BSES
Sugarcane for the future

Yellow Canopy Syndrome

From the Professional Communication and Extension Unit, BSES

This newsletter has been designed to keep the Australian sugarcane industry up-to-date on Yellow Canopy Syndrome (YCS) – a condition occurring in the Northern, Herbert and Burdekin districts of Queensland.

Ensuring an accurate diagnosis of the condition is essential for providing correct on-farm advice. This may take some time, as we saw some years ago when Northern poor root syndrome was first identified.

BSES reassures you that our most experienced researchers including plant pathologists, entomologists, agronomists and crop nutrition experts, and our industry partners are working on this matter as a top priority.

Yellow Canopy Syndrome defined

In early 2012, several crops of cane in the Mulgrave Mill area, just north of Cairns, showed obvious leaf yellowing.

The yellowing returned in early 2013 in the Mulgrave area, but generally in different crops. Cases were also reported in the Herbert and Burdekin regions.

The condition has affected plant cane, replant cane and ratoons in a number of varieties.

Our researchers documented and examined cases across the affected regions and were able to understand the difference between this new condition, and the natural leaf yellowing which occurs in every growing season.

This new condition has now been clearly described so that everyone can be assured that those researching the condition and the general farming community are referring to the same thing.

To prevent confusion with other known 'yellow leaf' conditions, such as Yellow Leaf Syndrome which is a specific disease, this new condition has been named **Yellow Canopy Syndrome (YCS).**

Our investigations so far

Our Professional Extension and Communication Unit is coordinating a working group of technical experts from within BSES and staff from cane productivity services groups to identify the cause of the yellowing.

To date our thorough investigations of affected fields have failed to identify any potential causal agent that is common to all fields. There are also no obvious conclusions as to what is causing the yellowing.

As the cause is not yet known, we have begun a research program that aims to pinpoint the factors contributing to YCS.

Trial one: Transmission of yellowing by planting material

With the planting season upon us local productivity services are being asked by growers whether YCS can be transmitted via planting material.

At this stage, we don't believe it can – but this has not been ruled out conclusively. An experiment at Tully has been initiated to investigate this further under highly controlled conditions.

Trial two: Linear bugs

Linear bugs have been found on leaves in some affected crops. An experiment will be initiated shortly in the Mulgrave area to determine if linear bugs contribute to YCS.

What planting material should I use?

Until the results of the Tully trial are known we recommend that growers stick to the basic principle of using the best quality planting material they can access.

Cane that is severely affected and not growing actively is unlikely to germinate well and establish vigorously so should be avoided.

Seeking research funding for YCS

We are currently developing a project proposal for out-of-round funding from the Sugar Research and Development Corporation. The project will firstly aim to identify what is causing YCS and secondly develop approaches to ease possible cane losses associated with the condition.

The sugarcane industry working together

The search to identify the cause of YCS has been strongly supported by Burdekin Productivity Services Limited and Herbert Cane Productivity Services Limited.

These groups have worked collaboratively with our research team to collect data from affected growers and conduct some small-scale experiments.

They remain essential partners in the BSES-led working group which is committed to identifying and understanding YCS.

Stay Informed

To remain informed about YCS **Subscribe to updates** on the BSES website. You will automatically receive further information as it becomes available.

> www.bses.com.au

Understanding YCS – what we know so far

Our Professional Extension and Communication Unit and technical experts including entomology, pathology and agronomy researchers have worked steadily since early this year to understand YCS.

Our observations, initial tests and consultations with industry and research partners have produced the following conclusions:

- Some varieties (e.g. KQ228(b), Q200(b), Q247(b), MQ239(b)) are more susceptible to YCS.
- YCS does not resemble any known systemic viral, bacterial or fungal disease and its distribution within a block and within regions is not characteristic of these types of diseases.
- The symptoms on younger leaves are not typical of any known air-borne or water-borne bacterial or fungal disease.
- The symptoms and field distribution are also not characteristic of root diseases. Poor root growth in some affected crops could be associated with YCS but is unlikely to be the cause of the yellowing.
- The widespread distribution of the condition on many soil types in three regions would make it extremely unlikely to be a nutritional or chemical problem.
- Some of the symptoms and field observations may be consistent with damage caused by an insect – possibly linear bugs.
- Some of the symptoms may be associated with environmental stress.

Our conclusions are explained in more detail in the following table.

Causal agents considered	Evidence	
	Reasons why it is not	Reasons why it is possible
Disease	• The yellow symptoms do not match any other known disease – this has been confirmed by international pathologists. • Other factors affect varieties differentially too. • The symptoms are spread too evenly over the affected crops to match normal disease incidence – except for some leaf diseases. • There is no evidence yet that the condition can be transmitted. • The leaf symptoms don't have patterns or discolouring that is typical of any known type of pathogen. • Apparent recovery of crops has occurred in Smithfield. • Symptoms are not characteristic of sugarcane yellow leaf virus (SCYLV) and tests have proved to be negative. • Root disease has not been associated with such specific leaf symptoms.	• Some diseases are known to cause leaf yellowing. • There is a difference between varieties, as with other diseases.
Insect	• Almost all stools in the crops are affected and this is not normally seen with pest infestations, which generally have a clustered field distribution. • High populations of any one pest were not seen in affected fields. • Rubbery stalks would only normally be seen during a high population pest infestation.	• Linear bugs were found in some affected crops. • Leaf symptoms appear more like those created by a sucking insect and have appeared during peaks in populations of some of these insects, for example – *Perkinsiella* plant-hoppers. • Insect pests could cause the condition on new land, across a range of soil types and districts. • Imidacloprid alleviation of symptoms (if confirmed) could have an insect control mechanism. • This same circumstance occurred in the past when everyone assumed a disease, but the leaf symptoms were caused by an insect, the froghopper blight.
Poor root growth	• Some affected crops have been identified on new land that has never grown crops before, which is unlikely to be affected by poor root growth. • Some crops on older ground, but where good root growth was expected, are also showing symptoms. • Roots examined from affected and unaffected crops were all poor, with only slight differences in root growth. Symptoms did not align with the quantity of roots. • No specific leaf symptoms have been associated with any other cases of poor roots, for example – Pachymetra root rot or poor root syndrome.	• Poor roots could lead to insufficient nutrient uptake and leaf symptoms. • Poor root growth has been noted in some affected crops.
Herbicides	• Symptoms have been observed on farms where no herbicides have been applied. • No common link between symptoms and herbicide use on affected farms has been observed as yet. • The symptoms do not resemble any one particular herbicide.	• Herbicides can lead to leaf symptoms of various descriptions. • Almost all farms use herbicides on a regular basis. • The symptoms could coincide with particular herbicide applications at the out-of-hand stage.
Physiological stress	• It is unlikely that the conditions experienced early in 2013 are any more severe than those experienced in places like the Ord River, or in Queensland in other years (1960 – 2000). No similar reports have been recalled of such symptoms in other years. • Why would the symptoms appear in the Herbert/lower Burdekin only, and not in areas like Millaroo/Dalbeg which would be hotter during the day?	• The symptoms occurred during a peak in hot ambient temperatures. • Farmers reported stress – missed watering, hot weather, less fertiliser – as a factor leading to the onset of the symptoms.
Nutrition	• The occurrence of the yellowing on different soil types makes it seem unlikely. • Symptoms occur under a range of management programs, including in volunteer crops and well fertilised crops. • The symptoms do not generally match any known nutrient deficiency or toxicity **(as detailed in the following table).**	• Yellowing symptoms are associated with a nutrient deficiency or toxicity **(as detailed in the following table).** • In the Burdekin region, crops from better managed farms appear to have significantly fewer symptoms.

Are the symptoms related to a nutrient deficiency or toxicity?						
Nutrient		Deficiency	Reasons	Usual symptoms	Toxicity	Reasons
Primary	Nitrogen (N)	No	Symptoms do not match those usually seen with an N deficiency.	Growth of the whole plant is affected, resulting in stunted growth, reduced stooling and yellowing of leaves from the base of the plant upward. Necrosis of the tips and edges of the leaves.	Ammonium toxicity not likely	The appearance of symptoms does not seem to have coincided with N fertiliser applications.
	Phosphorus (P)	No	Symptoms do not match those usually seen with a P deficiency.	Stunted growth, thin short stalks with short internodes. Leaves are thinner, narrower and shorter than normal and have bronzed or purple colour and die-back from the tips.	Not likely	Soils often have high P status. The appearance of symptoms does not seem to have coincided with P fertiliser applications.

Table continued next page.

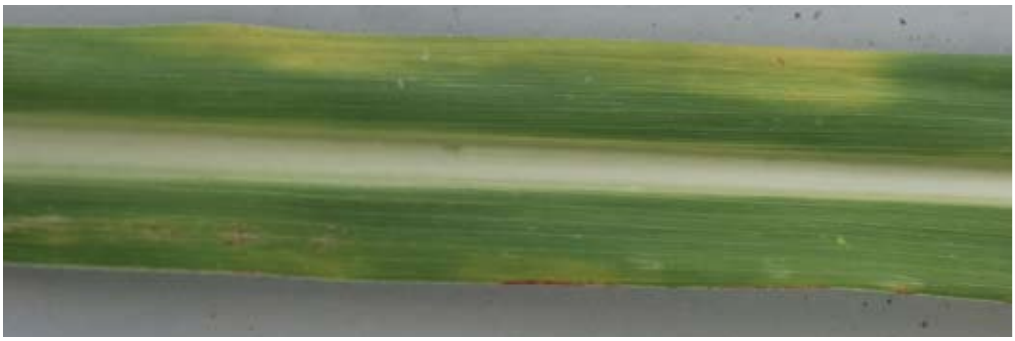
Are the symptoms related to a nutrient deficiency or toxicity?						
Nutrient		Deficiency	Reasons	Usual symptoms	Toxicity	Reasons
	Potassium (K)	Possible, but unlikely	Some similar symptoms, but not exactly as expected.	Thin stalks and stunted growth. Yellow to brown discolouration of the lower leaves with scorching (firing) of the outer edges. Mid-ribs may have a red appearance. Burdekin soils generally well-supplied. Ground water used for irrigation supplies some of the K. Leaf analyses conducted by Herbert Cane Productivity Services Limited showed satisfactory values.	No	Symptoms resemble 'salt' burn.
Secondary	Calcium (Ca)	No	Symptoms do not match those usually seen with a Ca deficiency. Burdekin soils generally well-supplied with Ca. Some of the affected blocks have been recently limed.	Stalks are thin and taper towards the growing point and the rind may be soft. The apical meristems may die. Top growth poor. Older leaves are pale green with yellow mottling and die prematurely. Young leaves are distorted (curl) and necrotic.	No	Not applicable
	Magnesium (Mg)	No	Symptoms do not match those usually seen with a Mg deficiency	Younger leaves are green. Older leaves show symptoms first and are pale with yellow mottling and inter-veinal chlorosis (yellowing between the veins). Older leaves develop chlorotic spots that turn orange (orange freckle) and then brown. The spots join to give a rusty colour.	No	Not applicable
	Sulphur (S)	No	Symptoms do not match those usually seen with an S deficiency.	Young leaves are light green to yellowish, and may develop faint purplish edges. Chlorosis spreads to most of the leaves but without die-back from the tips (as with N deficiency). Stalks and leaves are thin. Leaf edges become necrotic.	No	Not applicable. Large amounts of S have not been universally applied.
Micro	Zinc (Zn)	No	Symptoms do not match those usually seen with a Zn deficiency.	Intra-veinal chlorosis, with broad bands of yellowish striping developing along the whole leaf. The midribs and leaf margins remain green. Symptoms initially appear on all but the youngest three leaves. Stunted growth.	No	Zn toxicity resembles an iron deficiency. Zinc has not been universally applied, nor are soil Zn values generally high.
	Copper (Cu)	Possible, but ques-tionable	Question why severe Cu deficiencies would appear simultaneously in the moist tropics (acid soils) and dry tropics (alkaline soils).	Young leaves become droopy and show inter-veinal chlorosis with small dark green patches. Leaves become bleached and paper-thin and rolled, when severe. Reduced tillers. Stalks become rubbery. Internode elongation will be reduced.	No	Cu has not been universally applied, nor are soil Cu values generally high.
	Iron (Fe)	No	Symptoms do not match those usually seen with a Fe deficiency.	Younger leaves show symptoms before older leaves. Inter-veinal chlorosis extending from the base to the tips of the leaves. Entire leaves/young plants may become chlorotic.	No	Not a documented issue.
	Manganese (Mn)	No	Symptoms do not match those usually seen with a Mn deficiency.	Younger leaves show symptoms before older leaves. Inter-veinal chlorosis extends from the middle to the tips of the leaves. Leaves may split and fray in the wind.	No	Mn toxicity is only possible in extremely acid soils and exacerbated by waterlogged conditions.
	Boron (B)	No	Symptoms do not match those usually seen with a B deficiency.	Immature leaves are distorted and develop translucent lesions or 'water sacks' between the veins. Young plants become 'bunched' due to many tillers. Leaves show varying degrees of chlorosis and tend to be brittle, but they do not wilt.	No	Although B toxicities may be easily induced, it is not an option here because there is no indication of B applications.
	Molybdenum (Mo)	No	Symptoms do not match those usually seen with a Mo deficiency.	Short longitudinal chlorotic streaks develop on older leaves before the younger leaves, and dry prematurely from the middle towards the tip. Stalks become short and slender.	No	Not a documented issue.
Other	Silicon (Si)	No	Symptoms do not match those usually seen with a Si deficiency. Burdekin soils are generally well-supplied with Si.	Initial symptoms appear as minute white flecks on the upper surface of the lower green leaves. The upper surface of deficient leaves 'sunny side up' then develop a reddish-brown or bronze colouration.	No	Not applicable
	Sodium (Na)	No	Sodium is considered non-essential for sugarcane and is found in trace quantities in plant tissue. Deficiencies are not documented.		No	High levels of Na adversely affect soil structure and hence root and top growth. It is diagnosed by exchangeable sodium percentage (ESP) in soil.
	Chlorine (Cl)	No	Symptoms do not match those usually seen with a Cl deficiency.	Deficiency symptoms occur initially in the younger leaves. Apical meristems remain alive, immature leaves are chlorotic and wilted without necrotic spots. Leaves wilt during the day and recover at night.	Possible where root growth is affected	Cl toxicity causes short roots with very little lateral branching.
	Aluminium (Al)	No	Al is not considered essential for plant growth.		No	Al damages roots – they become stubby with few root hairs. Soluble Al not found in soils with pH>5.5. Sugarcane relatively tolerant of high soil aluminium levels.

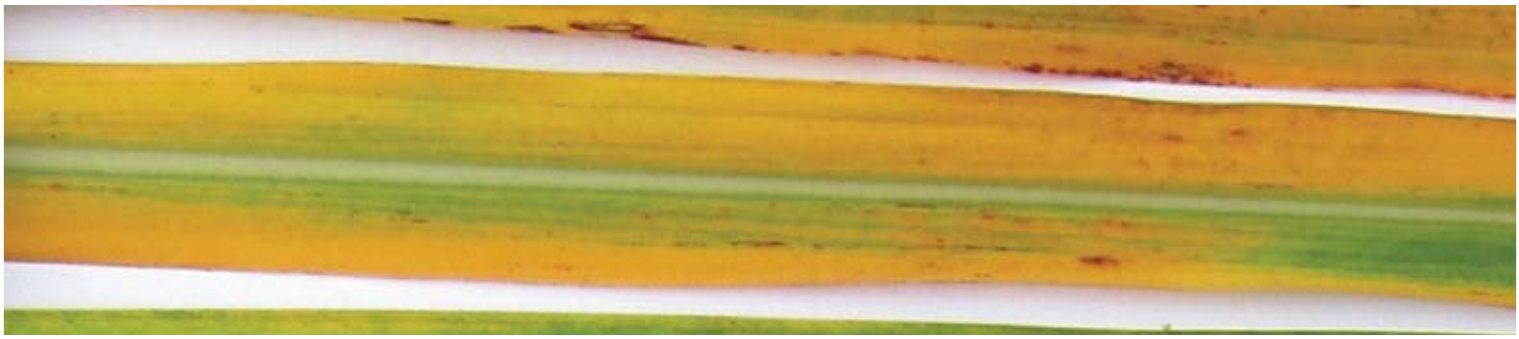
YCS symptoms

Growers should continue to look out for the YCS symptoms in their crops and report any findings to their local cane productivity service group.

YCS symptoms

- Young leaves may show faint general yellowing at the tip. This progresses to a stronger yellowing/chlorosis generally to one side of the leaf and towards the leaf tip.
- Leaves five or six show uneven course mottling, with areas of uneven green and yellow tissue developing. This symptom is uneven, and looks more like a stress condition or herbicide effect. It extends right down the leaf blade.
- The lower canopy leaves are more uniformly yellow, showing areas of brown-black necrotic spots. Leaf tips and some margins begin to die.
- Older leaves senesce early.
- There are no internal stalk symptoms or discolouration in the growing point area.
- The overall crop looks quite yellow, and this yellowing extends into the youngest leaves in the worst affected crops.





BSES
Sugarcane for the future

Postal address: PO Box 86 Indooroopilly QLD 4068
Street address: 50 Meiers Road, Indooroopilly QLD 4068
Phone: 07 3331 3333
Fax: 07 3871 0383
Email: info@bses.com.au

www.bses.com.au