers to change.

*Source: SRA Grower Survey June 2015.*

## Adoption Main areas of practice change




The main areas of practice change relate to the application and management of fertiliser, herbicide, pesticides and other chemicals. The 'Other practice change' includes new or upgraded machinery, row spacing, improved soil health, irrigation upgrades and adoption of precision agriculture.

*Source: SRA Grower Survey June 2015.*

## Adoption | Impact of practice change: examples

- Preliminary results of an SRA-led study in the Herbert region indicate growers who have adopted new farming management practices and technology have significantly higher cane and sugar yields than those growers who continue to use traditional management methods:

| | New technology adopters | | Traditional management | |
|---|---|---|---|---|
| | t/ha | CCS | t/ha | CCS |
| Plant crop (includes plough out replant) | 92.7 | 12.7 | 86.6 | 12.1 |
| First ratoon crop | 87.0 | 11.6 | 80.2 | 10.7 |

- Results from SRA's Grower Survey show:
  - 55% of growers now grow legume fallow crops (most widespread in NSW (87%) and Southern (76%) regions), with 75% of these growers having reduced applications of nitrogen as a result;
  - 56% of growers now apply mill mud with a resulting reduction of around 75% in the application of phosphate and nitrogen;
  - Tillage has been reduced on 76% of cane farms over the last 5 years; and
  - 57% of growers have at least 1 piece of machinery enabled with GPS or autosteer, providing growers with accurate planting, fertilising and harvesting capability that minimises soil compaction and environmental impact, reduces wastage of fertilisers or pesticides and provides data to inform on-farm management decisions.
- A 37% increase in tissue culture ordered for delivery between 2014 and 2015 demonstrates the increasing adoption of tissue culture plants as a way to propagate clean seed. Tissue-cultured plantings are more uniform and produce more sticks than conventional plantings so larger quantities of planting material are achieved. Earlier commercial-scale production of more productive new varieties can be achieved when using tissue culture.

*Source: SRA.*

## Return on investment | Cost-benefit analyses

- During 2014/15, SRA commissioned a number of reviews and cost-benefit analyses for specific RD&E programs and projects.
- The reviews were undertaken to assess the progress, effectiveness and impact of the relevant RD&E projects so that SRA can demonstrate to levy payers and government investors that the research investments made by SRA are delivering valued impacts. The reviews also inform SRA management and Board regarding performance from past investments and provide strategic guidance and an agreed roadmap for future allocation of RD&E investments. It should be noted that the reviews included investments made before SRA existed and, as such, total funding assessment includes that from SRDC and BSES.
- Cost-benefit analyses were undertaken on four projects that were completed in 2013/14:
  - New Farming Systems: Appropriate Nutrient Management;
  - Best Practice Integrated Weed Management (IWM) for Sugarcane;
  - Biomass Accumulation; and
  - Harvesting Best Practice (HBP).
- Cost-benefit analyses were also completed on two mid-term projects:
  - A Collaborative Approach to Precision Agriculture RD&E for the Australian Sugar Industry; and
  - Preparing the Australian Sugar Industry for Exotic Threats.
- As detailed in the table to the right, five of the six projects analysed yielded positive returns on investment, with Benefit-Cost Ratios (BCRs) ranging from 2.3 to 27.4 for the total investment in each project at the 30 year benefit horizon. At an aggregated level, the six projects assessed produced a BCR of 4 to 1.
- The investment in HBP was the highest performing in terms of return to investment, due in the main to a combination of the high proportion of the industry assumed to be adopting HBP, the high yield savings that could be gained and the relative low cost of the project (compared to the other five projects assessed).
- The Biomass Accumulation project generated a BCR of 0 to 1 as it did not produce any impacts that could be valued. This reflects the nature of the project outputs being knowledge generation that may inform future biomass work and, as such, are difficult to assess in terms of future impact or value.

| Project | Years from last year of investment | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | | 10 | | 20 | | 30 | |
| | BCR | NPV ($m) | BCR | NPV ($m) | BCR | NPV ($m) | BCR | NPV ($m) |
| New Farming Systems: Appropriate Nutrient Management | 0.21 | -2.71 | 1.39 | 1.34 | 1.96 | 3.29 | 2.31 | 4.48 |
| Best Practice IWM for Sugarcane | 0.05 | -3.76 | 1.81 | 3.23 | 3.08 | 8.24 | 3.85 | 11.31 |
| Biomass Accumulation | 0 | -0.29 | 0 | -0.29 | 0 | -0.29 | 0 | -0.29 |
| HBP | 0.53 | -0.25 | 13.03 | 6.31 | 21.93 | 10.99 | 27.40 | 13.86 |
| A Collaborative Approach to Precision Agriculture | 0 | -3.53 | 0.67 | -1.17 | 1.92 | 3.26 | 2.70 | 6.01 |
| Preparing the Australian Sugar Industry for Exotic Threats | 0 | -1.94 | 1.82 | 1.58 | 3.56 | 4.95 | 3.56 | 4.95 |

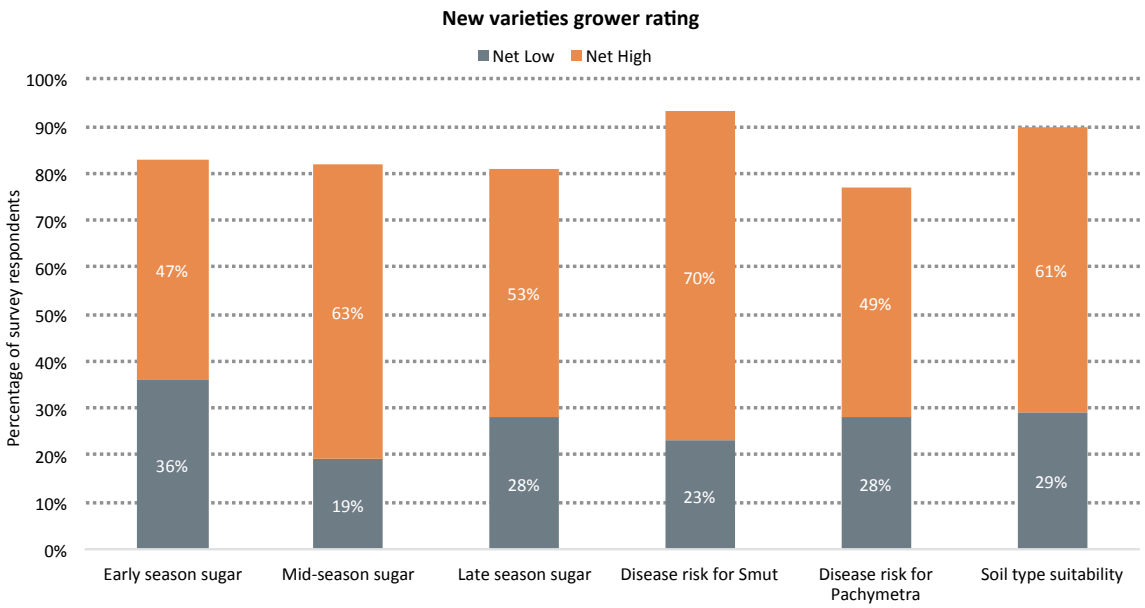
BCR: Benefit-Cost Ratio is the ratio of present value of investment benefits to the present value of investment costs.
NPV: Net Present Value is the discounted value of the benefits of an investment less the discounted value of the costs, i.e. present value of benefits – present value of costs.

- The specific RD&E project impacts that contributed to the positive return on investment include:
  - New Farming Systems: Appropriate Nutrient Management: Increasing best practice for nutrient management, through reductions in nitrogen and phosphate fertiliser applications under specific conditions, resulting in lower export of nutrient to the environment and increasing profits for growers.
  - Best Practice IWM: Improvements towards weed control in the sugarcane industry, increasing profitability from improved nutgrass control, reductions in the use and costs of pre-emergent sprays to control weeds in green cane trash blanketing, and potentially lowering the industry's risk of environmental damage in the future.
  - Biomass Accumulation: Cost-savings in future if biomass is pursued as an industry priority, and input into improved decisions about whether to pursue biomass opportunities in the future.
  - HBP: Reduction of in-field cane losses with an estimated average increase in cane recovery of 4 tonnes per hectare, increasing net revenue for sugar cane millers and growers. Whilst this project yields a high return on investment, it is recognised that the potential returns to industry will only be realised if HBP becomes widely-adopted across the industry. To this end, HBP is a key impact area for SRA and will receive increased focus and investment during 2015/16 to assist industry in understanding the benefits that HBP delivers.
  - A Collaborative Approach to Precision Agriculture RD&E: Significant contributions towards zonal management interventions, potentially increasing growers' profits through reductions in the amounts of soil amendments, fertiliser and chemicals required.
  - Preparing the Australian Sugar Industry for Exotic Threats: Reduction in yield losses through faster diagnostic tests, allowing for faster responses to incursions through improved information regarding varietal resistance, ultimately limiting spread and better management of pest/diseases.
- In addition to the project-specific cost-benefit reviews that were undertaken, SRA commissioned the following three program reviews:
  - A review of the SRA investment in molecular breeding and marker discovery for implementation in the breeding program;
  - Profit-based measures to capture, evaluate and prioritise genetic improvement of water efficiency and nitrogen-use efficiency in sugarcane; and
  - Review of precision agriculture in sugarcane in Australia.
- A further review of nitrogen-use efficiency in sugarcane was brokered by SRA on behalf of the Commonwealth Government through funding from the Australian Government Reef Programme.
- When the reviews are completed, SRA will assess the recommendations and gain industry opinion prior to using review outcomes for future RD&E planning and investment.
- SRA will continue to undertake regular reviews and cost-benefit evaluations at RD&E program and project levels. The outcomes of these reviews will be reported on in future SRA Performance Reports.

*Source: SRA; Economic Assessment of SRA Investment in Six RD&E Projects – Final Report, Agtrans Research, June 2015.*

## Perception of value

### Perception of new varieties




93% of survey respondents planted a new variety in 2014 (i.e. planted a variety that was released in the previous seven years). New varieties achieved a higher rating from growers for mid-season sugar than for early or late sugar. Ratings for smut resistance are high but significantly lower for pachymetra. Soil type suitability is rated higher in some regions than others.

82% of growers surveyed indicated SRA's primary area of focus should be on varieties.

*Source: SRA Grower Survey June 2015.*

## SRA RD&E Performance rating

| SRA performance rating | Total | Region | | | | | |
|---|---|---|---|---|---|---|---|
| | | Southern | Central | NSW | Herbert | Burdekin | Northern |
| High | 66% | 62% | 63% | 67% | 67% | 67% | 70% |
| Not high | 27% | 22% | 33% | 27% | 28% | 21% | 25% |

Two-thirds of growers surveyed rated SRA fairly-high to very-high in terms of their perception of value/influence of SRA information, tools, products and services. The main reasons provided were SRA's work into new varieties and R&D generally, as well as delivering information and products back to industry.

*Source: SRA Grower Survey June 2015.*

# Appendix 1: Acronyms

| Abbreviation | In full |
|---|---|
| ABARES | Australian Bureau of Agricultural and Research Economics |
| ACFA | Australian Cane Farmers Association |
| BCR | Benefit Cost Ratio |
| BMP | Best Management Practice |
| CAT | Clonal Assessment Trial |
| CCS | Commercial Cane Sugar |
| DNA | Deoxyribonucleic Acid |
| EHP | Department of Environment and Heritage Protection (Queensland) |
| FAT | Final Assessment Trial |
| GM | Genetically Modified |
| GPS | Global Positioning System |
| ha | Hectares |
| HBP | Harvesting Best Practice |
| HT | Herbicide Tolerant |
| IWM | Integrated Weed Management |
| KFAs | Key Focus Areas |
| m | Million |
| Mt | Million tonnes |
| NPV | Net Present Value |
| NSW | New South Wales |
| QLD | Queensland |
| R&D | Research and Development |
| RD&E | Research, Development and Extension |
| SNP | Single Nucleotide Polymorphism |
| SRA | Sugar Research Australia Limited |
| SRDC | Sugar Research Development Corporation |
| t | Tonnes |
| TCH | Tonnes of Cane per Hectare |
| TSH | Tonnes of Sugar per Hectare |
| YCS | Yellow Canopy Syndrome |

# Appendix 2: 2013/14-2017/18 Strategic Plan Summary

| | | | | |
|---|---|---|---|---|
| **Our vision** | Delivering valued solutions for a growing Australian sugar industry | | | |
| **Our purpose** | Undertaking targeted RD&E programs for the sugar industry | | | |
| **Our key focus areas** | **1. Optimally-adapted varieties, plant breeding and release** | **2. Soil health and nutrient management** | **3. Pest, disease and weed management** | **4. Farming systems and production management** |
| **Our objectives** | • World-class variety development.<br>• Enhanced variety breeding, selection and release.<br>• Collaborative, interdisciplinary and systems approach to RD&E. | • Understood and improved soil health issues.<br>• Understood impacts of on-farm practices on water quality.<br>• Improved methods and tools to enable, or improve, cane production on poor performing or marginal soils. | • Enhanced biosecurity capability.<br>• Minimised economic and environmental impacts of pests, diseases and weeds through targeted research. | • Research leading to the optimal use of inputs on-farm.<br>• Research on planting technologies, ratoonability, break-crop and fallow practices to optimise yields.<br>• Practical application of the value chain model to enhance grower, harvester and miller interfaces and improved adoption of harvesting best-practices. |
| **Our deliverables** | • Locally-adapted cane varieties.<br>• Enhanced collaboration with growers, millers and productivity services groups.<br>• Increased regional trials and releases.<br>• Earlier communication and dissemination of information, including variety selection tools.<br>• Diagnostic and advisory services.<br>• Research collaborations. | • Identification of soil health factors. This will include R&D covering crop nutrition; soil biology; soil fertility; regional soil factors; chemical utilisation; and reduction of soil pathogens and nematodes.<br>• Practices to reduce chemical inputs and nutrient losses.<br>• Review of Six Easy Steps ™.<br>• Rapid soil screening technologies. | • Plant and molecular screening.<br>• Integrated pest and weed management systems.<br>• Pest and weed control strategies and technologies.<br>• Herbicide-resistant cane varieties.<br>• Alternative chemical treatments.<br>• Updated management dossiers on key exotic threats. | • Precision-agriculture techniques and resources.<br>• Best-practice information.<br>• Improved planting technology and crop establishment.<br>• Harvesting best-practice regional trials and demonstration. |
| **Our measures of success** | • 3 varieties which meet the above expectations released per 5-year period for each region.<br>• Percent production from new varieties (<7 years since release).<br>• Rate of genetic gain (tonnes of cane per hectare (TCH), commercial cane sugar (CCS), tonnes of sugar per hectare (TSH)).<br>• Weighted average disease ratings for varieties in each region. | • Soil health indicators developed for sustainable sugarcane production.<br>• Guidelines, mechanisms and/or varieties identified for increasing nutrient use-efficiency within plant and ratoon crops.<br>• Guidelines and mechanisms developed for minimising chemical and nutrient losses and understanding water quality.<br>• SIX EASY STEPS™ nutrient management program reviewed with improvements made where necessary.<br>• Guidelines for implementation of PA developed. | • Industry supported through effective pest, disease and weed diagnostic capabilities and awareness and training programs.<br>• Development and adoption of SRA-developed packages for integrated management of key pests, diseases and weeds.<br>• Weighted average disease ratings for varieties in each region.<br>• Up-to-date dossiers to support contingency plans to minimise threats and impacts of key exotics.<br>• Capability to provide entomology, pathology and weed expertise to meet the pest, disease and weed diagnostic and management needs of the industry. | • Methodology for more rapid and efficient bulking of sugarcane varieties.<br>• Adoption of a better sugarcane planting technology.<br>• Improved crop performance over longer cropping cycles.<br>• Better crop management under conditions of water stress (too much and too little).<br>• Adoption of PA technology and techniques.<br>• Adoption of harvesting best-practice. |
| **Industry benefits** | • Increased cane and sugar yields.<br>• Climate tolerant varieties.<br>• Pest and disease resistance.<br>• Reduced inputs.<br>• Improved ratoonability.<br>• Increased regional trials and releases.<br>• Faster varietal adoption. | • Improved soil health.<br>• Reduced impact of off-farm run-off.<br>• Improved production on marginal soils.<br>• Improved reputation and relationship with community and environmental groups. | • Enhanced capacity to deal with incursions of exotic pests, diseases and weeds.<br>• Minimised economic and environmental impacts. | • Adoption of agronomic and harvesting best-practices.<br>• Optimised yields.<br>• Optimised use of inputs.<br>• Reduced operational costs. |

## Our values

| | |
|---|---|
| **Innovation** | Through adaptability, creativity and goal orientation |
| **Investor satisfaction** | Through strategic alignment, active communication and commitment |
| **Accountability** | Through personal accountability, including health and safety, honesty, active communication and integrity |
| **Teamwork** | Through shared goals, cooperation and trust |

| Our key focus areas | 5. Milling efficiency and technology | 6. Product diversification and value addition | 7. Knowledge and technology transfer and adoption | 8. Capability development, attraction and retention |
|---|---|---|---|---|
| **Our objectives** | • Review of logistics management to reduce operational costs and improve mill capacity utilisation.<br>• New or improved processes, technology and/or infrastructure to increase mill processing efficiency.<br>• Possible solutions to address quality issues. | • Ongoing research to identify and/or develop alternative products or uses for sugarcane and determine the basic requirements for adoption.<br>• Economic feasibility studies of identified industry by-products, their use and likely market viability. | • Coordinated extension that optimises innovation and adoption at the farm level and encourages research that meets the needs of the industry.<br>• Inclusion of extension mechanisms in research proposals.<br>• Enhanced communication and transfer tools to disseminate research findings to end-users and facilitate their uptake by growers and millers.<br>• Assessment of the uptake of developed technologies and evaluate the effectiveness of technology transfer tools. | • Review of current and future RD&E skills and capacity needs for the sugarcane industry.<br>• Development and retention of current industry participants, as well as attraction of new participants to the sugarcane industry.<br>• Fostered collaboration for cross-industry and cross-sectoral skill development, innovation and networks. |
| **Our deliverables** | • Optimised milling processes and technology. | • Industry supply chain analysis.<br>• Exploration of alternative processing options and products.<br>• Feasibility analysis of alternative products. | • Translational research approach.<br>• Collaborative extension.<br>• Enhanced research and technology extension.<br>• Multi-media extension. | • Industry RD&E skills and capability assessment.<br>• Scholarship program.<br>• Participative and collaborative partnerships.<br>• Succession planning.<br>• Performance management framework. |
| **Our measures of success** | • Adoption of improved or novel milling processes and technology. | • Sugar industry supply chain analysis completed.<br>• Identification of new opportunities in product diversification and innovation. | • Joint planning of research translation and extension programs with other stakeholders.<br>• Effective delivery of extension messages, as demonstrated through research uptake.<br>• Increased awareness of technological innovations, locally and internationally.<br>• Research outputs' key RD&E messages are promoted in a timely manner through various channels.<br>• Increased support for and participation in SRA delivery networks, events and extension programs. | • Published results of industry RD&E skills and capability assessment and recommended strategies in National Sugarcane Industry RD&E Strategy.<br>• SRA participation and investment in relevant collaborative and cross-sectoral RD&E programs.<br>• Increased availability of skilled industry personnel.<br>• SRA sponsored Young Industry Participants' Forum held annually.<br>• Development and uptake of new and existing knowledge transfer or training programs or resources.<br>• Scholarships awarded to current and future industry participants. |
| **Industry benefits** | • Improved mill capacity utilisation.<br>• Improved mill processing efficiency.<br>• Improved quality.<br>• Optimised mill transport and logistics. | • Alternative products or uses for sugarcane.<br>• Economic feasibility of industry by-products. | • Skilled advisory sector that drives the adoption of new technology and practices.<br>• Improved collaboration and coordination of extension services.<br>• Improved communication, knowledge transfer and adoption. | • Attraction and retention of industry participants.<br>• Highly-skilled industry workforce.<br>• Cross-industry and cross-sectoral collaboration.<br>• Connected and respected. |

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