Sugar Research Australia

Burdekin Productivity Services
PRODUCTIVITY PROFITABILITY SUSTAINABILITY

BURDEKIN REGION

RATOON STUNTING DISEASE EXTENSION PACKAGE FOR GROWERS AND CONTRACTORS

CONTENTS

RATOON STUNTING DISEASE 3

BILLET PLANTERS, FUNGICIDE DIP TANKS AND RATOON STUNTING DISEASE 5

PLANTING MATERIAL 7

MACHINERY HYGIENE PLAN AND CHECKLIST 9

PLANT MATERIAL INSPECTION CHECKLIST 10

PREVENT WEED SPREAD BY MACHINERY 11

(Cover photo) *Kalamia mill in the Burdekin. Picture by Callun Lund.*

Significant parts of this document were originally compiled as a joint effort from all Wet Tropics Cane Productivity Services and industry organisations; Mossman Ag Services, Tablelands Canegrowers, MSF Sugar, Innisfail Babinda Cane Productivity Services and Tully Cane Productivity Services in conjunction with SRA. This edition was completed by BPS and SRA.

SRA acknowledges and thanks these organisations for their work in compiling the original Wet Tropics Ratoon Stunting Disease Extension Package.

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RATOON STUNTING DISEASE

Ratoon Stunting Disease (RSD) was discovered by BSES pathologists in 1944. It is now recognised worldwide as probably the most economically important disease of sugarcane. RSD is found in all districts in eastern Australia. Disease incidence is related to the degree to which appropriate management strategies are applied.

CAUSAL ORGANISM

The disease is caused by the bacterium *Leifsonia xyli* subsp. xyli, which infects the xylem (water transport) vessels of the sugarcane plant. The bacterium is rod shaped, typically with a slight bend and measures 0.25–0.5 µm by 1–4 µm.

SYMPTOMS

RSD leads to no external symptoms other than stunting. Diseased fields often have an 'up-and-down' appearance due to differing levels of stunting in adjacent stools.

YIELD LOSS

RSD causes varied yield losses depending on the susceptibility of the variety and the weather conditions.

A 2021 paper at the Australian Society of Sugarcane Technologists (ASSCT) conference estimated that yield losses in the Burdekin, in a crop with 100 percent infection, could be about 10% for plant cane, and about 15% for ratoon cane. Yield losses are higher when the cane is suffering moisture stress.

DIAGNOSIS

The bacterium that causes RSD is found at the highest concentration in xylem vessels; it is also possible to detect the bacterium in leaves and leaf sheaths. SRA currently uses a DNA molecular assay (qPCR) to specifically detect the pathogen.

The SRA RSD laboratory tests approximately 8–10,000 samples each year for the Australian sugarcane industry. This helps ensure new crops are established from disease-free planting material and also provides feedback on disease incidence in commercial crops.

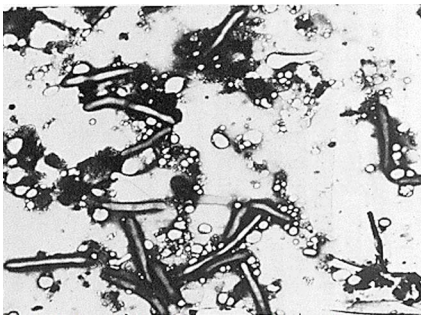
Sampling for RSD diagnosis involves collecting at least 16–20 stalks throughout a field. Selecting stunted stools in a crop can increase the chances of detecting the disease, if it is present.

SPREAD

The two primary methods of disease spread are the use of infected planting material and contaminated cutting equipment.

The bacterium is highly contagious and can be spread for many metres down a row after a planter or if a harvester cuts a diseased stalk or plant.

Any implement that cuts the stalk or makes contact with the freshly-cut end of the sett or billet may readily spread RSD. Some of the more common implements that spread RSD are cane knives, whole-stalk and billet planters, harvesters, cane-stripping machines, haul-out vehicles used to transport billets to planters and break pushers. The recirculating fungicide spray system on planting machines can carry the bacterium and spread the disease.



RSD bacteria under an electron microscope.

An implement can be disinfected by:

- removing all soil and plant material with water and detergent under high pressure
- treating knives and parts of machines that come in contact with cut surfaces with a registered product containing didecyldimethyl-ammonium chloride (Steri-Max). The disinfectant should be left in contact with the implement for 5 minutes before use and applied according to label directions. Other disinfectants are suitable for small-scale application (70% methylated spirits or sodium hypochlorite)
- on harvesters, disinfecting the base-cutter, butt-lifter roller, chopper-box and extractor fans when cutting cane to be sent to the mill. When cutting billets for planting, the whole feed-train should be disinfected, as well as the base-cutter, chopper-box and extractor fans.

If diseased volunteer plants from the previous crop are present, the newly-planted crop will become infected with RSD during the first harvest. The practice of 'ploughout-replant' (when a new crop is planted within a few weeks of ploughing out the previous crop) has resulted in a sharp increase in RSD incidence in some districts.

Juicing billets to sample for RSD.

MANAGEMENT

Control has been effective in most parts of the Australian sugarcane industry. The keys to controlling the disease are planting disease-free seed and preventing infection of healthy crops by disinfecting planting and harvesting equipment. In districts where there is a high acceptance of approved seed and a high percentage of RSD plant source inspections, the disease has generally been kept at low levels.

Approved seed is produced for distribution to farmers by repeatedly hot-water treating (50°C for 3 hours) or mother plot cane. Plants for the mother plot are hot-water treated annually. It is essential that approved seed is planted into fallow ground with no volunteers.

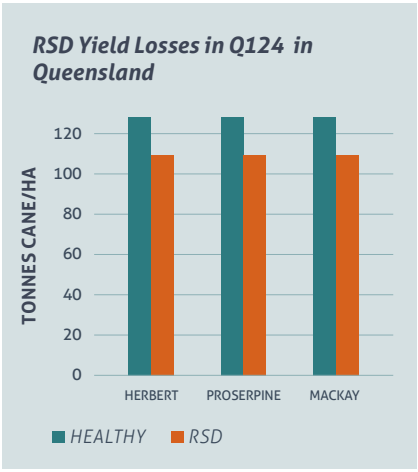
RESISTANT VARIETIES

No sugarcane varieties are resistant to RSD: they can all become infected, suffer yield losses, and further spread the disease.

Some varieties are more sensitive to RSD and carry significantly higher levels of the bacteria. In situations where RSD is a high risk and hygiene measures are not guaranteed, it may be appropriate to avoid varieties such as KQ228$^{\phi}$ and Q253$^{\phi}$.

FOR FURTHER INFORMATION

If you would like further information on RSD management, contact your local productivity services company.



BILLET PLANTERS, FUNGICIDE DIP TANKS AND RATOON STUNTING DISEASE

BILLET PLANTERS AND FUNGICIDE DIP TANKS

Recent tracking of RSD field spread in a Far Northern Mill area linked billet planters using dip type fungicide application to increased disease incidence. Samples of the fungicide solution were obtained from several planters and sent to the SRA RSD laboratory; the RSD bacterium was detected in the solution suggesting dip tanks are a likely mechanism for RSD transmission. This finding prompted contact with productivity services companies across the industry to determine if RSD spread in other districts and regions via dip planters was likely to be occurring.

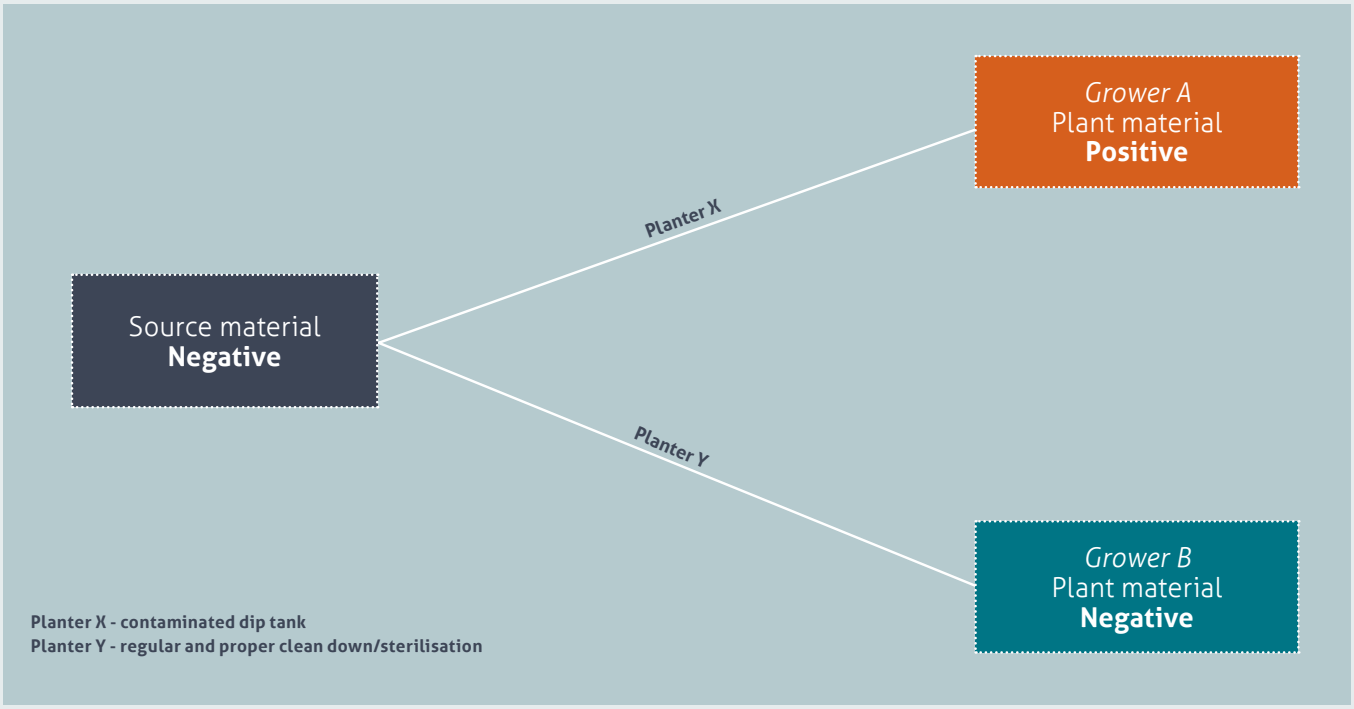
The evidence suggests it is highly likely. As billets pass through the contaminated dip, very effective RSD transmission is possible with the infested juice contacting the cut ends of all setts as they pass through the dip. In districts where the disease is prevalent, this could potentially lead to very rapid spread of the disease to many new plantings around the district. RSD appears to be an increasing problem and it will be important to limit dip type planter transmission to prevent even greater yield loss from this most important disease.

WHAT TO DO

There are several important steps to take to address the situation, some of which apply generally to RSD management.

1. Disease-free planting material:

It is most important to ALWAYS access disease-free planting material. Initial quantities to plant a disease-free plant source can be obtained from approved seed plots of your local productivity services company. Starting with RSD-free material is a trusted foundation for disease management and higher productivity.



One example demonstrating how this issue was identified.

2. Billet planters with fungicide dips:

The latest research has clearly identified the need to very regularly replace the fungicide solution in dip planters, especially when the disease is present at significant levels in a district or region. The solution should be changed after every block is planted, especially when suspect cane has passed through the system, or at least every few hours. Not only should the dip be replaced, but all surfaces contacting the solution should be washed thoroughly with copious volumes of water and then sterilised with cane knife steriliser (Steri-Max or an equivalent containing benzalkonium chloride). It is important that if employing a planting contractor, that the planter arrives clean and sterilised and leaves in the same state. It is imperative that left-over billets from another farm are not planted on your property; RSD spread via diseased planting material is another way the disease is transmitted.

To minimise RSD incidence, all other management strategies for control of RSD should also be followed including sterilisation of all other cutting equipment and planting into fallow ground (with no volunteers). Please contact a productivity services advisor if you need further information.

SUMMARY

What does RSD mean for your farm?

RSD can be the cause of hidden losses to productivity and profitability to your farm and business. The identification of RSD is not easy.

What are the pathways that RSD could be entering your farm or spreading within your farm?

With a disease that is so hard to see, these are questions worth thinking about.

They are also conversations worth having with your contractor.

It is imperative to keep RSD off your property to maintain high productivity. It is a lot easier to keep it off-farm than to remove the disease once your farm becomes infected. This can be achieved by having a clean seed and hygiene strategy in place for your farm and equipment.

PLANTING MATERIAL

Once a grower has planned the varieties they wish to plant, there are several factors to consider before planting:

What is the original source of that material? When selecting plant material a grower would ideally consider if the material has come from an approved seed plot (ASP), if it has been hot water treated (HWT), if the material was planted using tissue culture (TC) or if the material was subject to a plant source inspection (PSI) in the previous year.

What is the crop class of the material? Ideally when selecting planting material, the material should be Pl – 1R. In situations where this is not the case, 2R is the very last resort that should be considered.

When a grower is selecting material for planting, crop class and the time period from hot water treatment should always be considered. The example below is a best case scenario using material from a plant crop each year. You should be mindful that just because the material is from a plant crop, it does not necessarily mean that it is clean. The time since hot water treatment should be considered whenever choosing your plant source. Using a timeline, like the example below, is an easy way to determine the history of your plant source material.

For every year that the plant source material is away from hot water treatment, the risk of infection is increased due to more interactions with potential infection sources (i.e. cane volunteers, machinery).

What is the condition of the material? A grower should always organise a PSI with BPS staff. This allows for a thorough inspection for any pest damage and most importantly an inspection for indications of disease that may be present in the plant. A PSI for RSD in particular should become a vital step in farm practice plans to ensure individual growers are optimising their potential for productivity and profitability.

An example for a Plant Material Source - tracking back how long that material has been away from either Hot Water Treatment, Tissue Culture or BPS Approved Seed Plot. The timeline shows that just because it's plant cane, does not mean it is "clean cane".

COST ANALYSIS

RSD can almost be a silent killer when it comes to a profit loss to a farm.

ASSUMPTIONS	RSD	RSD FREE
Variety	KQ228ϕ	KQ228ϕ
Sugar price ($)	$450	$450
Relative CCS	14.6	14.6
Yield (t/ha)	108	120
Estimated yield loss due to RSD (%)	10%	0%
Cane price ($/t)	43.13	43.13
Gross $/ha	$4658	$5175
Cost of production ($/ha)	$3546	$3546
Net return ($/ha)	$1112	$1629
Potential profit lost due to RSD infection	**$517/ha**	

These numbers are estimates only and are estimated based on a range of highly variable factors. You should carefully consider your own situation.

Disclaimer
The information contained in this table is based on knowledge and understand at the time of writing in 2021. However, because of constant changes in the standards and other requirements, users of this table are reminded of the need to ensure that information upon which they rely is up to date and to check the accuracy of information with an appropriate independent adviser if required. Recognising that some of the information in this table is provided by other parties, the publisher takes no responsibility for the accuracy, currency and reliability and correctness of any information included in the table provided by the parties.

Example Farm *(as per above table)*

John had a PSI completed on the material he selected to use for planting that year. John's farm is 150 hectares and it generally cuts about 120 TCH across the farm. Unfortunately, John had one positive sample in his KQ228ϕ, which yielded less than the rest of the farm, at about 112 TCH.

The estimated yield loss due to RSD infection in his KQ228ϕ equates to around 7%. John's other two blocks of Q240ϕ were RSD FREE.

With zero infection in his other blocks, John managed to cut a slightly higher yield of 120 TCH. When John sat down with his advisor to calculate his losses at the end of the season, (RSD infected versus his RSD-free blocks), John concluded that even though he still received a payment for that block of approximately $1430, ($1725 in the healthy blocks), John missed out on an additional $345 per hectare because of RSD. It may seem like a small figure but John worked out that his 10 hectares of RSD infected cane equated to him missing out on an additional $3450 for his farm for that year.

As infection increases and spreads further through the block, with farm hygiene not taken seriously, lost revenue will increase further as the crop cycle continues.

MACHINERY HYGIENE PLAN AND CHECKLIST

Any equipment which may cut the cane plant can spread RSD from an infected source. Therefore cane knives, harvesters, plant cutters, planters (whole stick and billet), break pushers and stool splitters should all be sterilised prior to entering either a clean block of cane from an infected block or from farm to farm.

Sterilising Procedure:

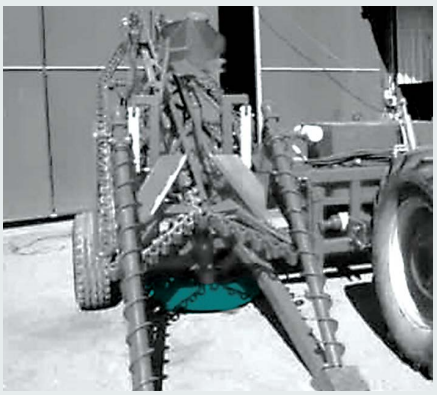
1. Ensure that equipment is free of soil and debris. Wash equipment with water prior to sterilising, if possible.
2. Use 1% Steri-Max to thoroughly sterilise equipment. Leave equipment to stand for 5 minutes for the chemical to work effectively OR use 30% water and 70% methylated spirits to thoroughly sterilise equipment. It is not recommended to use methylated spirits where there are potential fire hazards.
3. Steri-Max should be disposed of after 24 hours once mixed with water. The chemical will de-activate overtime, once mixed with water.
4. Avoid using water with high organic content when mixing with Steri-Max.

HARVESTER

BILLET PLANTER

STOOL SPLITTER

WHOLE STICK PLANT CUTTER



CANE KNIFE

STOOL SPLITTER (CLOSE UP)

EQUIPMENT OF CONCERN – KEY STERILISATION POINTS INDICATED IN BLUE

PLANT MATERIAL INSPECTION CHECKLIST

LOOK AT YOUR CROP HEALTH AND HABIT:

- ✓ Is your crop STANDING or LODGED?
- ✓ Ideally when looking at selecting your planting material, you would want the crop to be standing to ensure quality seed.
- ✓ It is also good to have four to six green leaves on the crop that you want to plant.
- ✓ Are the EYES on the stalks PRESENT or MISSING?
- ✓ When assessing the eyes of your cane, feel for firmness.
- ✓ Look for any borer holes or pest damage; you do not want to use material that is damaged.
- ✓ Take a look throughout the block; are the stalks in good condition?
- ✓ Are there any STRESS CRACKS?
- ✓ Is there any PEST DAMAGE (rats/pigs/borer)?
- ✓ Is there any PIPING present in the stalks (cut several sticks through the block to check)?
- ✓ The best plant source have shorter distances between internodes.
- ✓ Ensure no side shooting.

LOOK AT YOUR CANOPY HEALTH AND HABIT:

Check for any SMUT WHIPS

- ✓ If whips are found, this is infected plant and you should not use it for planting material.
- ✓ Plants of susceptible varieties may be severely stunted and will take on a grass-like appearance with thin shoots.
- ✓ Each shoot may develop the characteristic 'whip' ranging from a few centimetres to a metre long.
- ✓ Whips can form on side shoots on mature stalks.

Check for LEAF SCALD

- ✓ Visual inspection for the specific, pencil-line symptom and scorched leaves.

Check for CHLOROTIC STREAK

- ✓ Irregular creamy-white streaks with wavy margins on the leaves.
- ✓ As the disease progresses, these streaks lengthen and widen.
- ✓ Some sections within the lesion can die.

Regardless of your personal diagnosis for any disease, ALWAYS contact your field officer to arrange a booking for further inspection, especially for RSD inspection.

An RSD test needs to be booked a minimum of a month before the seed source is due to be planted.

PREVENT WEED SPREAD BY MACHINERY

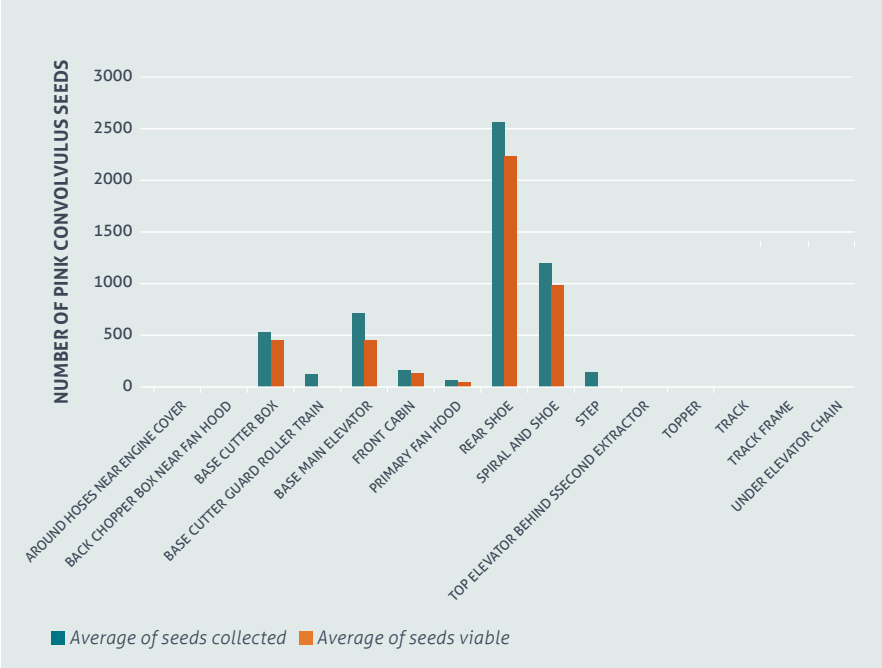
Unclean machinery is a major mechanism of weed seed dispersal, both from block to block on farms and between farms. Growers should clean down machinery especially when moving from known weedy blocks onto other parts of the farm. They should also have clean-down agreements with contractors.

Harvesters are a major contributor to weed seed spread. In a survey of harvesters in Mackay during 2012, thousands of convolvulus vine seeds were collected from the spirals, shoe and floating rear shoe. In the case of pink convolvulus, the majority of seeds were viable throughout the season.

Simple hygiene measures like blowing down with an air compressor will remove most of these seeds.

Use this cleaning opportunity to also disinfect the harvester for RSD.

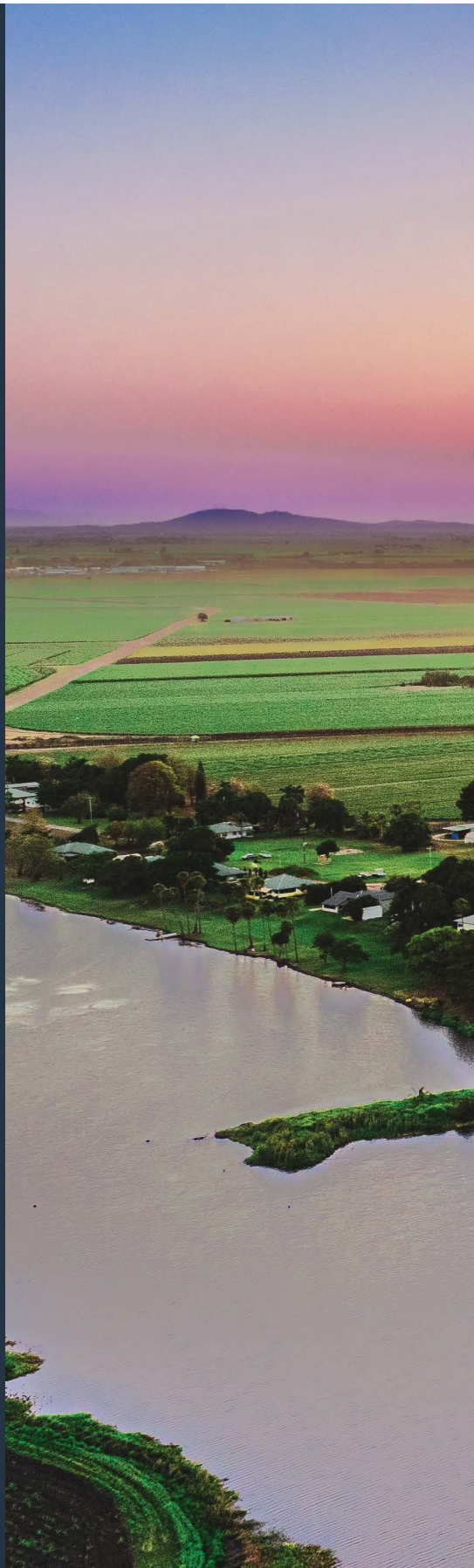
BASIC MACHINE HYGIENE HELPS PREVENT WEED SEED SPREAD.



Location of vine seeds on a harvester (Fillols E & Staier T. 2015).

Pink convolvulus seeds hidden on top of harvester spirals, after the machine was cleaned down.

Sugar Research Australia Limited
ABN 16 163 670 068

Brisbane Office 50 Meiers Road, Indooroopilly QLD 4068 Australia
Postal Address PO Box 86 Indooroopilly QLD 4068 Australia

T 07 3331 3333
E sra@sugarresearch.com.au
sugarresearch.com.au