



Industry update

July 2014

sra

Sugar Research
Australia

Research wrap-up for 2013–14

The initial one-year research project 'Solving the Sugarcane Yellow Canopy Syndrome' – funded by Sugar Research Australia (SRA) and the Queensland Government Department of Agriculture, Fisheries and Forestry (DAFF) – was completed last month.

The first year of research has gathered a wealth of data about the symptoms of Yellow Canopy Syndrome (YCS). A number of possible causes of the condition – herbicide application, linear bugs, a nutrient deficiency or toxicity, and known viral, bacterial or fungal diseases – have also been largely eliminated from further consideration. In addition progress has been made on understanding the effect YCS has on key plant processes such as photosynthesis and sugar transport.

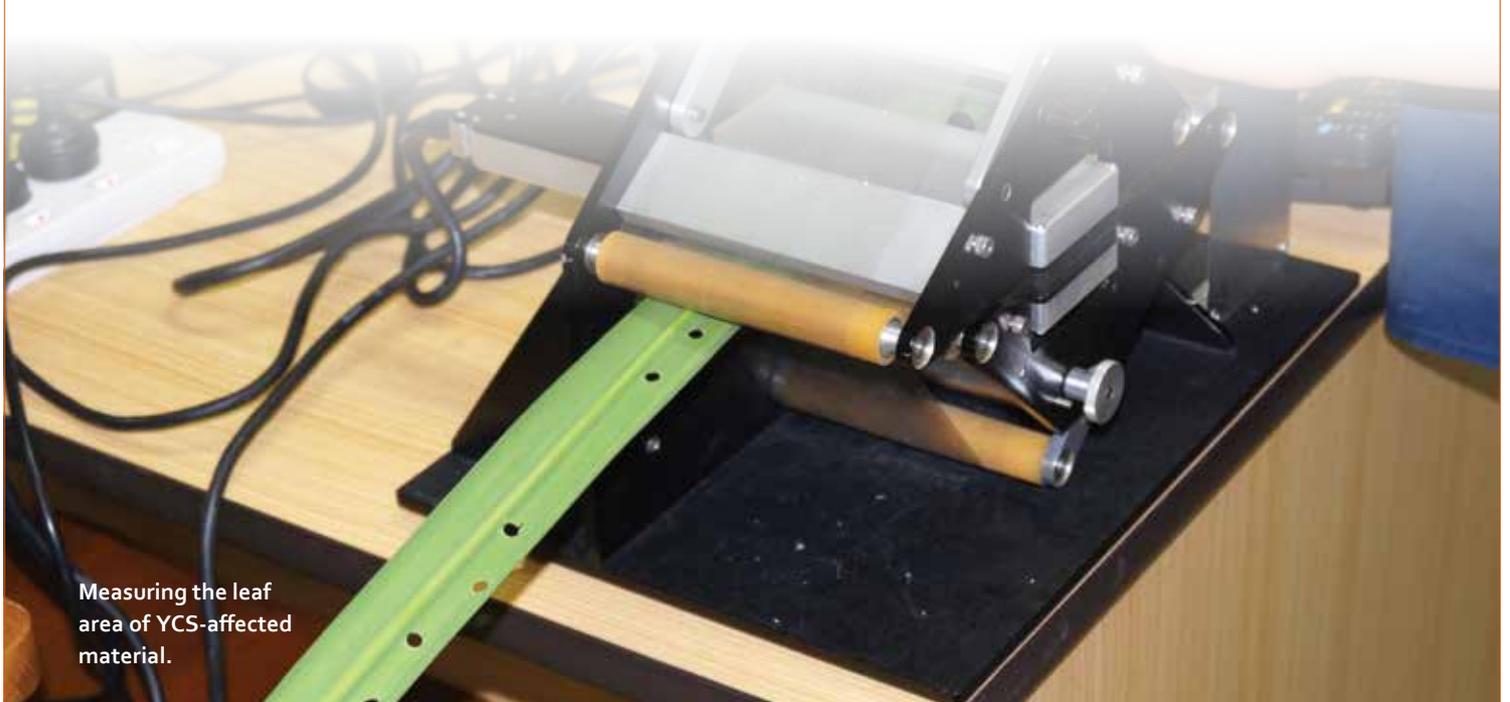
Importantly the SRA research team has been successful in inducing YCS symptoms in non-affected plants. This lays an important foundation for future research work as trials and experiments can be conducted in a controlled environment, increasing the level of confidence in the results.

Armed with this array of informative data the new research program will narrow its focus to target the possible cause or causes of YCS and how these might best be addressed.

YCS in Queensland in the 2014 season



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



Measuring the leaf area of YCS-affected material.

What our current research is looking into

Scientific Reference Panel

Left to right: Professor John Lovett, Dr Andre Drenth and Dr Geoff Inman-Bamber



In April this year, the SRA Board approved an investment of \$4 M from reserves to fund an integrated three-year research program to help solve the YCS puzzle. This investment program includes significant funding from DAFF from this month.

The program, which commenced on 1 July, includes a three-year extension of the initial research project and two new research projects. Each research 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.

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

Dr Khanna, Professor Lovett, project leaders, key project scientists and extension staff involved in the research program met in Lucinda on 30 June to share their research plans and discuss strategies for solving YCS. The group will meet regularly as results become available and will share their findings to accelerate learnings about YCS.



Above: Dr Harjeet Khanna.

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: A comprehensive series of pot and field trials have been designed and will be rolled out in the Tully, Herbert, Burdekin and Central regions throughout August and September.

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 (USA) 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: This project involves a detailed analyses of the dozens of plant hormones, hundreds of biochemicals, and hundred thousands of different genes within sugarcane plants. SRA's Brisbane laboratories are well set up for the analyses of sugars that are routinely measured in sugarcane however this new research requires infrastructure and expertise that only a few laboratories in the world have.

For this reason partnerships with research facilities in Melbourne, Saskatoon in Canada and Houston in the USA have been formed.

Samples of YCS-affected plants were collected in early July in the Herbert region using the same plants as those used in Research project 3. These samples are currently being analysed by SRA and the three collaborating research institutions.

By the end of July the profile of more than 200 000 potential genes is expected to be completed. The detailed characterisation and identification of specific genes that might be associated with YCS will be undertaken, however because of the limited information about the genetic makeup of the sugarcane plant the analyses is expected to take up to three months.

The information produced from the analyses will pinpoint the reasons why the cane leaves go yellow and point to potential management strategies that could be developed.

Over the one-year lifespan of the project three analyses will be completed to ensure that the factors that are identified are consistently associated with the presence of YCS.

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 early July in the Herbert region using the same plants as those used in Research project 2. The samples are currently being analysed by UWS researchers at The Hawkesbury Institute for the Environment. The samples will be processed and submitted to collaborators at the Beijing Genome Institute (BGI) for metatranscriptomics and metagenomic analysis.

Researcher profile



Researcher:
Dr Priya Joyce,
Senior Researcher,
SRA

Background: PhD in plant physiology from the Waite Agricultural Research Institute, Adelaide University, looking at the biochemical response of barley to environmental stress. Has worked in the sugar industry for over ten years.

Project role: Dr Joyce works across both SRA projects investigating the physiology, biochemistry and anatomy of the sugarcane plant to reveal further clues as to how it is impacted by YCS.

During a sampling exercise earlier this year Dr Joyce discovered that all of the unfurled leaves of a YCS-affected plant – even those that were not discoloured – showed signs of stress.

This finding was important as it indicated that the stress signal for YCS had already been experienced by younger leaves well before the visual yellow symptom developed.

To further this research Dr Joyce will examine sugarcane plant leaves at the microscopic level.



Answers to common grower questions

Should I harvest my YCS-affected blocks first or leave them until later in the season?

Although CCS levels appeared to be lower in severely affected cane early in the 2013 crush, the levels improved as the crush continued. Little if any apparent losses of CCS were recorded as the season progressed. If you are concerned about the possible CCS levels in an affected block we suggest that you submit samples to your mill to identify the exact CCS levels. If the levels are low you may wish to leave the cane in the field until mid-season to see if the CCS levels improve.

Consider your whole-of-farm management plan when deciding which cane blocks to harvest. If you delay cutting a particular block or blocks, this may impact on your other farming operations and the ploughing out of blocks to be fallowed that year.

Should I plough out my YCS-affected blocks?

Observations on a number of farms have found that YCS-affected crops which were harvested last year went on to ratoon well this year. Ploughing out of blocks prematurely could impact on your crop rotation and may be an unwarranted cost to your farming business.

Does YCS affect the millability of cane?

In some cases severely affected cane may have smaller stalks than healthy cane. This does not impact the way the cane is processed through the mill.

I have YCS-affected blocks on my farm. I am concerned that if they have a poor root system the plant will be damaged during harvesting.

There is no clear evidence to date that links YCS with poor root systems. Good harvest practices should always be followed to ensure stools are left undamaged for future ratoons.

Can YCS be spread to other blocks in my farm, or other farms on the harvester?

YCS is not caused by any known pest or disease therefore whether or not it can be spread via a harvester between blocks or farms is still unknown.

We recommend that as part of your standard harvesting operations that good harvester hygiene is followed. This involves maintaining equipment hygiene and sterilising the harvester between blocks, to minimise the risk of ratoon stunting disease.

Should the harvester be set up differently for YCS-affected blocks?

YCS-affected blocks should be harvested in the same way as non-affected blocks, unless a known poor root system exists for some other reason. If your crops are known to have a poor root system you need to flag this with your harvester operator.

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