

P & K Farming

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P&K Farming

Tender Document

Contractor Agreement- Farm Management

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Introduction

P&K Farming wishes to engage an independent contractor to provide farm management services to P&K Farming at the P&K plot located at Cnr. Robertson and Ivory Roads AYR 4807 (“the Contractor”).

The Contractor must possess the necessary expertise to:

1. provide farm management services as set out in the Contract Requirements below and as amended from time to time; and
2. implement and maintain the highest level of farm cleanliness and hygiene as required by P&K Farming, BPS and SRA to ensure (as best as possible) the disease free status of the plot is restored and maintained.

The accompanying documents contain information necessary for prospective tenderers to consider the requirements of P&K Farming and if desirous, tender for the Contractor Agreement-Farm Manager.

Farm Details

P&K Farming owns the plot located at Cnr. Robertson and Ivory Roads, Ayr (“the Plot”). The plot consists of an area of approximately 45 hectares which is used as an approved seed cane distribution plot together with a further area of approximately 4 hectares for use as a seed cane mother plot.

Burdekin Productivity Service has an agreement with Sugar Research Australia Ltd (“SRA”) under which it is responsible for treating, propagating and distributing from approved seed cane plots, approved sugar cane varieties bred by Wilmar Sugar and SRA (“the SRA Varieties”), to sugar cane growers throughout the Burdekin cane growing area.

To enable BPS to provide this service to growers it requires a supply of treated approved seed cane. BPS has requested that P&K Farming supply the Plot for use as an approved seed cane plot.

As the cane from the Plot is utilised to supply clean seed cane to growers in the Burdekin region, it is paramount that the cleanliness and hygiene on the farm be maintained to the high standard required by Sugar Research Australia's Technical Guidelines "Procedures for the Establishment and Operation of Approved-Seed Plots Fifth Edition 2017", as amended from time to time, attached at Schedule A.

Farm area:

1. approximately 85.17 hectares, of which there is, with slight variance each year, approximately:
 - a. 4 hectares for use as a seed cane mother plot;
 - b. 20 ha of clean seed (plant);
 - c. 20 ha of clean seed cane (first ratoon);
 - d. 20 ha of second ratoon cane for commercial production; and
 - e. 20 ha fallow.

Row width:

1. currently at 5'2ft centres but P&K would consider moving the centres to either 5ft or 5'3ft over time.

Irrigation and pumping infrastructure:

1. Three pumps, one centrifugal open water pump in Plantation Creek and two turbines, one which has recently been replaced with a variable speed drive;
2. The farm is watered through open/shut valves; however the nature of the operation means that areas may need watering by cup change at times.

Farm Operation:

1. Hygiene is paramount and all machinery, implements and equipment must be sterilised and certified by BPS prior to entry on to the Plot;
2. Plant and First ratoon cane is grown for clean seed cane supply;
3. The nature of clean seed cane supply requires:
 - a. a different farming system and process to that of a commercial cane farm;
 - b. the harvest of small amounts of green cane in a non-systematic fashion at various times during the year. This effects the timing of ratooning and general operation of the farm;

- c. the Contractor to be available to complete tasks at very short notice and outside business hours, on weekends and public holidays;
 - d. all best endeavors be made to ensure seed cane not grown to the full tonnage potential (ideally 100 T/Ha) by limiting inputs (e.g. fertiliser and watering) to ensure that the cane to be utilised for clean seed cane remains (as much as possible) standing to ensure the quality of the seed cane billets.
4. Second ratoon cane grown for commercial purposes and is supplied to the Mill. Second Ratoon cane is to be grown to its full commercial potential with inputs applied in accordance with the applicable regulations.

Contractors:

1. P&K Farming (or BPS) currently have contract agreements (N.B. contract service providers may change from time to time and at the discretion of P&K Farming and/or BPS) with the following contractors to provide services at the P&K Plot:
 - a. TLB Harvesting (planting)
 - b. VMV Harvesting (commercial harvesting)
 - c. G&G Ag Contracting (seed cane harvesting)
2. The Contractor will be required to work with the abovementioned contractors to ensure smooth operation of the farm. The Contractor will also be required to work with BPS, SRA and other contractors. It is important that the Contractor has the ability to work harmoniously, professionally, collaboratively and cooperatively with other contractors.

The Contract Requirements

General Duties, Record Keeping & Workplace Health and Safety

- oversight and/or management of the operation of the Plot for both cane and any fallow crops planted at the direction of P&K Farming, including planting, cultivation, growing, watering, burning and harvesting of that cane and/or fallow crop;
- ensuring all farm operations and practices comply with health, safety, and environmental standards and regulations;

- maintaining irrigation records;
- maintaining other farm records including but not limited to chemical and fertiliser records and records for application of any other products to the standards required by regulations;
- compliance with all requirements of the Biosecurity Act 2014 (Qld) and associated regulations and instruments made under it;
- compliance with all acts, ordinances, rules, regulations, other delegated legislation, codes and the requirements of any Commonwealth, state and local government departments, bodies, and public authorities or other authority so far as these same may affect or apply at any time;
- liaising with Burdekin Productivity Services, Sugar Research Australia and P&K Farming in relation to the operation of the Plot as required by those organisations;
- liaising with Sugar Research Australia to ensure that operations are conducted in accordance with the current SRA Technical Guidelines (current version- “Procedures for the Establishment and Operation Of Approved-Seed Plots Fifth Edition 2017”) as amended from time to time (“SRA’s Technical Guidelines”);
- properly train and supervise workers and/or contractors and plan, coordinate, and direct their activities;
- control costs of production in line with budget expectations;
- understand and operate within the requirements of the P&K Farming Workplace Health and Safety Policies and Safe Operating Procedures at all times and keep documentary evidence of compliance;
- immediately report any risks to persons or property or any risks in relation to hygiene, pests & diseases to P&K Farming;
- maintain itemised records for time spent and tasks completed on farm as directed by P&K Farming for submission with taxation invoices for contract payment.

Hygiene/Pest & Disease

- maintain cleanliness and hygiene on the farm to the high standard required by Sugar Research Australia’s Technical Guidelines “Procedures for the

Establishment and Operation of Approved-Seed Plots Fifth Edition 2017”, as amended from time to time, attached at Schedule A.

- advise P&K Farming and Burdekin Productivity Services prior to any machinery entering or exiting the Plot;
- ensure that all machinery is sterilized and certified by Burdekin Productivity Services prior to entry from the Plot;
- ensure that headlands are slashed and tidy and plastic is clean and tidy;
- ensure that all outlets and culverts are clearly marked;
- ensure high standard of fallow management -critical that no volunteers are allowed to grow in fallow;
- ensure high standard of fallow management to minimise and eliminate weed pressure and ensuring that grass and broadleaf weeds are controlled before flowering;
- ensure that no irrigation water from neighbouring farms runs off into the Plot;
- ensure that the Plot remains separated by at least 10m headland from any commercial crops or if there is no headland between the Plot and commercial crops, plant six rows of approved seed of a highly smut resistant variety as guard cane

Planting & ratooning cane

- ordering and accepting delivery of farm inputs (e.g.fertiliser) in line with budget expectations;
- liaise with Burdekin Productivity Services, Sugar Research Australia and P&K Farming regarding varieties to be planted into the mother plot;
- full-stick plant mother plot with varieties as directed by BPS;
- liaise with BPS to ensure that all planting operations are conducted in accordance with SRA’s Technical Guidelines;
- ratoon cane and liaise with BPS to ensure that the treatment of ratoon cane is conducted in accordance with SRA’s Technical Guidelines;
- liaise with BPS, P&K and planting contractors for the planting of approved seed cane into the distribution plot and take all actions necessary to prepare lands for planting.

Growing, cultivation and maintenance of sugar cane and fallow crops

- conduct a wide range of farming operations as required and in consultation with P&K Farming, including but not limited to:
 - general farm maintenance;
 - cultivation;
 - monitoring;
 - watering;
 - fertilising;
 - spraying.

Farm Infrastructure

- The Contractor must utilise the fixed improvements, irrigation plant and equipment and any working plant in a way to maintain good condition.
- The Contractor must, as best as possible, maintain the fixed improvements, irrigation plant and equipment and any working plant in good repair and order.

Harvesting

- Liaise with BPS, P&K and harvesting contractors for the harvesting of approved seed cane and take all actions necessary to prepare lands for harvest;
- Liaise with harvesting contractor for the harvesting of cane harvested to be sent to the mill and take all actions necessary to prepare lands for harvest

Additional services

- If P&K Farming requests, undertake additional farm management services as required.

Contractor Equipment

- The Contractor will supply their own, or have access to necessary machinery, implements and equipment to undertake the works. This includes a full stick planter for use to plant the mother plot.
- The Contractor must utilise machinery, implements and equipment sufficient to undertake the works in a proper and economical fashion.

- Where the Contractor provides or accesses its own equipment, the equipment must be suitable for the work and must be maintained by the Contractor in good working condition and utilised in a safe manner.
- All machinery and implements owned and/or utilised by the Contractor on the Plot must be properly certified by an appropriately qualified engineer.
- All machinery and implements owned and/or utilised by the Contractor on the Plot are used by the Contractor at the Contractor's own risk.
- The Contractor must maintain all insurances required at law and comprehensive insurances in respect of the Contractor's own equipment.

Performance of Services

- The Contractor must specify the persons that the Contractor has designated to provide the farm management services;
- The Contractor must perform the Services in a diligent and professional manner according to any standards that normally apply to the services.
- The Contractor must ensure that the Designated Persons have all the requisite qualifications, skills and training and comply with relevant policies of P&K Farming .
- The Contractor must act in good faith in all dealings with P&K Farming and must not do anything that may be harmful to the reputation or interests of P&K Farming .
- The Contractor must liaise with and report to P&K Farming with respect to all aspects of the Services.
- The Contractor must comply at its own cost and expense with all Acts, ordinances, rules, regulations, other delegated legislation, codes and the requirements of any Commonwealth, state and local government departments, bodies, and public authorities or other authority so far as these same may affect or apply to the Contractor or to the Services and must indemnify P&K Farming from and against all actions, costs, charges, claims and demands in respect of any breach of this obligation.

- The Contractor is required to warrant that it is not under any obligation or restriction which would in any way interfere with or conflict with the Contractor providing the Services.
- All information acquired during the term of the Contractor's appointment is confidential to PCGO and is not to be disclosed either during the appointment or after the appointment concludes to third parties except as permitted by law and with prior clearance from P&K Farming.

Insurances

The Contractor must take out all insurances required to be effected by law.

Timing of the services & Contract period

The work will be required to be performed any times as determined by the Contractor and as required by the farming operations.

The Contract will have review periods at 6- and 12-month intervals. This is to ensure that the Contractor is meeting performance and works are appropriate and in line with budget expectations.

The Contract will be an ongoing engagement which will be able to be terminated by either parties' notice or by breach of obligations.

Engagement with P&K Farming

In the initial 12 months the Contractor will:

1. meet with representative directors and managers of P&K Farming on a fortnightly basis;
2. will issue invoices for works (including work docket) on a fortnightly basis;
3. will engage with representative directors and managers of P&K Farming to ensure that contract works do not exceed requirements or budget expectations.

The time frame for this meeting procedure will be reviewed on expiry of the initial 12 month period.

Workplace Health & Safety

The Contractor must demonstrate compliance with all duties of an employer specified in the Workplace Health and Safety Act and Regulations.

The Contractor must, when requested by P&K Farming, submit a complete copy of its WHS Management System documentation that must include as a minimum requirement:

- An OH&S policy and objectives.
- The organisation structure and responsibilities.
- Risk assessment documentation.
- Safe work practices and procedures.
- OH&S training and induction records.
- OH&S auditing and inspection procedures.
- OH&S consultation procedures.
- OH&S performance monitoring.
- A plant and equipment register.
- Emergency procedures.
- Incident recording and investigation procedures.

If the Contractor is unable to provide a WHS Management System, the Contractor must be willing to implement these documents, assessments and systems prior to commencing works.

Addenda to Tender Documents

PCGO may amend the Tender Documents at any time before the Tender Closing Date, and issue such information as Addenda.

Clarification

The Tenderer may request in writing clarification of the Tender Documents from PCGO at any time until four business days before the Tender Closing Date. Any responses to queries will be issued to all Tenderers. Enquiries concerning this request for tender should be made to:

P&K Farming	Contact Person:	Lisa Parker
	Postal Address:	PO Box 588, AYR QLD
	Physical Address:	142 Young Street, AYR QLD
	Email:	manager@pcgo.com.au

Lodgment of Tenders

Tenders may be lodged:

- a) by electronic mail at manager@pcgo.com.au;
- or
- b) in the tender box in the PCGO office
- or
- c) by post to PO Box 588, AYR QLD

NOTE: Facsimile & Verbal Quotations will NOT be accepted

No responsibility will be taken for documents forwarded by mail or courier that are not submitted by closing time.

Closing Date

5pm, Monday 28 February 2022

Proposed Contract Start Date

1 April 2022

REQUIREMENTS OF TENDER

Tenderers are required to demonstrate their capacity to deliver the Services by supplying the following information.

This information and other data will be used to assist in the evaluation of tenders submitted.

Tenderers will be required to participate in an interview between the Tenderer and P&K Farming representatives further discuss the tenderer information and the contract requirements.

Details provided by the Tenderer shall be treated as confidential.

1. TENDERER DETAILS

Details of the tendered including the following:

- Tenderers Name
- Registered Address
- Postal Address
- Telephone
- Email address
- Contact Person
- Designated persons of the tenderer who will be undertaking the farm management services.

2. PLANT AND EQUIPMENT

Details concerning all plant and equipment intended to be used under this Contract shall be provided as part of the tender.

The plant description as a minimum shall outline the make, model, age, capacity, general condition for each item (where applicable).

A full stick planter or access to a full stick planter will be required.

3. FINANCIAL INFORMATION

The Tenderer must be financially solvent.

Details as to whether the tenderer has in the last five years been declared bankrupt, insolvent, entered into receivership, management agreement, scheme or composition pursuant to the Bankruptcy Act or Corporations Law.

4. PREVIOUS EXPERIENCE

A statement should be submitted detailing previous experience of the Tenderer in the type of works to be covered by the Contract.

5. WHS MANAGEMENT SYSTEMS

Tenderers are required to submit their Workplace Health and Safety policy, Occupational Health and Safety Management System, Safe Operating Procedures, Hazard and Risk assessment procedures, reporting, monitoring and supervision procedures and induction.

If the Contractor is unable to provide a WHS Management System, the Contractor must be willing to implement these documents processes and systems prior to commencing works.

Details should also be given if the Tenderer has been convicted of an offence under the Workplace Health and Safety Law.

6. RECORD KEEPING

Tenderers are required to submit information in relation to all of their record keeping systems and provide evidence of their compliance with the *Environmental Protection (Great Barrier Reef Protection Measures) and Other Legislation Amendment Act 2019*, amended sections of the *Environmental Protection Act 1994* and the *Chemical Usage (Agricultural and Veterinary) Control Act 1988*

7. CHEMICAL CERTIFICATION

Tenderers are required to hold a current valid Commercial Operators License or be willing to obtain that license prior to commencement of the contract.

8. BMP ACCREDITATION

A current valid BMP accreditation is not mandatory but will be viewed favourably.

9. COSTS

Tenders are asked to quote either:

- on an hourly rate basis per task type; or
- a fixed annual fee for all services.

Costs are to include diesel fuel but are not to include cost of the following inputs:

- Electricity
- Water

- Chemical
- Fertiliser
- Cost of other contractors sourced by P&K

Schedule A

Procedures for the Establishment and Operation of Approved-Seed Plots Fifth Edition
2017



Sugar Research
Australia™

**PROCEDURES FOR THE ESTABLISHMENT AND
OPERATION OF APPROVED-SEED PLOTS
FIFTH EDITION 2017**

MN07002

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This manual was prepared by SRA for use by SRA, Productivity Services and other organisations in the Australian sugar industry providing approved seed.

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Warning our tests, inspections and recommendations should not be relied on without further, independent inquiries. They may not be accurate, complete or applicable for your particular needs for many reasons, including (for example) SRA being unaware of other matters relevant to individual crops, the analysis of unrepresentative samples or the influence of environmental, managerial or other factors on production.

1. INTRODUCTION

An approved-seed scheme provides cane growers with disease-free seed of varieties that are true-to-type. Disease-free seed (stalks, billets, setts or tissue culture plantlets used for planting) is a key control measure for systemic diseases of sugarcane, including ratoon stunting disease (RSD), leaf scald, Fiji leaf gall, smut, chlorotic streak and mosaic.

Provision of a nucleus of disease-free or approved seed in each mill area in the Australian sugar industry is co-ordinated by SRA, in cooperation with the distribution agents of SRA varieties. In most areas, the distribution agents are local Productivity Services. SRA provides the distribution agents with a disease-free supply of new varieties. These varieties have been DNA fingerprinted to ensure correct identification and that they are true-to-type. The distribution agent multiplies the new varieties following procedures set out in this manual and sells the approved seed to growers. The growers use the cane as a nucleus to further multiply the varieties on their farm in preparation for planting commercial fields.

All new SRA varieties are covered by Plant Breeder's Rights, and an agreement between SRA and the distribution agent allows the latter to provide these varieties to growers who have signed a PBR Licence Agreement. This procedures manual forms a part of the agreement between SRA and the distribution agents.

The procedures in this manual set the minimum standards for the operation of approved-seed plots and the procedures are based on world's best practice for sugarcane disease management in sugarcane. Quality-control measures are built into the procedures to ensure that, as far as possible, the disease-free status of seed plots are maintained. This involves regular visual inspection and sampling for RSD. Variety integrity is also ensured by sampling leaves of varieties for DNA fingerprinting to ensure that variety identification is correct.

Hot-water treatment plays an important role in the production of approved seed. Research showed that hot-water treatment can control RSD, leaf scald, chlorotic streak, and smut in seed-cane. Heat treatment can affect germination, and in many regions cane is first hot-water treated and planted into a mother plot. Cane from the mother plot is used to establish the approved-seed plot from which cane is supplied to growers. The use of the mother-plot system reduces the risk of large areas of germination failure, after hot-water treatment. In some districts, where insect-borne or air-borne diseases are present, the mother plots are established in a remote area to reduce the risk of disease spread from commercial crops.

The following procedures set the minimum standards for operation of approved-seed plots under agreements between SRA and distribution agents.

2. RECORDS

Records of the source of planting material used in the seed plots, treatments applied, samplings for RSD and DNA fingerprinting and visual inspections are essential for quality control. All distribution agents should record all this information. A form to assist with record keeping is illustrated in Appendix 1.

If one of the following diseases is recorded during an inspection, the distribution agent should notify a SRA pathologist immediately.

Diseases in this list will be referred to as serious diseases in this document:

- Fiji leaf gall;
- RSD;
- Smut
- Leaf scald;
- Mosaic;
- Striate mosaic;
- Chlorotic streak;
- Dwarf;
- Sclerophthora stunt;
- Bacterial mottle;
- Exotic diseases (e.g. downy mildew, Ramu stunt, leaf scorch, etc).

3. MOTHER PLOTS

3.1 Definition

A plot that provides planting material free of serious diseases for planting of approved-seed plots.

3.2 Site selection

1. Select a plot that is well drained, flood-free and has no record of major sugarcane diseases or problem weeds within the last two crop cycles.
2. Inspect surrounding cane to establish that no serious diseases are present. This includes adequate sampling of all surrounding blocks for RSD.
3. Separate the plot by at least a 10 m headland from any commercial crops.
4. Isolate the plot when insect-transmitted diseases (e.g. Fiji leaf gall and mosaic) are present, unless disease incidence is at low levels. Separate mother plots geographically from the nearest known infected field.
5. Locate the plot 500 m from any blocks with a recent history of leaf scald.
6. Select sites suitable for reasonable cane growth, with available irrigation if required, and secure from animal pests.
7. Signpost the plot to notify that entry is restricted to authorised personnel only.
8. Fallow the site for at least 6 months and ensure that there are no volunteer sugarcane plants before establishing the plot.

3.3 Establishment and entry of new varieties

1. No smut susceptible varieties (rating 8-9) should be planted in a mother plot.
2. Select planting material from a plot that has been derived from cane that has received a long-hot-water treatment (LHWT) or cold-soak long-hot-water treatment (CS-LHWT) (LHWT = 50°C for 3 hours, CS-LHWT = 40-hour soak at ambient temperature followed by 50°C for 3 hours) and smut fungicide treatment in two consecutive years.
3. Inspect the plant source for RSD (see notes on RSD sampling) and other systemic diseases, particularly smut, Fiji leaf gall, leaf scald, mosaic, striate mosaic, chlorotic streak, sclerophthora stunt, bacterial mottle and dwarf diseases, plus genetic mutations. The cane should have been

treated and inspected for these diseases in the previous 2 years. Consult a SRA pathologist if any of these diseases are found in the proposed plant source.

4. Ensure that the correct variety is cut for planting and there is no mixing of varieties. A DNA sample for fingerprinting is recommended, and this should be timed so that results will be obtained well before the intended planting date. SRA requires that samples are taken from the first plant crop of each new variety to ensure that there has been no mixing or mislabelling during the planting process (see 3.7.3). Contact a SRA Variety Officer for further information on DNA fingerprinting.
5. If the seed plot operator does not manage plant sources for for the mother plot, they should ensure that they are supplied with a signed statement verifying that the treatments and inspections listed in points 2-4 have been met.
6. The source of planting material used to establish tissue-culture plantlets for planting in mother plots should meet all of the conditions listed in points 2-4 and should have originated from the region in which the mother plot is located, or from a location with a similar incidence of serious diseases. The plantlets must be hardened in a location with a similar incidence of serious diseases also. Plantlets should be inspected for serious diseases by an experienced inspector during the hardening stage.
7. CS-LHWT all cane, as described in section 3.4.1, followed by treatment with a registered smut fungicide, as per the label (see section 3.4.4) (excludes tissue cultured plantlets).
8. Clean and disinfect the planter as described in section 3.4.5.
9. Thoroughly disinfect all cane knives or use a separate set of cane knives maintained for mother plot use.

3.4 Procedures for heat treatment and disinfection

Detailed instructions for hot-water treatment and operation of hot-water treatment plants are given in Appendix 2. The following instructions are for hot-water treatment of cane for use in mother plots.

3.4.1 *Procedure for CS-LHWT*

1. Soak cane in cold water for at least 40-48 hours, with circulation of the water and a slow input of fresh water.
2. Treat whole stalks, or two-eye setts in baskets.
3. Stack whole stalks loosely in layers approximately three stalks deep, with 50 mm spacers between the layers by using pieces of timber or similar materials.
4. Hot-water treat the cane for 3 hours at 50°C, within 6 hours of being removed from the cold-soak tank. Keep the cane in separated layers during the heat treatment. Ensure there is adequate circulation and check tank temperature regularly; the temperature should remain at 50 ± 0.2 °C.

3.4.2 *Procedure for LHWT*

Hot-water treat the cane for 3 hours at 50°C in bundles of whole stalks, ensuring there is adequate circulation; check the tank water temperature regularly. The temperature should remain at 50 ± 0.2 °C.

3.4.3 Procedure for SHWT (Short-hot-water treatment)

Various short-hot-water treatments can be used to control smut or chlorotic streak.

Smut

For general smut control, hot-water treat bundles of cane at 52°C for 30 min. The long-hot-water treatments used for RSD and leaf scald are also effective for eliminating smut.

Chlorotic streak

For control of chlorotic streak, hot-water treat cane at 50°C for 30 min.

3.4.4 Procedures for fungicide treatment to reduce sugarcane smut infection

After hot-water treatment, smut can re-infect treated cane, either through spores in the air or soil. Fungicides can be used to reduce re-infection and this protection lasts for a number of months. It is recommended that all hot-water treated cane be treated with a registered smut fungicide.

Two smut fungicides are registered; these are:

- propiconazole (Throttle®, Tyrant®);
- flutriafol (Sinker®)

The fungicides should be applied as per the label. Propiconazole must be applied as a dip for at least 5 min; Sinker® can be applied as dip or as a spray through a cane planter.

3.4.5 Procedure for disinfecting implements

All implements that are likely to cut the leaves or stalks of cane in the seed plots should be disinfected thoroughly before entering the plot.

1. Thoroughly clean all implements removing all dirt and cane residues. A high-pressure cleaner is recommended.
 - a) Harvesters - include toppler, throat, basecutter, feed rollers, chopper box, boot, elevator, and primary and secondary extractors.
 - b) Planters - include planter trailer, feed chute, blades and rubbers, and exit chute. If a recirculating fungicide spray or dip is used, ensure that tank and spray-lines are completely emptied and flushed with disinfectant.
 - c) Plant cutters and whole-stick harvesters - include topplers, base-cutter and gathering chains.
 - d) Stripping machines - include guards on inter-row tractor and fan, and fan blades.
 - e) Cultivation equipment - include tines, coulters, discs and tool bars. Special attention should be paid to disinfecting stool-splitting fertiliser boxes. Cultivate plant cane first, followed by first ratoon.
 - f) Other equipment - include cane knives, slicing knives, brix dibblers, chain saws used to trim stalks, trucks used to transport cane.
2. Spray or dip equipment using Cane Knife Steriliser® or Steri-Max® at a 1 in 100 dilution, allowing a 5 min treatment time. Renew disinfectant solution daily, or whenever it becomes dirty.

Alternatively, implements can be disinfected with 70% methylated spirits, a faster-acting sterilant; implements can be used after a 1 minute treatment time. However, methylated spirits is flammable and care should be taken using it near ignition sources.

3.5 Planting within the plot

1. Fallow all mother plot land for at least 6 months, eliminating all volunteers early in the fallow period.
2. Use cane varieties already in the mother plot as a source of plants. Treat the cane as follows:
 - a) LHWT at 50°C for 3 hours is sufficient if the leaf scald resistance rating of the variety is <4.
 - b) CS-LHWT if leaf scald resistance rating of the variety is ≥4.

Check with a SRA Variety Officer or QCANESelect™ for the latest variety ratings.

1. Apply a registered smut fungicide after hot-water treatment (see section 3.4.4).
2. Wash and thoroughly disinfect planting and cutting machinery.

3.6 Cutting planting material and harvest

1. Ensure that only staff of the distribution agents, or workers under their direct supervision cut planting material with disinfected cane knives, plant cutters or harvesters.
2. Harvest unused cane in the mother plot with thoroughly-disinfected cane knives or mechanical harvesters.

3.7 Inspections

3.7.1 *Diseases with external symptoms*

1. Inspect mother plots by walking every row at least three times during a season. Inspect as young plant cane, advanced tillering to out-of-hand, and at 6-12 months of age (where possible).
2. Record the percent smut infection (assume two stools/m of row, count the number of infected stools and divide by 2 times the length of row inspected - and multiply by 100). If a smut-infected stool is found, destroy the whole stool by digging it out or spraying with glyphosate. Notify a SRA pathologist if more than 0.5% (1 per 100 m of row) smut-infected stools are found in an individual plot.
3. Examine any unusual or suspect disease stools and send a specimen to a SRA pathologist for further identification if a serious disease is suspected. Clearly identify specimens as high priority.
4. Notify a SRA pathologist immediately if any serious diseases are found.

3.7.2 *RSD inspections*

ELISA Assay

1. Sample all varieties in the mother plot for RSD.
2. Sample at least 50-100 stalks per variety and bulk extracts into 12-25 samples. Varieties in plots < 200 m long require 10-50 samples per plot.
3. Collect extracts in tubes and send to the SRA RSD laboratory at Indooroopilly for ELISA assay. Detailed sampling procedures are listed in Appendix 3.

Other RSD assays

1. If another type of assay is to be employed, contact a SRA pathologist for sampling advice.

3.7.3 *Variety purity and identity*

1. Carefully inspect the mother plot to ensure that no mixing of varieties has occurred.
2. Check new varieties by comparing the cane in the mother plot with a known, identified stalk sample. Collect a leaf sample for DNA fingerprinting of all new varieties by 1 December each year. Send the sample to a SRA-nominated DNA laboratory by 1 December each year (protocol for sample collection is given in Appendix 4). Contact a SRA Variety Officer for further information on DNA fingerprinting.
3. Carefully inspect the plot for off-types or sports. Keep a record of the number and type of off-types. Destroy off-types by spraying young plants with glyphosate or digging out the plants.

3.8 Crop cycle

Do not allow cane to remain in the mother plot past first ratoon, if the plot is to continue at the same location.

4. APPROVED-SEED PLOTS

4.1 Definition

Plots of varieties that are true-to-type and free of important diseases from which planting material is distributed to commercial producers for establishment of their own on-farm seed propagation, or for commercial planting.

4.2 Site selection

1. Select a plot that is well drained, flood-free and has no record of major sugarcane diseases or problem weeds within the last two crop cycles.
2. Select sites likely to lead to reasonable cane growth, with irrigation available if needed, and which are secured from animal pest damage.
3. Inspect surrounding cane to establish that no serious diseases are present; this includes adequate RSD testing.
4. Separate the plot by at least a 10 m headland from any commercial crops. If there is no headland between the plot and commercial crops, plant six rows of approved seed of a highly smut-resistant variety as guard cane.
5. Isolate the plot where insect-transmitted diseases (e.g. Fiji leaf gall and mosaic) are present, unless disease incidence is at low levels.
6. Locate the plot 500 m from any blocks known to be infected with leaf scald.
7. Signpost the plot to notify farmers that they must report to staff before entering the plot.
8. Fallow the site for at least 6 months and ensure that there are no volunteer sugarcane plants before establishing the plot.

4.3 Establishment and entry of new varieties

1. No smut-susceptible varieties (rating 8-9) should be planted in the approved-seed plot.

2. Only plant with cane from a mother plot or from a plot not more than 1 year away from hot-water treatment. The plant source must have been intensively inspected and free from RSD and other systemic diseases, particularly smut, Fiji leaf gall, leaf scald, mosaic, chlorotic streak, striate mosaic, sclerophthora stunt, bacterial mottle, dwarf disease, plus genetic mutations.
3. Ensure that the variety is correctly identified and there are no volunteer stools of other varieties.
4. Where planting material for an approved-seed plot is sourced from a farmer, or other supplier, ensure that a signed statement is obtained verifying that the treatments and inspections listed in point 2 and point 3 have been met.
5. The source of planting material used to establish tissue-culture plantlets to be propagated in approved seed plots should meet all the conditions listed in points 2-4, and have originated from the same region in which the mother plot is located. If not, then they must be sourced from a location with a similar (or lower) incidence of serious diseases. The plantlets must be hardened in a location with a similar incidence of serious diseases to the region in which the approved seed plot is located. Plantlets should be inspected during the hardening stage for serious diseases by an experienced inspector.
6. Smut intermediate-susceptible varieties must be treated with Sinker® at planting (see section 3.4.4).
7. If smut is present in the mother plot, all varieties in which smut was detected must be given a SHWT (52°C for 30 min, see section 3.4.3) plus treated with a registered smut fungicide (see section 3.4.4).
8. Where no mother plot is available, the cane should be LHWT (or CS-LHWT if leaf scald rating is ≥ 4) (see sections 3.4.1 and 3.4.2) followed by a smut fungicide treatment (section 3.4.4) before planting
9. If there is a risk of chlorotic streak infection in the approved seed plot, the cane should be SHWT (section 3.4.4) followed by a smut fungicide treatment (section 3.4.4).
10. Disinfect planting and cutting equipment before commencement of operations.

4.4 Planting within the plot

1. Fallow the site for at least 6 months and ensure that there are no volunteer sugarcane plants before planting the plot.
2. Cane to be planted should be treated as outlined in section 4.3.

4.5 Inspections

4.5.1 Diseases with external symptoms

1. Inspect approved-seed plots by walking every row at least three times during a season. Inspect at young plant cane, advanced tillering to out-of-hand, and at 6-12 months of age (if possible).
2. Record the percent smut infection (assume two stools/m of row, count the number of infected stools and divide by 2 times the length of row inspected and multiply by 100). If a smut-infected stool is found, destroy the whole stool by digging it out or spraying with glyphosate. Notify a SRA pathologist if more than 0.5% (1 per 100 m of row) smut-infected stools are found in a plot.

3. 3. Examine any unusual or suspect disease stools and send a specimen to a SRA pathologist for further identification. Clearly identify specimens as high priority when contacting a pathologist.

4.5.2 *RSD inspections*

ELISA assays

1. Conduct intensive sampling for RSD in all varieties in the approved seed plot.
2. Sample at least 50-100 stalks per variety and bulk extracts into 12-25 samples. Varieties in plots < 200 m long require 10-50 samples per plot.
3. Collect extracts in tubes and send to the SRA RSD laboratory at Indooroopilly for ELISA assay. Detailed sampling and sample handling procedures are given Appendix 3.
4. Send any doubtful or positive samples to a SRA pathologist for confirmation of the diagnosis.

Other RSD assays

1. Contact a SRA pathologist for sampling advice if another assay is employed

4.5.3 *Variety purity and identity*

1. Carefully inspect the approved-seed plot to ensure that no mixing of varieties has occurred.
2. Collect a leaf sample for DNA fingerprinting of all new varieties by 1 December each year. Send the sample to a SRA-nominated DNA laboratory by 1 December each year (protocol for sample collection is given in Appendix 4). Contact a SRA Variety Officer for further information on DNA fingerprinting.
3. Carefully inspect the plot for off-types or sports. Keep a record of the number and type of off-types. Destroy off-types by spraying young plants with glyphosate or digging out the plants.

4.5.4 *Weeds*

Undertake weed inspections in plots and carry-out appropriate management to ensure that the plot is weed-free.

4.6 **Distribution of approved seed**

4.6.1 *Classes of approved seed*

1. Approved seed should be sold or distributed under three categories.
 - a) *Approved seed*: Cane from the plant crop in the approved-seed plot.
 - b) *First-ratoon approved seed*: May be sold as larger quantities as required, but with a notice stating that this cane has been cut in the previous season.
 - c) *Second-ratoon approved seed*: If sold, it should be for commercial planting only, and the purchaser must accept there is no guarantee of the disease status of the cane.

4.6.2 *Distribution*

1. Seed is distributed in different ways in different regions; the following are some of these methods. It is important that each method minimises contamination risks posed by diseases and that varieties are not mixed.

- a) *Farmer cuts cane by hand under staff supervision.* Only open the plot during specified periods on specified days. Staff either supervise disinfection of knives, disinfect knives themselves for the farmers, or provide disinfected knives that are returned when the farmer leaves. Staff should direct the farmer where to cut, and estimate or weigh the amount of cane supplied. Knives should be disinfected between varieties.
- b) *Distribution agent arranges cutting.* Contract cane cutters or whole-stalk cane-cutting machines cut the cane, which is then available for collection by the farmer or the cane is delivered to collection points, or to the farm. Careful supervision and training of contract workers should be carried out to ensure they use the correct disinfection procedures (see section 3.4.3). Disinfect knives and plant cutters between varieties.
- c) *Contractors or farmers cut cane by chopper or whole-stalk machines.* The distribution agent must supervise disinfection of the machines, ensuring disinfection is carried out thoroughly. They should also supervise the machine operation to ensure there is no contact with any adjacent commercial cane or that the wrong variety is cut (see section 3.4.3).

4.7 Crop cycle

A crop cycle of only plant, first ratoon and fallow is recommended for approved-seed plots.

4.7.1 *Harvest of excess cane*

1. A reliable contractor or farmer should be contracted to harvest excess cane.
2. Staff should supervise the disinfection of the harvester before it commences cutting at the plot.
3. Supervise the harvest and do not let the harvester contact any commercial cane adjacent to the approved-seed plot.
4. Harvest plant cane first, followed by first ratoon.

APPENDIX 1 – Certification of mother plots and approved-seed plots

RECORD OF PLANTING AND INSPECTION OF MOTHER PLOTS AND APPROVED-SEED PLOTS

DATE DISTRIBUTION AGENT

I certify that inspections and treatments listed in Tables 1-4 and attached documents and maps were performed according to the procedures given in the SRA Manual MN07002 “Procedures for the establishment and operation of approved-seed plots: Fifth Edition 2017”.

.....
Signature of staff member authorised to sign by the distribution agent

Location of plot (government map details or GPS coordinates)

Please record in addition to the completed tables:

1. A map of the plot showing blocks, block numbers and varieties.
2. Reports from RSD laboratory of RSD test results.
3. Report from DNA fingerprinting laboratory.

Table 1 Source of planting material and treatments

Treatments are the hot-water treatments applied to the cane at planting in the current planting season (Nil, SHWT, LHWT, CS-LHWT), only required for plant crops.

Category – MP = mother plot, ASP = approved-seed plot.

Source – give reference to block number and location of the source or organisation who supplied the cane, e.g. Blk3 MP = Block3 mother plot, or SRA = supplied by SRA.

Variety	Crop Class	Category MP/ASP	Source	Treatment	Block number	Area (Ha) or length of row (m)	Date planted

Table 2 Disease inspections

- Visual inspections: enter inspection dates
- Smut: calculate the percent smut infection

= (number of infected plants all inspection/2 x the metres of row) x 100

- RSD: show number of samples.

Block	Variety	% Smut infection	Visual Inspection			RSD
			Early	Mid	Late	

Table 3 Summary of Approved Seed distributed

Tonnes sold in the previous calendar year to growers as approved seed.

Variety	Crop Class	Block Number	Tonnes sold	Whole-stalk or billet

Table 4 DNA fingerprinting (new varieties only)

Variety	Category MP/ASP	Block	DNA Fingerprinting		
			Sample collected	Sample sent	Result received

APPENDIX 2 – Hot-water treatment of sugarcane to control diseases and pests

INTRODUCTION

Hot-water treatment of cuttings (stalks or stalk pieces) to minimise pest and disease incidence and spread, was pioneered in Australia. Hot-water treatment can reduce the risk of planting material being infected with ratoon stunting, leaf scald, chlorotic streak, smut and insect pests. It does not usually control viral diseases such as mosaic and Fiji leaf gall. Hot-water treatment is only a part of an integrated disease management (IDM) program and must be used in combination with disease inspection, crop management and hygiene to reduce the risks of reinfection (see attached 'Procedures for the establishment and operation of approved-seed plots').

Protocols for hot-water treatment vary depending on the disease or pest target. The temperature/time combinations most commonly used are close to the thermal death point of sugarcane. It is, therefore, critical that the temperature is not exceeded or germination will be severely affected. However, for effective disease control, the temperature must not drop below the target temperature. Temperature control thus must be precise with narrow tolerances. Water circulation is also critical to ensure that all parts of the tank are maintained at the correct temperature. Temperature checks during each run of the facility is essential to ensure good disease control. A regular maintenance program is also essential to ensure the tank is operating correctly.

The following specifications for disease and pest control were developed by SRA.

HOT-WATER TREATMENT FACILITIES

Tank size

The ratio of sugarcane stalks by weight to water volume should be 1:6. To treat a 1 tonne load of sugarcane, the tank should have a volume of 6000 L.

Circulation

Water circulation in the tank is critical. A general rule is that the circulation pump should circulate the entire water volume of the tank six times per hour.

The inlet pipe should be located at the base of the tank. A suitable screen should be in place to prevent blockages in the circulation system arising from leaf and stalk material. Water is returned to the tank via pipes located at the top of the tank.

Heating

A common heat source for hot-water treatment tanks is steam from the sugar factory. Electrical heaters or gas / oil furnaces are used in other facilities. Facilities that rely on steam from the sugar mill may only operate when the mill is operating; factory breakdowns may threaten successful treatment.

Electrical heating or steam injection pipes can be placed at the bottom of the tank or in a secondary tank from which the heated water is circulated back into the main treatment tank.

Handling of the sugarcane stalks

To load and remove the sugarcane stalks from the tank, a cradle, basket or sling is often used, with care taken to avoid impedance of the circulating water. Baskets should be made with mesh with sufficiently large holes to allow water movement, but small enough to prevent cane stalks or cuttings from passing through the holes.

Temperature control

Automatic temperature control is essential for effective operation of the facilities. Temperatures should be maintained at 50 ± 0.2 °C. If the temperature is elevated above this range for extended periods, poor germination may result; low treatment temperatures will lead to ineffective pathogen elimination.

Heat loss may be reduced via a tank lid. Surrounding tank insulation also reduces heat loss. Locating the tank in a shed restricts airflow around the tank, further reducing heat losses.

Temperature monitoring

Tank temperature should be monitored with a quality electronic data logger, with suitable associated thermocouples. Water temperatures in various parts of the tank should be monitored regularly to ensure water circulation is adequate and even. The accuracy of all temperature recording devices, including thermometers, should be checked regularly.

Water quality

Tank water should be of good quality, free of high salt levels and have near-neutral pH. In practice, the water can be used for a number of loads over a number of days, but should be replaced at least every 3-4 days - or sooner if large amounts of soil or plant material build up. Infrequent water changes may lead to fermentation of the sugars leached from the cane and result in poor cane germination.

In some countries, smut fungicides have been added to the tank water to protect against smut infection in the planted cane. This is not necessary (other fungicide treatment methods are available) and the disposal of large volumes of fungicide solution is an environmental problem.

HOT-WATER TREATMENT PROTOCOLS FOR DISEASES AND PESTS

RATOON STUNTING (RSD)

Hot-water treatment is used to control RSD; The disease is caused by the bacterium *Leifsonia xyli* subsp. *xyli*, which is widely distributed in all sugarcane-producing countries around the world. The disease can cause losses of 5-60% and is spread by planting infected planting material and by cutting implements, such as cane knives, harvesters and planters. Hot-water treatment of infected stalks at 50°C for 3 hours gives greater than 99% disease control. In some countries, the treatment is reduced to 50°C for 2 hours, but Australian research suggests that this treatment combination is not as effective at the 50°C, 3 hour recommendation.

Selection of cane for treatment

The cane to be treated should be free from RSD, if possible. If the cane is 100% RSD-infected, there is a risk that a small percentage of escapes may occur and the residual disease may spread to other plants when stalks are cut. If there is no alternative to using known diseased cane, it is recommended that the cane be treated in two consecutive years before it is used as a disease-free plant source.

To improve treated-cane germination, the cane source should be selected carefully; stalks should come from a well-grown and reasonably mature crop (preferably close to 12 months of age), with buds and root primordia in good condition; cane with stem rots or insect damage should be avoided.

Presentation for hot-water treatment

Dead leaves (trash) on stalks should be removed, though this is not essential. Leaves can cause blockages in the circulation system, so care should be taken to clean circulation system screens more regularly, if cane is treated with leaves attached.

The most common way cane is handled for RSD treatment is to treat whole stalks in large bundles placed in cradles or slings. The stalks should not be so long that they prevent circulation at the tank ends.

Alternatively, one- or two-eye setts or billets can be treated in open mesh baskets.

Treatment

The standard treatment is 50°C for 3 hours. Timing commences as soon as the cane is placed in the tank. Treatments longer than 3 hours may lead to poor germination. Maintaining the temperature at 50 ± 0.2 °C is essential for disease control and good germination.

Initially the tank should be heated to 51-52°C and then the cane lowered into the tank. The temperature will drop as the cane submerges; tank temperature should be returned to 50°C as quickly as possible. The water temperature should then be strictly maintained at exactly 50°C. A reliable thermometer should be checked regularly (every 10-20 minutes) throughout the treatment and adjustments made to the thermostat if necessary.

Post-treatment

After the cane is removed, it should be cooled as quickly as possible by spraying the cane with cool water. Immediately after removal, treated buds will be soft and minimal cane handling will minimise bud damage. The cane can be planted once it has cooled, though some prefer to leave the cane for 1-2 days to allow the buds to harden. Cane has been planted up to 2 weeks after treatment with acceptable germination, but this is not recommended.

The cane setts should be dipped or sprayed with a fungicide before planting (e.g. propiconazole or flutriafol) to provide sett rot protection. Hot-water-treated cane is particularly susceptible to sett rots.

The soil should be in ideal condition for planting to maximise germination. Ideally, cane should be treated and planted at a time when soil temperature and moisture are optimum.

Management of hot-water-treated cane

All implements that could cut the leaves or stalks of sugarcane must be sterilised before entering the hot-water treatment plot. Implements should be thoroughly washed and sprayed with 70% methylated spirits or 1% quaternary ammonium disinfectant; the latter sterilant requires a 5-minute contact time for effective control.

Summary – RSD

1. Select mature cane with no damage to buds or stalks.
2. Stack stalks in a crate or sling. Alternatively, one- or two-eye setts or billets can be treated in loosely-packed open mesh baskets or crates.
3. Heat the tank to 51-52°C.
4. Load the cane and treat for 3 hours, 50°C, commence timing when the crate is submerged in the water.

5. Cool cane quickly at the end of the treatment by spraying with cool water.
6. Handle the cane carefully until it has cooled; cane should be left for 1-2 days before planting.
7. Spray or dip cuttings with a registered fungicide.
8. Plant cane when conditions are ideal for germination - good soil tilth, ideal soil moisture and temperature.
9. Protect cane from reinfection by sterilising all cutting implements used in disease-free plots

LEAF SCALD

Leaf scald is caused by the bacterium *Xanthomonas albilineans*. Leaf scald can cause complete plant death in susceptible varieties, and is spread by planting infected stalks, strong wind-blown rain and cutting implements. Research has shown that hot-water treatment alone does not completely eliminate this disease. For effective control, the cane must first be soaked in water at ambient temperature for 40-48 hours with immediate hot-water treatment at 3 hours, 50°C (CS-LHWT). To improve the effectiveness of heat treatment, care must be taken to maximise water circulation by carefully stacking the cane in layers separated by spacers. Treated cane should be planted in an area that is unlikely to be reinfected by other disease sources (diseased cane or alternative hosts).

Selection of cane for treatment

The cane to be treated should be leaf scald-free. If no other alternatives are available, it is recommended that diseased cane be treated in two consecutive years before use as a disease-free plant source.

Well-grown, reasonably mature (preferably close to 12 months of age) cane, with buds and root primordia in good condition, should be sourced so as to improve germination. Avoiding damage from stem rots or insects is recommended.

Presentation for hot water treatment

Dead leaves (trash) on stalks should be removed. The cane should be stacked in layers no more than three stalks deep, with 50 mm spacers between the layers (e.g. pieces of timber). Alternatively, one- or two-eye setts can be treated in loosely-packed open mesh crates or baskets.

Treatment

A cold-soak long hot water treatment (CSLHWT) eliminates leaf scald. The cane is soaked for 40-48 hours in water at ambient temperature; a hot water treatment (50°C, 3 hours) follows. A slow replacement of the water during the cold-soak period prevents water stagnation, which can affect germination. Extending the cold-soak period beyond 48 hours will not affect the treatment, but buds will start to shoot after this period and may be killed by the HWT. HWT should ideally commence immediately after the cane is removed from the cold-soak tank, but a short delay of a few hours will not affect the treatment. If the heat treatment time extends beyond 3 hours, poor germination may result. Maintaining water temperature at $50 \pm 0.2^\circ\text{C}$ is essential for good disease management and germination.

Initially the tank should be heated to 51-52°C before the cane is lowered into the tank. The temperature will drop when the cane is submerged and the water temperature should be returned to 50°C as quickly as possible. The thermostat should be set at exactly 50°C and this must be checked against the reading of a reliable thermometer placed in the tank; the thermometer should be checked regularly (every 10-20 minutes) throughout the treatment period and adjustments made as necessary.

Post-treatment

When the cane is removed, it is important to cool the cane as quickly as possible using either a water spray, or water dip, using cool water. Cane buds are soft after removal and this requires the cane to be handled carefully. It can be immediately planted, though some prefer to leave the cane for 1-2 days before planting - to allow the buds to harden. Cane has been planted up to 2 weeks after treatment with acceptable germination, but this is not recommended.

Cane setts should be dipped or sprayed with a sett rot fungicide after treatment (e.g. propiconazole or flutriafol); hot-water treated cane is particularly susceptible to sett rots.

Ideally, cane should be hot-water treated when the soil temperature and moisture are ideal for germination.

A site well removed from known sources of leaf scald should be selected to plant the treated cane. Leaf scald has commonly been found in alternative grass hosts along river banks; the cane should not be planted close to these areas.

Management of hot water treated cane

All implements that could cut the leaves or stalks of the sugarcane must be sterilised before entering the hot-water treatment plot. Implements should be thoroughly washed and sprayed with 70% methylated spirits or 1% quaternary ammonium disinfectant; the latter requires a 5-minute contact period for effective decontamination.

Summary – Leaf scald

1. Select mature cane with no damage to buds or stalks.
2. Stack stalks in layers no more than three stalks deep, with 50 mm spacers between the layers (e.g. pieces of timber). Alternatively, one- or two-eye setts can be treated in loosely-packed open mesh crates or baskets.
3. Soak cane in water at ambient temperature for 40-48 hours with a slow input of fresh water.
4. Heat the tank to 51-52°C.
5. Load the cane and treat for 3 hours, 50°C; commence timing when the cane is submerged in the water.
6. Cool the cane quickly at the end of the treatment, by spraying with cool water.
7. Handle cane as little as possible until it has thoroughly cooled; cane should be left for 1-2 days before planting.
8. Spray or dip cuttings with a registered fungicide.
9. Plant in an area well separated from known sources of leaf scald.
10. Plant the cane when conditions are ideal for germination, which includes good soil tilth, ideal soil moisture and temperature.
11. Protect cane from reinfection by sterilising all cutting implements used in the disease-free plot.

SMUT

Smut, caused by the fungus *Sporisorium scitamineum*, is a serious disease of sugarcane recorded for the first time in Australia in 1998 in the Ord River Irrigation Area. It was subsequently found in Queensland in 2006. The disease can cause complete crop loss in susceptible varieties and is spread

by wind-borne spores produced in fruiting bodies known as whips. The spores may travel long distances with wind dispersal and can infect buds on standing stalks, buds on stalks planted into infested soil and via young developing shoots or tillers in plant and ratoon cane.

Effective smut elimination from stalks is achieved by hot water treatment at 52°C for 45 min.

The long-hot-water treatments used for RSD and leaf scald are also effective in eliminating smut.

After hot-water treatment, smut can re-infect treated cane - if the cane is planted into soil infested with smut spores or if smut spores land on cane buds before they are planted or if infection occurs via young tillers in the plant crop. Fungicides may provide several months protection from smut after planting, and it is recommended that all hot-water treated cane be treated with a registered smut fungicide.

Two fungicides are registered for smut control; these are: -

- propiconazole (Throttle®, Tyrant®);
- flutriafol (Sinker®)

The fungicides should be applied as per the label. Propiconazole must be applied as a dip for at least 5 min.; Sinker® can be applied as a dip or as a spray through a planting machine.

CHLOROTIC STREAK AND INSECT PESTS

The agent which causes chlorotic streak (*Phytocercomonas venanatanis*) is particularly sensitive to heat and can be eliminated completely by treatment at 50°C for 30 minutes. This short hot-water treatment (SWHT) does not control RSD or leaf scald; it does however improve cane germination.

Short-hot-water treatments of 50-52°C for 20-30 minutes are widely used to kill insect pests when cane is being moved from one area or country to another.

APPENDIX 3 - RSD sampling procedures

ELISA ASSAY

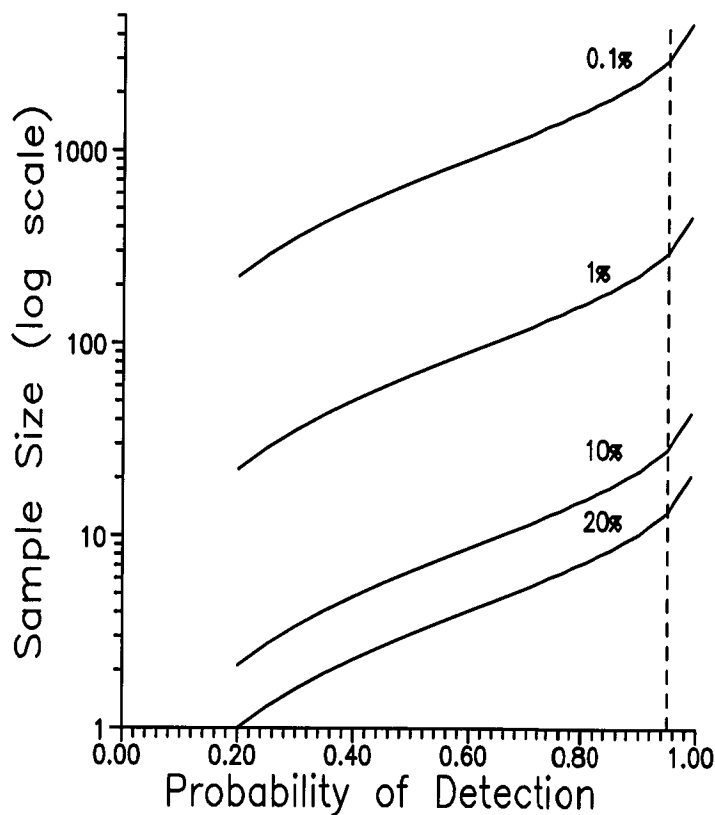
Selection of stalks

Stalks should be sampled at random throughout the plot. The largest stalks in poorly-grown stools (possibly poorly-grown due to RSD) should be selected.

Number of stalks to sample

The probability of detecting RSD in a field that is showing no obvious stunting depends on the number of stalks examined and the sensitivity of the diagnostic technique. The probability of a correct diagnosis is greatly increased as the sample number increases. For example, to have 95% probability of detecting disease that is randomly distributed and at a 10% incidence, 29 samples are needed; at 1% infected stools, 298 samples; and at 0.1% infected stools, 2,996 samples (Figure 1). Obviously, the practicality of handling the cane and the labour available will limit the number of samples able to be collected. Approved-seed and experimental plots will require much more rigorous sampling than routine farm plant sources. In approved-seed plots, 50-100 stalks should be sampled from each variety. In small plots < 200 m long, 10-50 samples should be collected.

Figure 1 Probability of detecting a positive with different sample sizes



Section of the stalk to sample

Extracts for RSD diagnosis should be taken from the base of the stalk, since bacteria are generally more concentrated in these nodes, particularly early in the season. In mature cane, the first node of reasonable length, 7.5-15 cm, can be sampled for ease of extract collection.

Bulking of samples

Extracts can be bulked to reduce the number of samples to be tested. However, this may reduce the chance of detecting the disease. For example, if 1 diseased extract is mixed with 9 healthy extracts, the bacterial concentration is 1/10 of that which was present in the diseased sample. It is possible that the diagnostic test may not be sensitive enough to detect the lower concentration of bacteria in the mixed sample. As a general rule, it is suggested that no more than 4 extracts from individual stalks should be bulked.

Equipment required

1. 1 mL titertubes and caps, and 96-place storage boxes.
2. Rubber milking machine inflation boot.
3. Air compressor - either 240 volt air compressor or a compressor that can be operated from a vehicle's 12 volt cigarette lighter. High-pressure compressors for car tyres are suitable.
4. Secateurs or long handled, beak blade lopping shears, and these should be sharp.
5. Esky with cooler block.
6. Methylated spirits and cleaning rags.

Procedure

1. For extraction at headland or shed, collect stalk pieces with at least 3-4 internodes. Take extracts the same day. It is much more difficult to collect xylem extract if stalks are allowed to dry out. Extracts are easier to collect in the morning.
2. Cut a single-node section of stalk from the stalk base. Cut one end square and the other at a 45° angle. If the stalk is dirty, clean the tip of the angled end and avoid soiling the angled cut surface.
3. Do not select insect-damaged, rat-damaged or rotten stalks. Avoid internodes with growth cracks where possible. If growth cracks are present, cut one end at a node.
4. Turn the air compressor on. Press the flat end of the stalk piece into rubber holder (Figure 2). Allow the fluid that bubbles out of the stalk to run off the angled tip of the stalk directly into a tube. Collect extracts from up to four stalks in the one tube. Collect approximately 0.6-0.8 mL of extract (minimum acceptable is 0.3 mL). Do not completely fill the tubes, since freezing will cause the caps to dislodge.

NOTE: Cane juice collected by squeezing stalks or with brix samplers is not suitable for RSD diagnosis.

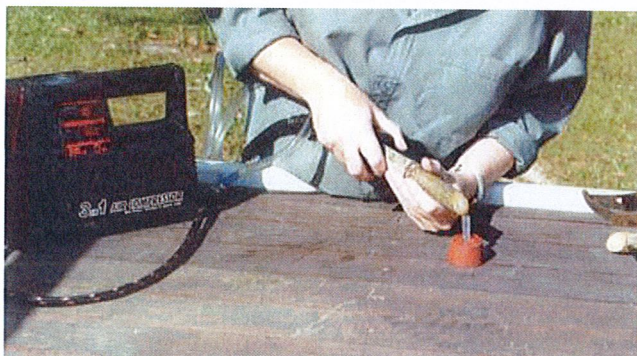


Figure 2 Equipment used for collecting xylem extracts for RSD diagnosis

5. Label each tube clearly with sample number and place in a 96-well storage box. Complete a record sheet to show position in the box and the block number, farm and district.
6. Clean and disinfect secateurs or lopping shears and the rubber holder between plots by wiping off organic matter and swabbing or spraying with methylated spirits.
7. Freeze the samples on return to the office.
8. Send samples to the SRA RSD laboratory at Indooroopilly by Air Express or other reliable overnight courier, in an Esky on cooler blocks. Include a copy of the record sheet that shows the layout of the samples in the box. Notify the laboratory that samples have been dispatched.

The address and contact details are:

Sugar Research Australia Limited
50 Meiers Road
Indooroopilly QLD 4068
Attn. Amanda Johnson
Phone: +61 7 3331 3333
Email: ajohnson@sugarresearch.com.au

Other RSD assay sampling: please consult a SRA pathologist for sampling and dispatch advice.

APPENDIX 4 - Guidelines for leaf sampling for DNA fingerprinting

1. Select the top-most leaf and remove the midrib. The leaf should be free of any disease symptoms.
2. Cut a small length (10-15 mm) and place in the storage tube supplied by the laboratory nominated by SRA.
3. The number of samples to collect will vary depending on the size of the plot, and whether mixing of varieties is suspected. If the latter is suspected, collect samples from throughout the plot and separate the different types, placing them in separate tubes.
4. Send the samples by overnight courier to the DNA laboratory.
5. For details on sampling for DNA fingerprinting, including storage tubes, and the address of the nominated laboratory, contact the local SRA Variety Officer