

Industry update

September 2014

sra

Sugar Research
Australia

New research activities

- SRA and local mills have flagged affected blocks that are showing minor, moderate and severe YCS symptoms. As this cane is crushed, data about its yield and CCS is being collected to identify the impact YCS has on these factors. The initial results of the mill data will be provided in the December edition of this Industry update.
- Additional SRA staff have joined the research program to expand the monitoring efforts of YCS in all cane-growing regions, including where YCS has not yet been identified. This detailed information will help to build our understanding of the condition's behaviour.

YCS in Queensland in the 2014 season



YCS continues to be found from Mackay to the far north. Symptoms may 'come and go' in waves and not all fields on a farm may be affected.

Identifying YCS

With crops in dry-down mode in preparation of harvesting, many are beginning to 'yellow' due to water stress. Cane can turn yellow for a variety of reasons including phytotoxicity (or herbicide damage), insect attack, disease, nutrient deficiency or natural maturing.

To help correctly identify YCS it is important to understand how symptoms from these causes, differ from the following YCS symptoms:

- Overall the crop generally looks quite orange-yellow, with the yellowing extending into the youngest leaves in the worst affected crops.
- Young leaves show faint yellowing at the tip. This progresses to a stronger yellowing generally to one side of the leaf and towards the leaf tip.
- Leaves five or six generally show uneven coarse mottling, with areas of uneven green and yellow tissue developing.
- Unlike typical viral or nutrient deficiency symptoms, this symptom is uneven, and looks more like a stress condition or herbicide effect.
- It extends right down the leaf blade.
- The midrib remains white and is the last part to turn yellow.
- Leaves in the lower canopy are more uniformly yellow, showing areas of brown-black necrotic spots.
- Leaf tips and some margins begin to die, with older leaves senescing earlier.
- Once affected, yellow leaves do not recover. In extreme cases, cane stalks may become thin and rubbery and root health is compromised.



What our current research is looking into

Three research projects funded by SRA and the Queensland Government Department of Agriculture, Fisheries and Forestry (DAFF) started on 1 July 2014. Each project is investigating different aspects of YCS and collectively they are expected to provide complementary information and results that build our understanding of the condition.

Research project 1

Solving the Sugarcane Yellow Canopy Syndrome



Project leader:
Davey Olsen

Lead research organisation: Sugar Research Australia

Collaborations: Burdekin Productivity Services Limited and Herbert Cane Productivity Services Limited on district surveys and mill data comparisons.

Project dates: 2014–2017

Project overview: This project builds on the findings of the first year of research and will focus on a number of promising lines of enquiry. A wide range of research trials will be conducted to understand whether YCS is caused by a living factor such as an unknown disease or pest, or a non-living factor such as high temperatures or water stress.

The project will also look at the role stress plays in triggering or increasing the symptoms of YCS and will seek to develop diagnostic tools that can accurately confirm the presence of YCS in an affected plant.

Current activities

In July and August a comprehensive series of pot and field trials were established in the Tully, Herbert, Burdekin and Central regions. These trials are investigating:

- The interaction of water deficiency and YCS symptom expression
- YCS symptoms and the physiological impacts across varieties
- Whether YCS can be transmitted in soil
- The link between crop age and incidence of YCS
- The effects of cold-soak, hot-water treatment on YCS

A trial will be established in the coming months in the Burdekin and Herbert regions to investigate the impact that soil biology, environmental factors (such as weather), and Confidor, water stress, and seed source have on YCS.

Research project 2

What biological factors cause or drive the development of YCS



Project leader:
Dr Frikkie Botha

Lead research organisation: Sugar Research Australia

Collaborations: World-renowned experts from institutes in Australia, Canada, Germany, the United States of America and South Africa on the collection of data and the complex analysis of results.

Project dates: 2014–2015

Project overview: Through a range of biochemical and physiological approaches this project seeks to understand how YCS affects the internal behaviour of the sugarcane plant.

An understanding of what is happening inside the plant may shed some new light on the biological factors that cause or drive the development of YCS.

Current activities

Samples of YCS-affected plants were collected in July in the Herbert region from the same plants as those used in Research project 3.

Work to date has helped to refine the approach to sampling and processing, to better target plants to be analysed.

Additional samples will be collected in the coming months.

Research project 3

A novel polyphasic framework to resolve Yellow Canopy Syndrome Paradox



Project leader:
Professor Brajesh Singh

Lead research organisation: University of Western Sydney

Collaborations: World-renowned experts from institutes in Australia, China and the USA on the collection and analysis of the complex dataset generated from metatranscriptomics and metagenomics and the correlation of these with YCS development, soil health, and plant responses.

Project dates: 2014–2016

Project overview: This project will attempt to identify all living organisms in YCS-affected sugarcane plants by combining genetic analysis and conventional cultural techniques.

This approach will provide a broader view of the complexity of organisms present in YCS-affected sugarcane plants and determine the potential involvement of a biological agent in YCS development.

In addition, the project might improve our understanding of the potential impact of YCS on soil health and the sugarcane plant and how YCS is expressed.

Current activities

Samples of YCS-affected plants were collected in July in the Herbert region from the same plants as those used in Research project 2.

Genetic material from the leaf, stem, root and the rhizosphere from both YCS-affected and healthy cane, has been extracted.

This material is being analysed to identify present bacteria and fungi. Scanning electron microscopy of these plants continues.

The potential to use salicylic acid from sugarcane plants as a bio marker that may help to predict the presence or onset of YCS, is also being examined.

A new Post-doctoral research associate will join this project in November 2014 bringing additional expertise.

The YCS research program is being coordinated by Dr Harjeet Khanna, YCS Program Coordinator, SRA with continued input by the Scientific Reference Panel.

Dr Khanna, members of the Scientific Reference Panel, project leaders, key project scientists and extension staff involved in the research program will meet in **Townsville in late November**.

At this meeting they will discuss their research findings, consider how these findings can contribute to strategies for solving YCS, and develop research plans to accelerate learnings about YCS.

The first year of research has largely eliminated a number of possible causes of the condition from further consideration – herbicide application, linear bugs, a nutrient deficiency or toxicity, and known viral, bacterial or fungal diseases. In addition progress was made on understanding the effect YCS has on key plant processes such as photosynthesis and sugar transport.

Importantly the SRA research team was successful in inducing YCS symptoms in non-affected plants. This lays an important foundation for future research work as trials and experiments can be conducted in a controlled environment, increasing the level of confidence in the results.



Above: SRA researchers measuring photosynthesis in a YCS-affected plant.

Researcher profile



Researcher:

Gerard Scalia,
Senior Technician,
SRA

Background

Masters in Biotechnology from the University of Queensland. Has worked in the sugar industry for six years.

Project role

Gerard works in Research project 2. With his team, Gerard is responsible for the collection, processing and tracking of samples of YCS-affected plants that are used in this project by SRA and collaborating research institutes in Australia and overseas.

Morning and afternoon samples of mid-leaf segments and disks, leaf sheath, internode tissue and xylem sap were collected from healthy and YCS-affected plants in the Herbert region in July.



Gerard recently built a prototype to extract xylem sap from sugarcane stalks under very low pressure to maximise the yield from each sample and reduce the level of contaminants.

As part of the continuing sampling work in Research project 2 Gerard is using a Multifunctional Microplate Reader to measure the levels of carbohydrates – starch, glucose and fructose – in leaf tissue.

This technology allows a larger volume of samples to be processed accurately and quickly.

This knowledge will help to build our understanding of the internal behaviour of YCS-affected plants.

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The SRA team setting up pot trials.

Head Office

50 Meiers Road
Indooroopilly QLD 4068
Australia

Postal Address

PO Box 86
Indooroopilly QLD 4068
Australia

Tel 07 3331 3333

Fax 07 3871 0383

Email sra@sugarresearch.com.au

Web sugarresearch.com.au