BSES Limited

BURDEKIN NITROGEN PROJECT

BSES TECHNICAL REPORT TE11004

SEPTEMBER 2011

PREPARED BY:

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1. Overview

In response to the introduction of the regulated method of determining N, some canegrowers in the Burdekin district (which produces approximately 25% of Queensland's sugarcane) expressed concern that sugarcane yields could be negatively affected by the permissible N application rates. Growers and Sucrogen (the milling company that operates in the Burdekin region) were also of the opinion that additional research was needed to ensure that any regulated N application would not compromise the profitability and/or supply security of the local sugarcane industry.

As a result of grower and industry concerns the Department of Environment and Resource Management (DERM) contracted BSES Limited to undertake a series of trials across the Burdekin district to determine the adequacy of the regulated N for sugarcane production on different soil types and at different on-farm locations. To date BSES has established ten trials, five of which are located in the Delta and five in the Burdekin River Irrigation Area (BRIA).

Replicated nitrogen rate strip trials have been established in plant sugarcane blocks on commercial farms in the Delta and BRIA. These sites were selected after considering a number of factors such as block size, shape, soil uniformity, irrigation systems employed and pest control measures. Consideration was also given to yield history of the blocks.

At the conclusion of this work, partial net grower returns per hectare for each N application rate will be calculated per crop and for the complete crop cycle. The optimum N application rates that maintain the profitability of sugarcane production will be identified with due consideration to the potential impact on the environment.

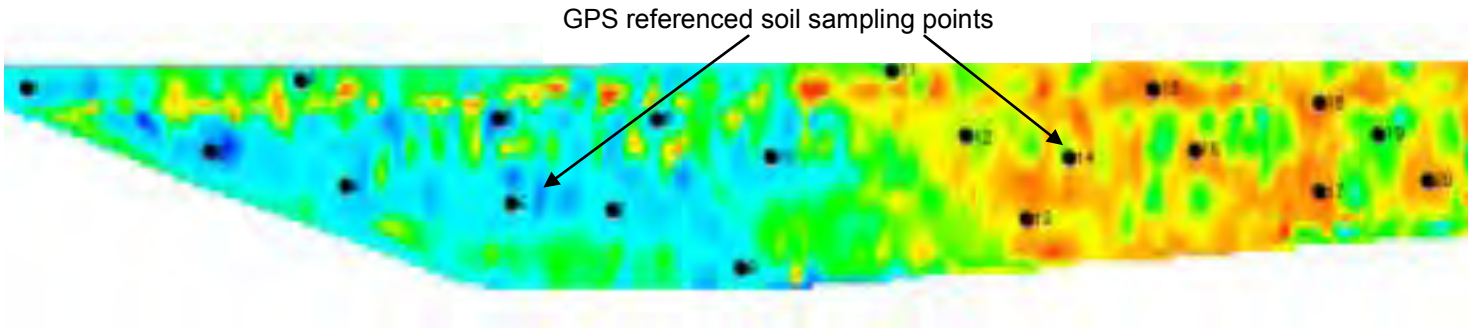
2. CURRENT PROGRESS

As part of the Burdekin Nitrogen Project a number of activities have been completed to date. This information has been compiled and presented to the Technical Management Group (TMG) and the Industry Reference Group (IRG) who oversee this project. TMG and IRG members are listed in Appendix 2.

At the beginning of the project protocols were developed in partnership with DERM. These protocols provide guidelines on research activities which will take place during the term of the project (refer to Appendix 1).

Eleven potential sites were initially identified through contacts made at grower group meetings, via the chairman of the IRG and through the local cane grower organisation Canegrowers, Burdekin. Once sites were identified a site inspection was undertaken with the grower to determine if the site was a prospective candidate for the nitrogen trials.

Once suitable sites were identified they were mapped using electrical conductivity resistivity measurements (Veris 3100). These maps were used to provide a general guide to changes in soil type and salinity/sodicity levels across blocks. This information was used to develop comprehensive soil sampling strategies for each site. Soil samples were collected to a depth of 1 metre, with sub-samples from 0-10 cm, 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm and 80-100cm depths being collected (Figure 3) and analysed for nutrient status separately. All soil sampling points across each site were GPS referenced (refer to Appendix 2).



A 'soil' map generated from the electrical conductivity / resistivity measurements showing identified soil sampling points.

Results of the soil analysis from each potential site were run through the regulated method to develop recommended fertiliser application rates for each site.

During crop establishment some growers applied additional fertiliser to their plantings. These applications were recorded and fertiliser boxes calibrated to determine quantity of fertiliser applied to the potential trial site. This information was recorded on the grower information sheet (refer to Appendix 2). Crop growth /

development and factors such as pests were monitored and recorded during the establishment phase.

From the time of planting, water samples have been collected for nutrient testing by DERM. Water sources for trial sites are either bores or channel systems. In the Delta water sources are generally bores and in the BRIA generally channels however in both areas a mixture of both water sources are sometimes used.

Information gathered from soil analysis, calibration of equipment and general observations were used to develop one page information sheets (refer to Appendix 2). These information sheets were then reviewed by the TMG to determine site suitability, design and treatments/nitrogen rates for individual sites (refer to Appendix 2).

Each trial contains three randomised replicates of three or four N treatments. The treatments include:

- Treatment 1: The regulated N application rate for the particular soil type
- Treatment 2: A lower N application rate than treatment 1
- Treatment 3: An N application rate comparable to that traditionally used by the grower
- Treatment 4: A higher N rate than treatment 3.

The outcomes of this review were then presented to the IRG for their consideration and endorsement.

Of the 11 candidate sites initially selected for the trial, one site was deemed to be inadequate due to a very poor sugarcane 'strike'. This site has been excluded from the trial. However given the location, the cooperative nature of the grower and the good practices applied by the grower, it was agreed that a trial would be established on another part of this grower's property in 2012. A total of 10 sites have been endorsed by the TMG and the IRG for 2011.

It was also agreed by the TMG and the IRG that another one or two sites will be established (under the current protocols) in the Kalamia area of the Delta in 2012. The inclusion of Kalamia sites will mean all areas of the Delta are covered by the Burdekin Nitrogen Project (refer to Appendix 2 for map showing location existing and potential trial sites).

Site and treatment information was provided to the BSES biometrician to design a randomised trial setup for each of the ten sites.

At the time of this report all ten sites are in the process of being pegged-out into strips to allow for the final fertiliser application of the various nitrogen rates.

The measured application of fertiliser will take place shortly after the delivery of a DERM-funded fertiliser box that is currently being built by Gessner. Expected delivery date is late September.

Once the strip trials have been established the following will be determined and monitored over the duration of this project:

- General plant growth and pest pressure
- Plant nutrient status via leaf analyses
- Sugarcane biomass accumulation
- Irrigation water quality
- Soil moisture status (at selected sites)
- Soil nitrate values to depth
- N losses via denitrification (at selected sites)
- Sugarcane yield, commercial cane sugar (CCS) content and calculated sugar yield

Satellite imagery (to be provided by DEEDI) will be utilised to capture images of each trial site. This technology has the potential to identify differences in crop responses to the various nitrogen treatments prior to harvest.

Trial site marked with pegs identifying trial site location and fertiliser application rate

3. APPENDIX 1

9/08/2011

Burdekin Nitrogen Trials

Protocol

Partial nitrogen budgets for replicated strip trials

Components of the budget

Nitrogen inputs, outputs and status components of a budget are indicated in Fig. 1.

Direct measurements of components A, B, C and D allow a 'partial' budget to be calculated as:

Partial budget = Inputs – Outputs
= (D-A) + B-C

Unless the input processes (mineralisation) and loss processes (denitrification, runoff, sediments, leaching) are measured directly, their cumulative result is reflected in the (D-A) term of the partial budget.

A net positive partial budget indicates accumulation in the soil if D>A or unmeasured net losses are occurring and are not reflected in the soil pools measured at times A and D. A net negative partial budget indicates a reduction in soil nutrient reserves which should be reflected by D<A. If D is not less than A then the soil pools measured at times A and D are not the ones providing available nutrients to the crop.

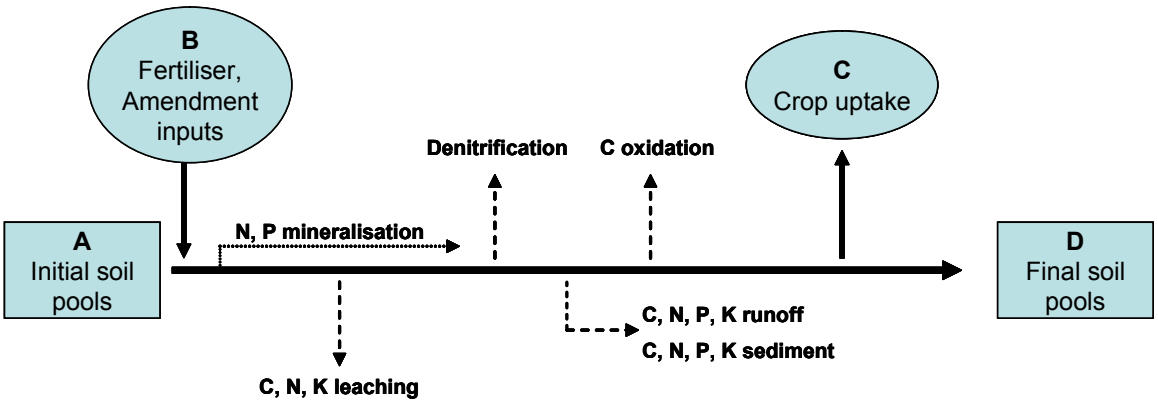


Figure 1. Nutrient input, output and status components of a nitrogen budget. The partial budget is calculated from measurements of A, B, C and D.

Methods for measuring components of a partial N budget

Components A and D
Total N, mineral N (ammonium-N + nitrate-N), potentially mineralisable N @ 7d, 14d of 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm, and 80-100 cm layers calculated as kg/ha using soil bulk density.

Component B
Inorganic N applied (kg/ha) as fertiliser, and nitrate-N applied in irrigation water.

Component C
Total N calculated as kg/ha using yield and %N content of above ground biomass and its moisture content.

Time of sampling components

Component A
Immediately prior to planting or immediately prior to application of fertiliser/amendment to ratoon. Any trash is removed from the soil surface before sampling.

Component C
Above-ground biomass samples will be taken at 6 months (stalk elongation) from a designated length of row for each rep, and weight of millable stalk and green leaf plus cabbage determined, with subsamples taken for total N and P analysis as detailed in 'Section 2. Protocols for establishing replicated strip trials.'

Immediately prior to harvest, another set of above-ground biomass samples will be taken as described in 'Section 2. Protocols for establishing replicated strip trials,' weighed fresh, and a subsample taken, dried at 60°C, re-weighed, ground and sub-sampled for analysis.

Component D
Immediately after harvest, collect separate composite top 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm and 80-100 cm layers calculated as kg/ha using soil bulk density from row area where biomass samples were taken. Remove any trash from soil surface before sampling.

Protocols for establishing replicated strip trials

A series of replicated demonstration strip trial sites are to be established in the Burdekin by BSES with a total of 9 sites to be established. Six sites located in the Delta and three located in the Burdekin River Irrigation Area (BRIA) and one site located at Babinda. The aim of the trials is to compare a range of nitrogen (N) application rates to a nitrogen rate determined using the method regulated under the *Reef Protection Act 2010*.

The following steps should be followed to ensure there is adequate consultation with industry and to ensure all relevant data required for this project is obtained.

1. Identify potential trial sites using a consultative process.

2. Assess each site in terms of suitability (size and shape of the block, uniformity of soil type, uniformity of standing crop for ratoon site/s, pest and disease status, uniformity of irrigation system, etc.) Plots will vary from 6 to 9 rows wide. The length of these rows will vary according to block size and shape.

3. Map the potential block using Veris 3100/EM33 to allow stratification of the block into similar units for replication and to identify soil sampling positions.

4. Identify the major soil type(s) in each potential trial block.

5. Collect composite soil samples for each potential trial site:

- Sites to be broken up into 4 sample zones according to the protocol shown in Fig 2. Adjustments to zone positions and boundaries will be done to reflect the nature of the block, the occurrence of soil types and Veris/EM maps.
- 8 - 10 subsamples for each depth (see bullet points below) are to be taken in each zone and combined to make one composite sample per zone.
- Where practical take a composite 0-10cm sample in each sampling zone. This sample is to be air dried (see below) and sent to Bundaberg BSES with the profile samples for forwarding on to DERM for pH, EC, exch K, Colwell-P, BSES-P, total org C, total N, W-B org C analysis.
- Take 2 sets (when in clay soils) of composite 0-20cm, 20-40cm, 40-60cm, 60-80cm & 80-100cm samples in each sampling zone.
- Once collected samples are to be air dried by leaving sample bags open.

A total of 2.0kg of soil is required for each composite sample.

- 500g for Incitec Pivot lab
- 1.5kg to be sent to Bundaberg BSES

Samples sent to Incitec Pivot are to undergo the following analysis:

- 0-20 cm *Custom test 2004-003 plus sand, silt and clay.*
- 20-40 cm *Custom test 2002-200 plus sand, silt and clay*
- *40-60 cm Custom test 2003-153 plus cations, plus sand, silt and clay.*
- *60-80 cm Custom test 2003-153 plus cations, plus sand, silt and clay*
- *80-100 cm Custom test 2002-200 plus sand, silt and clay*

Of the 1.5kg sample sent to Bundaberg 1kg will be placed in storage and the remainder sent to DERM for the following analysis:

- Analysis by ERS, DERM, Dutton Park includes:
  - Total N, total org C
  - Mineral N
  - Potentially mineralisable N (PMN) (0-20 cm only)
  - Denitrification potential and capacity (DPC) (0-20 cm only)

6. Use the method regulated under the Act and the BSES SIX EASY STEPS to determine inputs from soil test values.

7. Determine the N treatments rates in consultation with the Industry Reference Group (IRG), Technical Management Group (TMG) and each co-operator to establish appropriate rates for each trial site.

- N treatments will comprise 4 rates:
  - A rate determined by the method regulated under the *Environmental Protection Act 1994*.
  - A rate significantly lower than the rate determined by the method regulated under the Act.
  - A rate growers can associate with i.e. a rate they typically use
  - A high rate which is significantly higher than the industry standard.

8. Rates will be decided after consideration of site/soil specific details and will be equally spaced to allow a yield response curve to be established for the block.

9. Establish each trial using the identified treatments within randomised and replicated layouts.

10. Where possible, capacitance probes, e.g. Enviroscan, or similar equipment will be installed in the block to monitor soil water. As a minimum, rainfall should be regularly recorded using a rainfall gauge at each site.

11. At every irrigation event, a sample will be taken of the irrigation water in a B-bottle supplied on request by DERM Dutton Park. Water samples will be frozen and dispatched to the DERM waters lab for nitrate, EC and pH analyses.

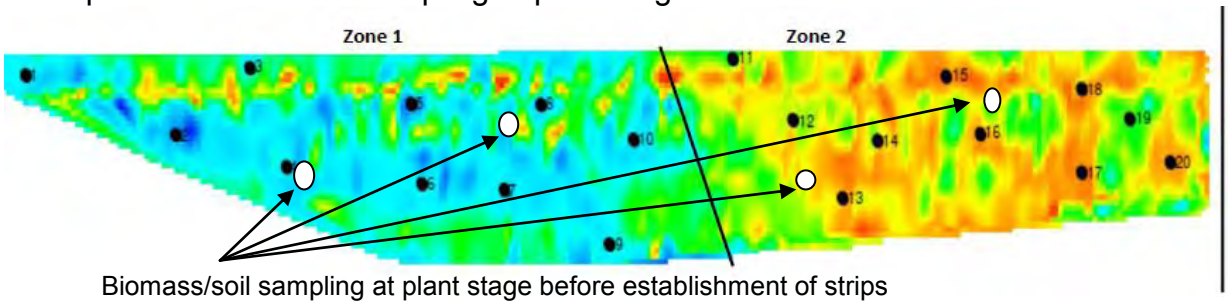
12. Once strips have been established choose a representative location within each strip and mark with a stake. Take an image at this marked point down the field and then an image from above looking down on the crop whilst standing on a ladder. Images to be taken at least once a month until entry is prohibited by crop size.

13. Strips to be mapped to determine the area within using Trimble GPS. For each strip map only the area to be harvested as part of the trial. For example where there are 6 rows per strip rows 1 and 6 will be guard rows. Map rows 2 to 5 to determine area. Harvested material from rows 1 and 6 from each strip will not be included in the yield determination.

14. Plant crop (before treatments have been imposed)

Where possible collect biomass/soil samples from several trial sites approximately 3 months post planting, pre-sidedressing. Two quadrats of 10 linear metres (e.g. 2 adjacent rows by 5 m each) to be hand harvested from each zone for the plant blocks. GPS all sample points. See Example 1 below.

Example 1. Biomass/soil sampling at plant stage



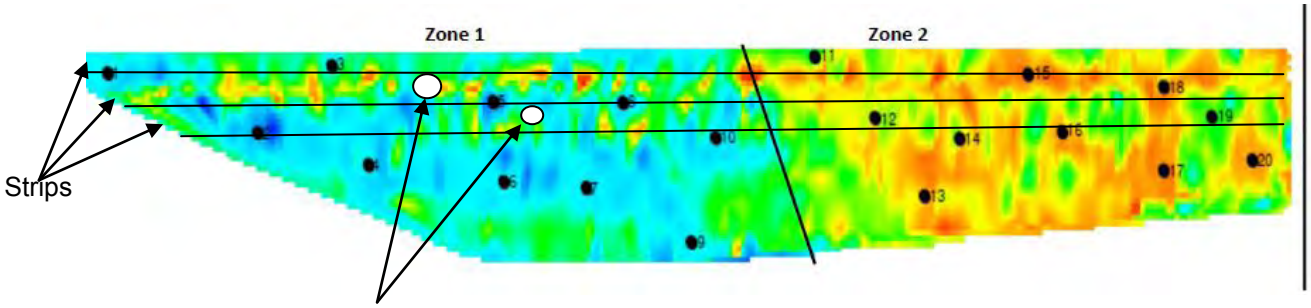
Biomass/soil sampling at plant stage before establishment of strips

For trial sites with 2 zones a total of 4 biomass/soil samples will be taken, for trials sites 3 zones 6 biomass/soil samples will be taken and for trial sites with 4 zones a total of 8 biomass/soil samples will be taken.

Ratoon crop (after treatments have been imposed)

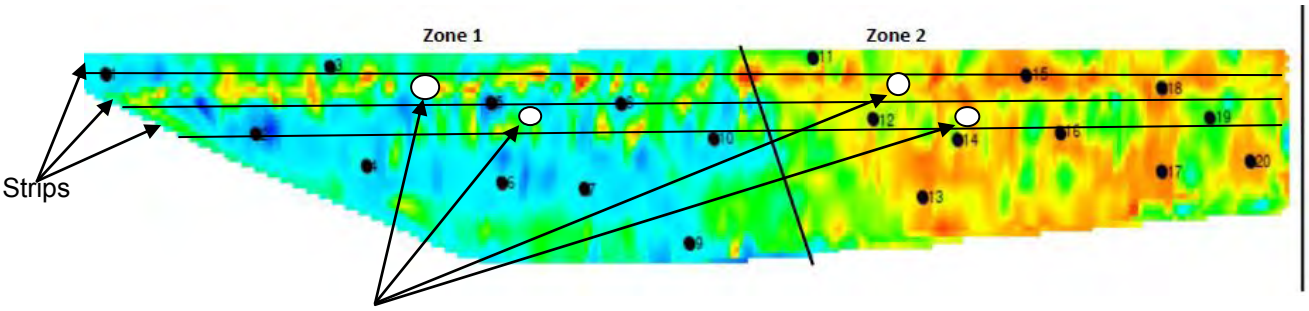
Where possible collect biomass/soil samples from several trial sites approximately 3 months postharvest and sampling date referenced with respect to split-stool/side-dress N application date. In the ratoons one quadrat of 10 linear metres of sample per strip (treatment), (a total of 12 sample quadrats per trial site); however if time and resources permit an additional quadrat sampling in each strip is desirable. GPS all sample points. See Example 2 below.

Example 2a. Minimum biomass/soil sampling at ratoon stage with established strips



Biomass/Soil sampling points for strips at ratoon stage

Example 2b. Desirable biomass/soil sampling at ratoon stage with established strips



Biomass/Soil sampling points for strips at ratoon stage

As a minimum for each site selected for biomass/soil sampling at the ratoon stage a minimum of 12 biomass/soil samples will be required to sample within each strip (i.e. 4 rates x 3 reps x 1 zone). If each strip and zone is then sampled the number of samples will double for trial sites with 2 zones (i.e. 4 rates x 3 reps x 2 zones) and triple for sites with 3 zones (i.e. 4 rates x 3 reps x 3 zones).

Sites with more than two zones may require some alteration to the above protocol ensure the sampling regime remains practical.

Biomass sampling. Follow method outlined below:

Collect sugarcane biomass samples ***according to the following procedure:***

- From the sampling rows (not guard rows) of a plot randomly select 2 adjacent rows and measure 5 m of each. Crop density in the selected areas should be indicative of the plot and not have gaps.
- A tiller count from the plot to be undertaken (use to calculate population (tillers/m^2).
- Cut all plants at ground level and weigh fresh biomass of whole plot in the field (use this to calculate biomass t/ha). This will give total fresh weight (FW) for 2 lengths of 5 m.
- Place plants in garbage bin bags, label and zip tie.
- Back at processing point undertake partitioning of material into:
    - Green leaf
    - Cabbage (leaf sheath and immature stalk)
    - Dead leaf (not likely to be any at this 3 month stage)
    - Millable stalk (not likely to be any at this 3 month stage).
- It may be necessary to subsample the material harvested in the field depending upon the amount harvested. If subsampling is necessary then this subsample becomes the Subsample FW.
- Once partitioning of the sample (or subsample) is complete, mulch (or cut up using secateurs) the green leaf sample and the cabbage sample and place into aluminium containers (ideally get 2 samples each, one as backup). Weigh to determine the FW of samples in each container.
- Place containers in oven at 60°C to get a dry weight, drying may take more than 2 days. Weigh daily until a constant weight is reached.

- Send samples to DERM lab for analysis of total N and P with analytical costs met from the DERM project budget.

15. Collect third-leaf samples during the leaf-sampling season (mid-November – April) from the treatment areas in each strip-trial according to existing BSES protocol. Dried samples will be sent to Bundaberg where they will be ground. The samples will then be split: one sub-sample will be processed through the BSES Leaf Analysis Service (N determinations by wet chemical methods, other nutrients according to usual procedures), the other sub-sample will be dispatched to DERM for total N and MIR analysis. Results will be distributed to IRG and co-operators.

16. Collect sugarcane biomass samples at the same time as the leaf sample according to the following procedure:

- Randomly select 2 lengths of 5 m of crop row that, are not adjacent to each other in each plot. Crop density in the selected areas should be indicative of the plot and not have gaps.
- Cut all plants at ground level and weigh biomass of whole plot in the field (use this to calculate biomass t/ha). A stalk count from the plot will also be undertaken (use to calculate stalks/m^2). Collect any surface trash from one inter-row adjoining the harvested length of crop row.
- Select 20 stalks from the hand harvested material. Partition into millable stalk (MS) and green leaf and cabbage (LC) (this is usually done by cutting between the 5^{th} and 6^{th} dewlaps, green leaf attached to the stalk is included in LC, dead leaf is discarded). Weigh each component in the field. Use to calculate % millable stalk. Calculate Millable yield (t/ha) = Biomass (t/ha) x % MS/100. Can also be used to determine individual stalk weights, individual millable stalk weight, etc.
- The tripod method will not be suitable for the total plot biomass, particularly at final harvest. A weigh trailer will be required.
- Select a further sub-sample from these samples (e.g., about 6 stalks), partition into MS and LC and shred each component using a mobile garden mulcher. Collect a sub-sample of the freshly mulched material and weigh (aluminium food trays are used). This should be done in the field with freshly cut stalks from all plots. Transport back to the lab. Dry at 60^{o}C and re-weigh to determine moisture content. Use moisture content to determine total dry biomass. Send about 100g each of MS and LC subsamples to the BSES lab at Indooroopilly for analysis of total N and P.

17. Regularly assess the trials for visual differences in plant growth and pest or disease symptoms.

18. Record rainfall, irrigation details (date, time on-time off, volume), fertiliser management (rate, form, placement, date), field operations. Manual rain gauges to be erected at each site and monitored for rainfall events.

19. Harvest the trials within the growers allocated harvest cycle in collaboration with harvest contractor and mill.

20. Immediately prior to burning and harvest, select 6 consecutive (or more depending upon resources) living stalks from the top and bottom of the block from each strip (replicate), separate into plant components, weigh, chop, dry at 60°C and re-weigh to determine moisture content. Mulch and send about 100g subsamples to the BSES lab at Indooroopilly for analysis of total N and P.

21. During the harvest, on the face of the crop in a middle row of each treatment select 6 consecutive (or more depending upon resources) stalks from two to three locations along the length of the strip (replicate) weigh, chop, dry at 60°C and re-weigh to determine moisture content. Mulch and send about 100g subsamples to the BSES lab at Indooroopilly for analysis of total N and P.

22. During the harvest, on the face of the crop conduct stalk counts in a middle row of each treatment. Two to three 5 metre strips of stalks to be counted down each selected row.

23. Ensure the size of the replicated strips enables yield (tonnes cane/ha) and CCS data to be collected at the mill after harvest.

24. Immediately following harvest, collect separate composite 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm & 80-100 cm samples from row area where biomass samples were taken. Air dry and dispatch to ERS, DERM, Dutton Park, for the following analyses:

i. Total N, total org C
ii. mineral N
iii. potentially mineralisable N (PMN)

25. A post-harvest sampling and assessment for Praty/Pachy and the free living omnivorous and predatory nematodes for selected sites where nematodes are thought to be problematic.

25. Consult with Mark Poggio (DEEDI, Ingham) to discuss economic issues relating to the trials. Calculate the partial net grower return per hectare using a standardised 'cane payment formula' to determine the partial net return per hectare to the grower:

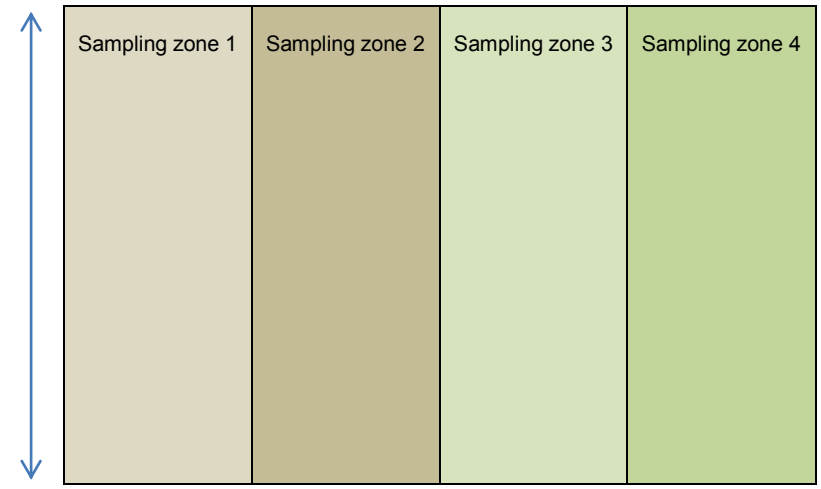
b. *Grower partial net return = ((price of sugar x (0.009 x (ccs-4)+0.6)) x cane yield) - (cane yield x estimated harvesting costs plus levies) - (fertiliser cost) (kg/ha) – (cane yield x estimated harvesting costs plus levies)*

26. Provide summaries of results to the co-operating grower TMG and IRG.

27. Continue the trials for at least 3 crop cycles.

Sampling zones according to changes in soil types

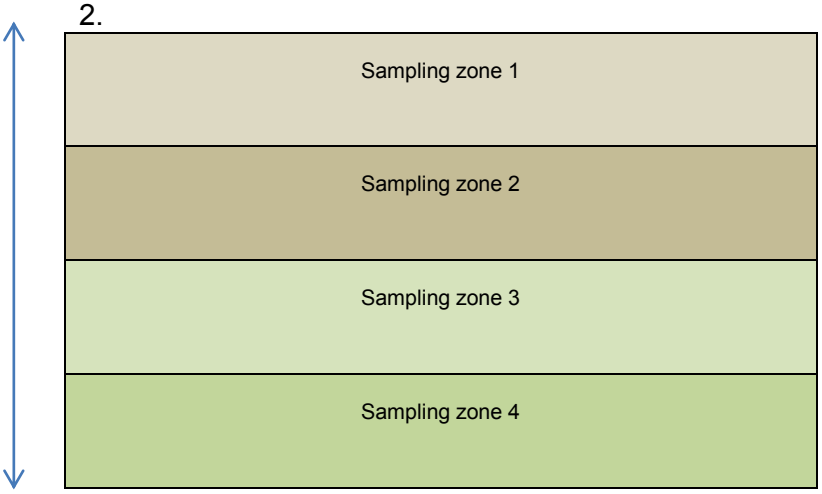
1.



Comments:

- **Suited when soil changes are across the field**
- **4 sample areas that run parallel to row direction**

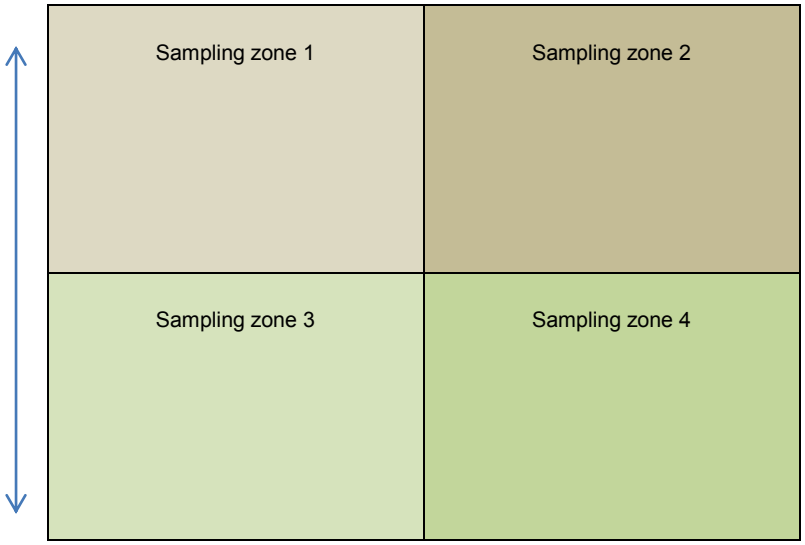
2.



Comments:

- **Suited when soil changes are down the field**
- **4 sample areas that run across row direction**

3.



Comments:

- **Suited to when the soil is variable across and down the field**
- **4 sample quadrants**

Figure 2. - Examples of soil sampling strategies

4. APPENDIX 2

PowerPoint presentations

1. At the outset of this project a PowerPoint presentation was developed and delivered to local growers informing them of the research which was about to take place in the district. More than half a dozen local grower group meetings were attended with presentations made at these events. This PowerPoint presentation was also delivered to the Canegrowers, Burdekin board.

2. A PowerPoint presentation was developed and delivered to the Industry Reference Group (IRG) and the Technical Management Group (TMG) of the Burdekin Nitrogen Project on the 12th August 2011. This presentation gave a technical summary of each site and now also includes the treatments to be imposed at each site.

   Copies of these PowerPoint presentations are attached.

Burdekin Nitrogen Project

BSES Limited

BSES Sugarcane for the future

BSES QCANES

BSES QCROPS

Project aim

To assess the suitability of the Regulated Nitrogen (N) Application Rates *(based on, but different to, the SIX EASY STEPS nutrient management guidelines for* ***sustainable sugarcane production)*** in the Burdekin Region.

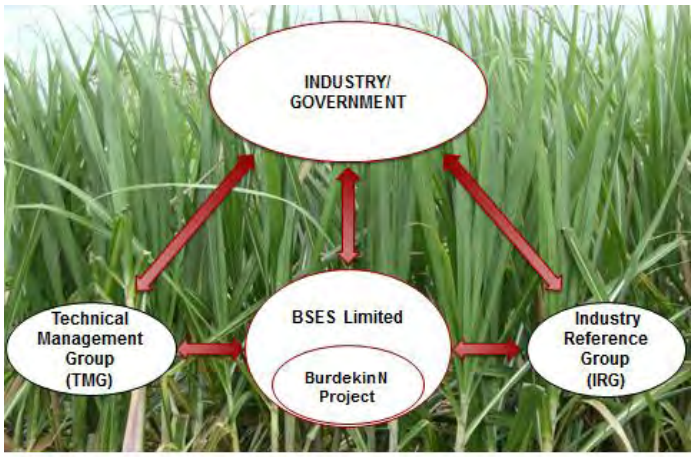
Sustainable sugarcane production: Profitable cane production in combination with environmental responsibility.

BSES Sugarcane for the future

Funding and collaborators

- Project funding provided by:
  - Queensland Department of Environment and Resource Management (DERM)
- Project managed and conducted by:
  - BSES Limited
- Collaborators:
  - Burdekin sugarcane growers
  - Sucrogen Ltd
  - Queensland Department of Employment, Economic Development and Innovation (DEEDI)

BSES Sugarcane for the future



BSES Sugarcane for the future

Who does what?

- DERM

Providing funding for the project under contract to BSES Limited.

- Project **contract** administered from Brisbane within the Reef Policy Group
- Scientific input from Principal Scientist: Dr Phil Moody

Who does what?

- BSES Limited

Responsible for undertaking the 2.5 year project under contract from DERM.

- As part of the QCROPS Group (Group Manager: Dr Peter Allsopp)
- Within the Improved Cropping Systems Program (Leader: Dr Bernard Schroeder)
- Coordinated by Julian Connellan (BSES Research Agronomist)
- Technical support: John Panitz (Extension Agronomist)
- Research Assistance: Research Officer / Technician: TBA

Who does what?

- Technical Management Group (TMG)

Responsible for ensuring that the project is conducted in a scientifically sound manner with the best chance of meaningful results and appropriate interpretation.

- Dr Phil Moody (DERM)
- Dr Bernard Schroeder (BSES Limited)
- Dr Andrew Wood (Sucrogen Ltd)
- Dr Mike Bell (DEEDI)

Who does what?

- Industry Reference Group (IRG)

Responsible for:

- Ensuring local 'ownership' of the trials and results by Burdekin growers
- Assistance with trial site selection
- Communication with local stakeholder groups

Who does what?

- Industry Reference Group (IRG)
  - David Defranciscis (Chairman): Sugarcane grower; Director, Pioneer Cane Growers
  - Jim Collins (Secretary): Manager, Canegrowers, Burdekin
  - Rod Schultz: Manager, Pioneer Cane Growers Org.
  - Panikos Spyrou: Manager, Kalamia Cane Growers
  - Evan Shannon: Manager, Davco Farming
  - Greg Shannon: Extension Leader, BSES Limited
  - Marian Davis/Ryan Matthews: Extension Officers BSES Limited

BSES Sugarcane for the future

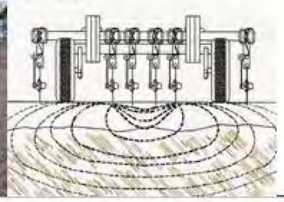
How will we achieve our aim?

- Working in collaboration with DERM and DEEDI, BSES will:
  - Establish strip trials in plant and ratoon blocks in the Delta and BRIA cane growing areas
    - Trial sites are chosen after considering factors such as block size, shape, soil uniformity, irrigation system employed, pest control measures
    - Consideration is also given to the yield history

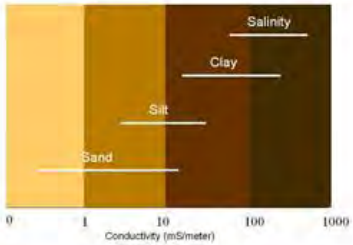
BSES Sugarcane for the future

Establishment of replicated trials

- Once potential site is identified in consultation with the IRG the site will be:
  - Surveyed with a Veris 3100: Plant cane sites
    - Similar to EM38 and will generate map of soil differences across he site.
  - Surveyed with a EM38: Ratoon sites



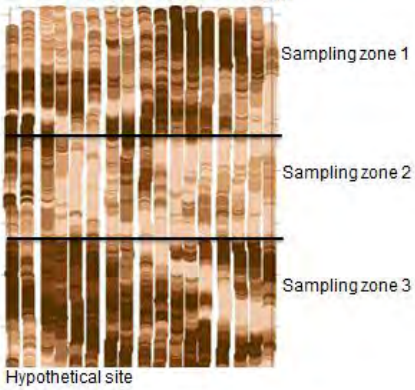
BSES Sugarcane for the future



- Maps generated by Veris 3100 or EM38 will provide information on changes in soil types
- Information will be used to develop soil sampling strategy

BSES Sugarcane for the future

Soil Sampling Strategy



Hypothetical site

Trial Design

- Strip trials will be established in plant / ratoon crops with uniform soil types
- Four possible treatments
  - Treatment 1 – Low rate
  - Treatment 2 – Regulated method / SIX EASY STEPS rate
  - Treatment 3 – Traditional grower application rate
  - Treatment 4 – A high rate
- Three replicates at each site

N application rates developed by IRG & TRG

Monitoring of sites

- Once strip trials have been established monitoring of the following parameters will occur for plant/ratoon and the next 3 crops:
  - Plant nutrient status via leaf analysis (Dec – April)
  - Biomass analysis (at same time as leaf analysis)
  - Regular visual assessments of general plant growth and pest pressure
  - Collection of yield and CCS data from strips

Monitoring of sites (continued)

- At selected sites the following parameters will be monitored:
  - Soil moisture status (ie.enviroscan)
  - Bore water quality (nitrates)
  - Soil nitrate status
  - N losses (denitrification)

Outcomes

- Yield data (tc/ha, ccs, ts/ha) associated with each treatment at each site
- Calculation of partial net grower return per hectare for each nitrogen application rate
- Identification of N application rates that will maintain the profitability and productivity of sugarcane production in the Burdekin whilst considering the impact of nitrogen applications to the environment

BSES
Sugarcane for the future

Thank You

BSES Limited

BSES
Sugarcane for the future

BSES QCANES

BSES QCROPS

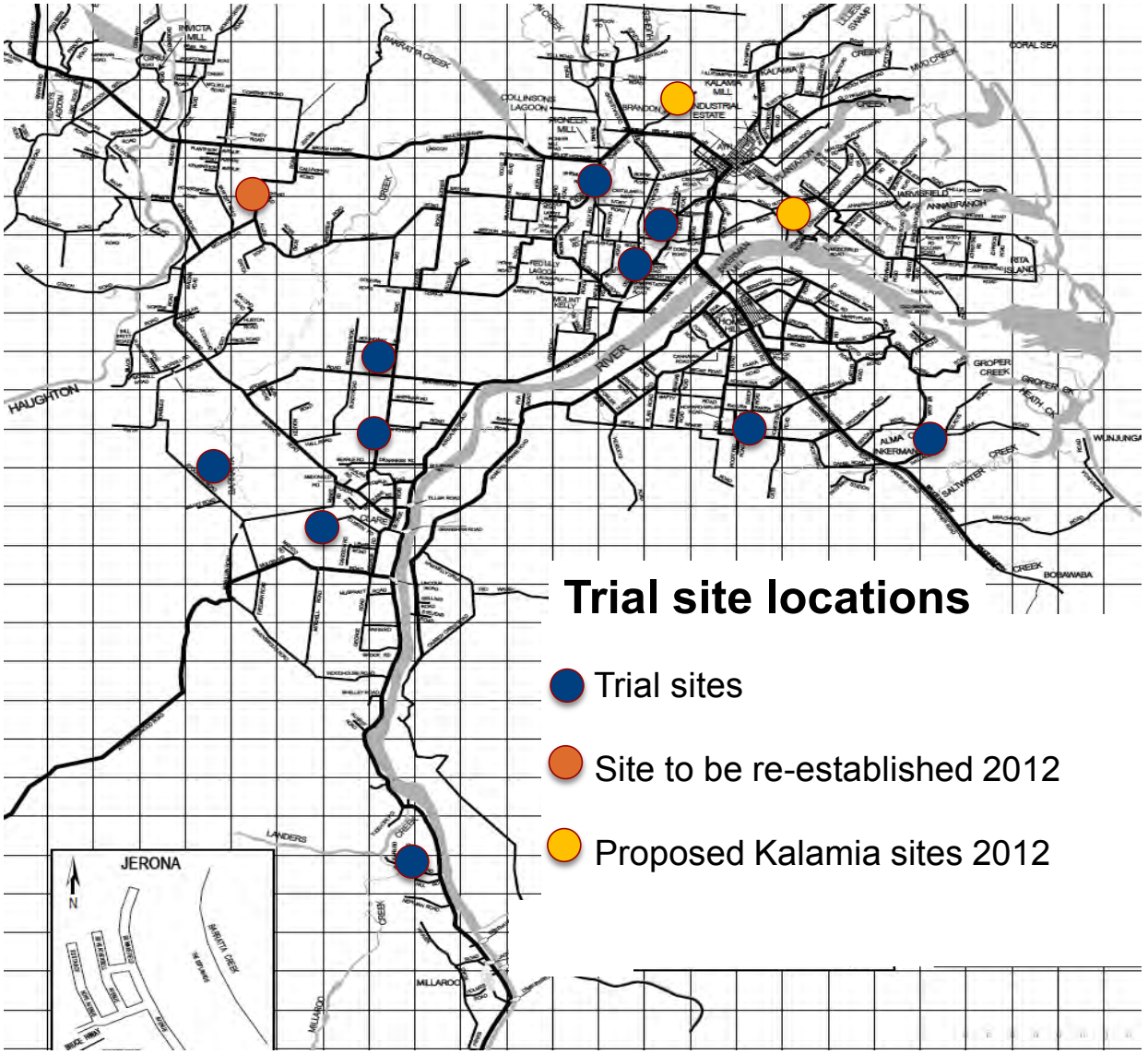
Burdekin Nitrogen Trials

BSES Limited

BSES
Sugarcane for the future

BSES QCANES
Varieties for your future

BSES QCROPS
Growing your bottom line


Trial site locations
Trial sites
Site to be re-established 2012
Proposed Kalamia sites 2012
JERONA
HAUGHTON
RIVER
CORAL SEA
MILLAROO
LANDERS

Grower 1.

Location: Delta
Latitude: 19°34'37.12"S
Longitude: 147°19'58.67"E
No. of rows: 107
Row width: 1.52 m
Trial block area: 10 ha
Variety: Q208
QDPI Soil type: BUfb
A.S.C: Black or Brown Dermosol

Nutrient Status	Unit	Value				
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Zone 4	Mean
pH (1:5 Water)		7.0	6.7	6.6	6.6	**6.7**
Organic Carbon	%	1.0	0.88	1.0	0.68	**0.89**
Nitrate Nitrogen	mg/kg	2.8	3.6	1.4	2.4	**2.6**
Phosphorus (BSES)	mg/kg	190	130	21	32	**93**
Phosphorus Buffer Index		46	41	43	38	**42**
Potassium (Amm-acet.)	meq/100g	0.14	0.1	0.13	0.19	**0.14**
Potassium (Nitric K)	meq/100g	2.3	1.9	2.5	1.9	**2.2**
Sulphate Sulphur	mg/kg	2.2	3.3	3.5	1.5	**2.6**

Nutrient Status	Unit	Value				
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Zone 4	Mean
Electrical Conductivity	dS/m	0.04	0.03	0.03	0.02	**0.03**
Cation Exchange Capacity	meq/100g	9.83	6.31	9.32	5.12	**7.6**
Calcium (Amm-acet.)	meq/100g	7.0	4.5	6.5	3.3	**5.3**
Magnesium (Amm-acet.)	meq/100g	2.5	1.6	2.4	1.6	**2**
Sodium (Amm-acet.)	meq/100g	0.19	0.11	0.19	0.03	**0.13**
Calcium/Magnesium Ratio		2.8	2.8	2.7	2.1	**2.6**
Clay	%	14	10	16	11	**13**
Sand (Fine)	%	31	33	34	28	**31**
Sand (Coarse)	%	35	41	31	50	**39**
Silt	%	20	16	19	11	**17**

Nitrogen Rates (4 treatments, 72 Rows)
Plant: 130kg/ha, 170kg/ha, 210kg/ha, 250kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha, 290kg/ha

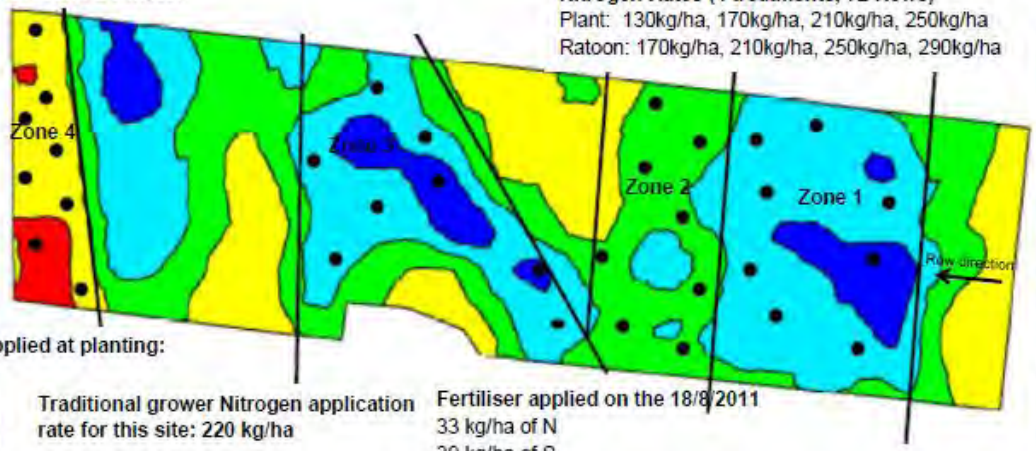


Image: 6/7/2011 (Planted 3/5/2011)

Fertiliser applied at planting:
N: 40kg/ha
P: 0 kg/ha
K: 43 kg/ha
S: 47 kg/ha

Traditional grower Nitrogen application rate for this site: 220 kg/ha

Fertiliser applied on the 18/8/2011
33 kg/ha of N
39 kg/ha of S

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Zone	N rate (kg/ha)	N rate (kg/ha)	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)
	DYP = 150 tonnes/ha	DYP = 180 tonnes/ha						
1	130	160	0	100	20	0	0	0
2	130	160	0	100	20	0	0	0
3	130	160	20	100	20	0	0	0
4	140	170	20	100	25	0	0	0

DYP = District Yield Potential

Grower 1.
2/08/2011

Nitrogen rates to be applied at plant and ratoon stages

N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	250	290
Grower	210	250
Regulated/ 6ES	170	210
Low	130	170

6ES - SIX EASY STEPS

Grower 2.

Location: BRIA
Latitude: 19°59'39.90"S
Longitude: 147°14'59.42"E
No. of rows: 55
Row width:1.6 m
Trial block area: 6 ha
Variety: KQ228
QDPI Soil type: 6Dbg
Soil group/order: Non-Sodic Duplex (Group 3)

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
pH (1:5 Water)		6.4	6.5	**6.5**
Organic Carbon	%	0.4	0.29	**0.35**
Nitrate Nitrogen	mg/kg	8.3	5.8	**7.1**
Phosphorus (BSES)	mg/kg	88	34	**61**
Phosphorus Buffer Index		23	20	**22**
Potassium (Amm-acet.)	meq/100g	0.2	0.11	**0.16**
Potassium (Nitric K)	meq/100g	2.1	2.2	**2.2**
Sulphate Sulphur	mg/kg	5.1	2.6	**3.9**

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
Electrical Conductivity	dS/m	0.04	0.03	**0.035**
Cation Exchange Capacity	meq/100g	4.03	2.82	**3.43**
Calcium (Amm-acet.)	meq/100g	3.3	2.3	**2.8**
Magnesium (Amm-acet.)	meq/100g	0.5	0.39	**0.45**
Sodium (Amm-acet.)	meq/100g	0.03	0.02	**0.025**
Calcium/Magnesium Ratio		6.6	5.9	**6.3**
Clay	%	8	5	**7**
Sand (Fine)	%	67	62	**64**
Sand (Coarse)	%	12	22	**17**
Silt	%	14	11	**12**

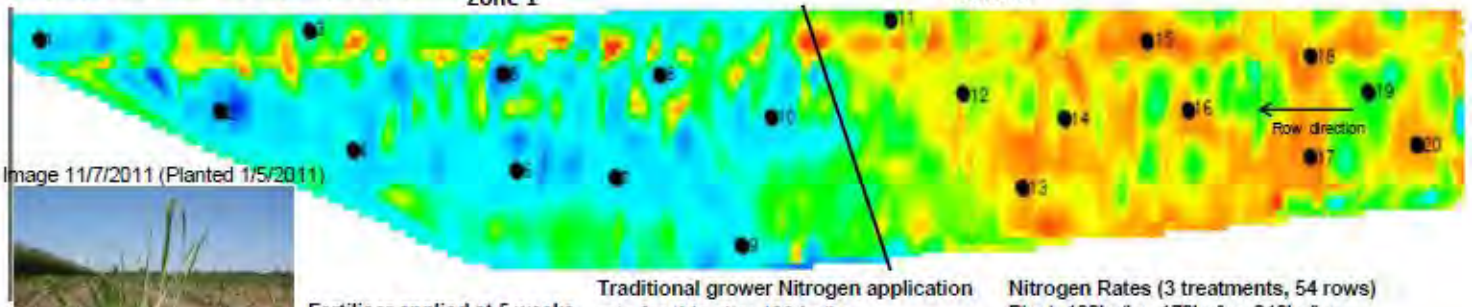


Image 11/7/2011 (Planted 1/5/2011)

Fertiliser applied at 5 weeks post planting:
N: 50 kg/ha
P: 0 kg/ha
K: 83 kg/ha
S: 58 kg/ha

Traditional grower Nitrogen application rate for this site: 190 kg/ha

Applied activated Silica (5 Tons) in February to this block.

Applied 33kg/ha of nitrogen (103 kg/ha of Ammonium Sulphate) in the 3rd week of August.

Nitrogen Rates (3 treatments, 54 rows)
Plant: 130kg/ha, 170kg/ha, 210kg/ha
Ratoon: 170kg/ha, 210kg/ha 250kg/ha

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Zone	N rate (kg/ha)	N rate (kg/ha)	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)	Mg (kg/ha)
	DYP = 150 tonnes/ha	DYP = 180 tonnes/ha							
1	150	180	0	100	15	0	0	0	0
2	150	180	20	100	25	0	0	0	0

DYP = District Yield Potential

Grower 2.

5/8/2011

Nitrogen rates to be applied at plant and ratoon stages		
N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	210	250
Grower/Regulated/6ES	170	210
Low	130	170
6ES - SIX EASY STEPS		

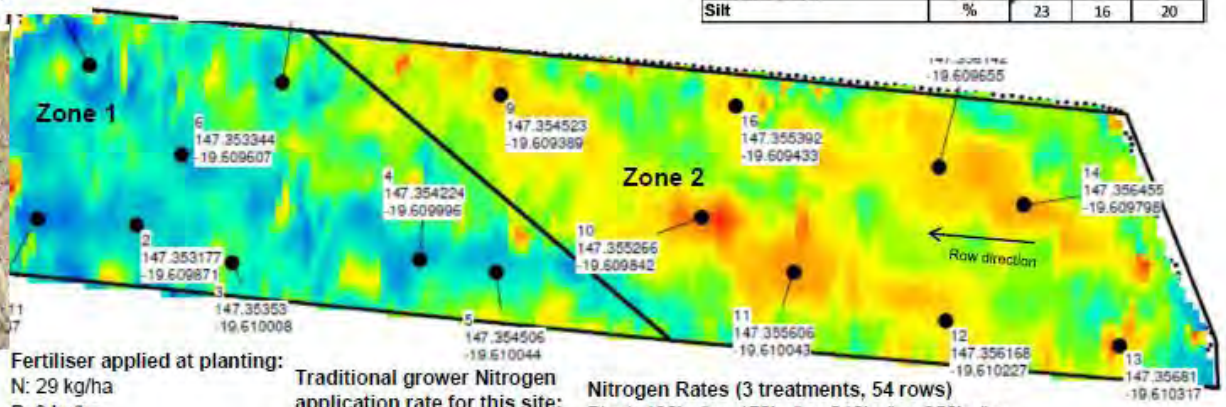
Grower 3.

Location: Delta
Latitude: 19°36'35.43"S
Longitude: 147°21'18.96"E
No. of rows: 74
Row width: 1.52 m
Trial block area: 5.16 ha
Variety: KQ228
QDPI soil type: BUfc
Soil group/order: Dermosol

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
pH (1:5 Water)		7.5	7.3	7.4
Organic Carbon	%	1.2	0.59	0.9
Nitrate Nitrogen	mg/kg	2.3	2.4	2.4
Phosphorus (BSES)	mg/kg	200	170	185
Phosphorus Buffer Index		47	36	42
Potassium (Amm-acet.)	meq/100g	0.23	0.17	0.2
Potassium (Nitric K)	meq/100g	4.9	3.8	4.4
Sulphate Sulphur	mg/kg	2.5	2.0	2.3

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
Electrical Conductivity	dS/m	0.04	0.03	0.03
Cation Exchange Capacity	meq/100g	16.7	10.3	13.5
Calcium (Amm-acet.)	meq/100g	11	6.5	8.8
Magnesium (Amm-acet.)	meq/100g	5.3	3.5	4.4
Sodium (Amm-acet.)	meq/100g	0.18	0.17	0.175
Calcium/Magnesium Ratio		2.1	1.9	2
Clay	%	23	14	18
Sand (Fine)	%	54	64	59
Sand (Coarse)	%	1	6	3
Silt	%	23	16	20

Planted: 6/5/2011



Fertiliser applied at planting:
N: 29 kg/ha
P: 8 kg/ha
K: 52 kg/ha
S: 27 kg/ha

Traditional grower Nitrogen application rate for this site:
170 kg/ha

Nitrogen Rates (3 treatments, 54 rows)
Plant: 130kg/ha, 170kg/ha, 210kg/ha, 250kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha, 290kg/ha

Zone	N rate (kg/ha)	N rate (kg/ha)	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)
	DYP = 150 tonnes/ha	DYP = 180 tonnes/ha						
1	130	160	0	80	20	0	0	0
2	140	170	0	100	25	0	0	0

DYP = District Yield Potential

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Grower 3.

2/08/2011

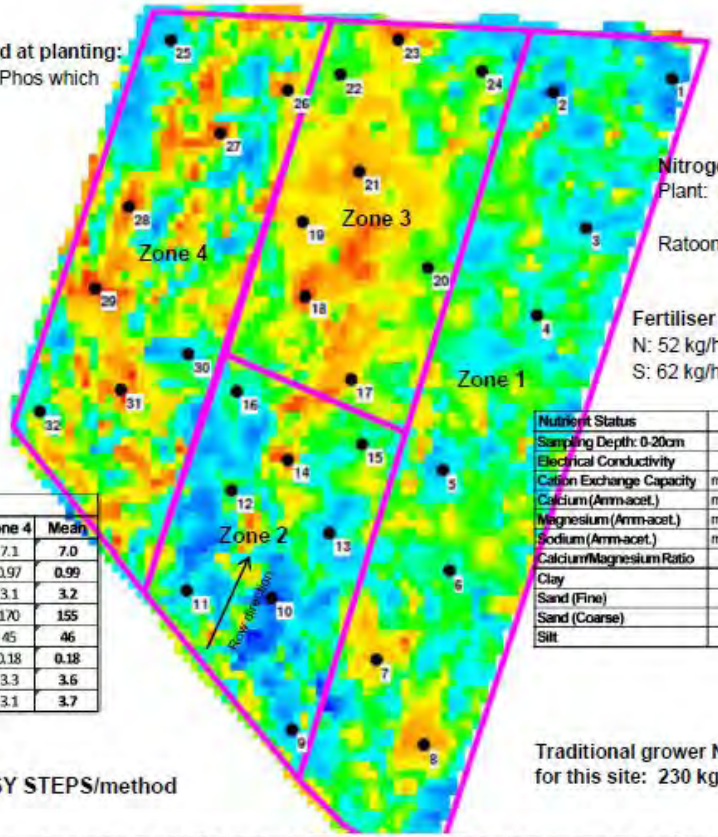
Nitrogen rates to be applied at plant and ratoon stages		
N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
Very high	250	290
High	210	250
Grower/Regulated/ 6ES	170	210
Low	130	170
6ES - SIX EASY STEPS		

Grower 4.

Location: Delta
Latitude: 19°35'27.67"S
Longitude: 147°21'55.68"E
No. of rows:
Zone 1: 66
Zone 4: 64
Row width: 1.52 m
Trial block area: 13 ha
Variety: Q200
QDPI Soil type: BUfc
Soil group/order: Dermosol

Fertiliser applied at planting:
100 L/ha of FlowPhos which contains:
N: 7.2%
P: 14%
K: 7.1%
Zn: 0.5%

Image 7/7/2011 (Planted on the 4 May 2011)



Nitrogen Rates (4 treatments, 72 rows)
Plant: 120kg/ha, 160kg/ha, 220kg/ha 280kg/ha
Ratoon: 160kg/ha, 200kg/ha, 260kg/ha 300kg/ha

Fertiliser applied on the 2/8/2011:
N: 52 kg/ha
S: 62 kg/ha

Nutrient Status	Unit	Value				
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Zone 4	Mean
pH (1:5 Water)		7.0	7.0	7.0	7.1	7.0
Organic Carbon	%	0.88	1.1	1.0	0.97	0.99
Nitrate Nitrogen	mg/kg	4.0	1.6	4.0	3.1	3.2
Phosphorus (BSES)	mg/kg	130	160	160	170	155
Phosphorus Buffer Index		45	42	50	45	46
Potassium (Amm-acet.)	meq/100g	0.15	0.2	0.18	0.18	0.18
Potassium (Nitric K)	meq/100g	3.6	3.8	3.6	3.3	3.6
Sulphate Sulphur	mg/kg	4.1	3.5	4.1	3.1	3.7

Nutrient Status	Unit	Value				
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Zone 4	Mean
Electrical Conductivity	dS/m	0.04	0.04	0.04	0.04	0.04
Cation Exchange Capacity	meq/100g	11.2	14.1	13.7	13.0	13
Calcium (Amm-acet.)	meq/100g	8.0	10.0	10.0	9.5	9.4
Magnesium (Amm-acet.)	meq/100g	2.8	3.7	3.3	3.2	3.3
Sodium (Amm-acet.)	meq/100g	0.21	0.21	0.2	0.17	0.2
Calcium/Magnesium Ratio		2.9	2.7	3.0	3.0	2.9
Clay	%	16	21	20	19	19
Sand (Fine)	%	59	55	52	53	55
Sand (Coarse)	%	6	3	8	9	6
Silt	%	19	21	20	20	20

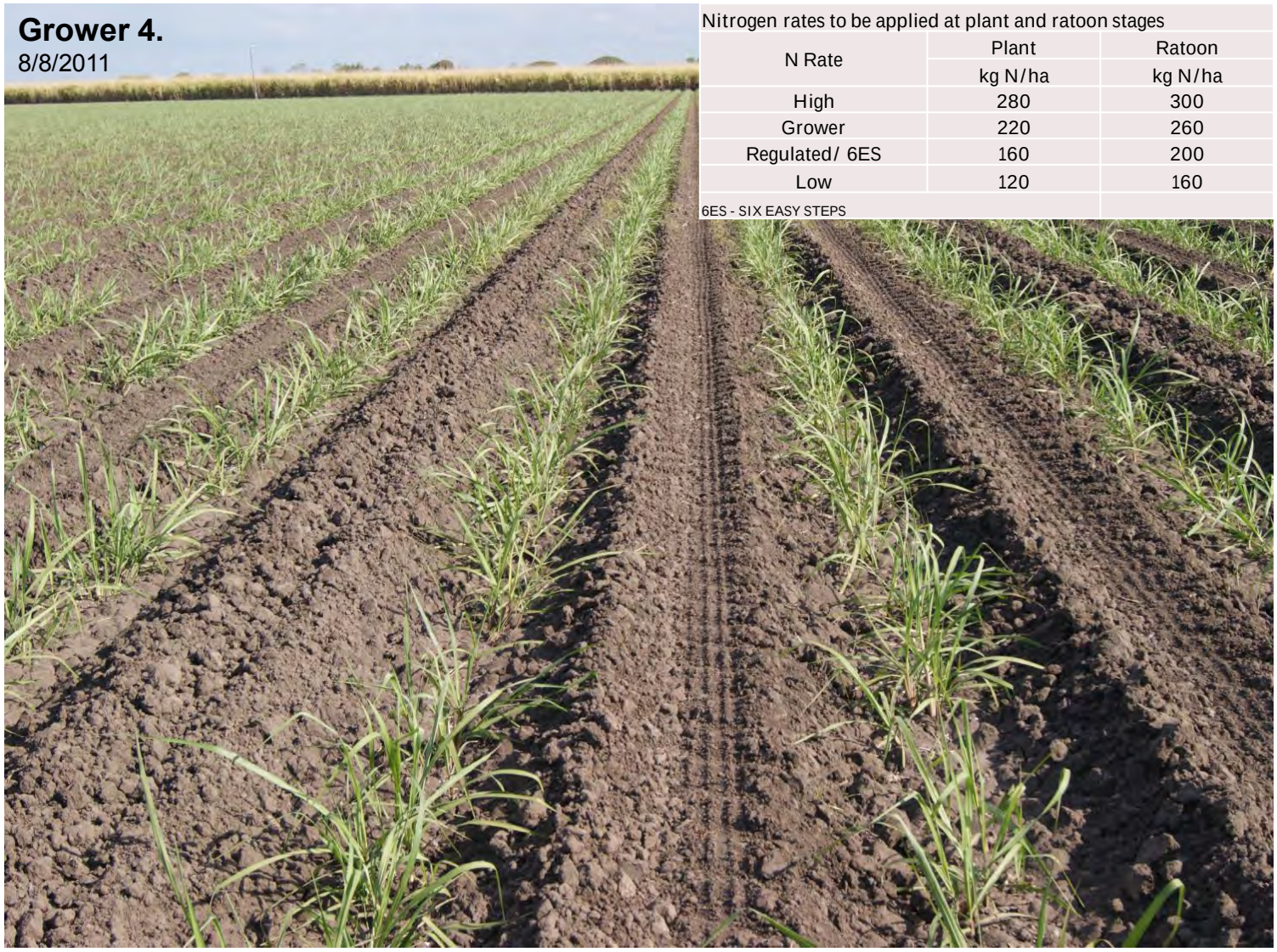
Traditional grower Nitrogen application rate for this site: 230 kg/ha

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane

Zone	N rate (kg/ha)	N rate (kg/ha)	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)
	DYP = 150 tonnes/ha	DYP = 180 tonnes/ha						
1	130	160	0	100	20	0	0	0
2	130	160	0	100	20	0	0	0
3	130	160	0	100	20	0	0	0
4	130	160	0	100	20	0	0	0

DYP = District Yield Potential

Grower 4.
8/8/2011



Nitrogen rates to be applied at plant and ratoon stages

N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	280	300
Grower	220	260
Regulated/ 6ES	160	200
Low	120	160

6ES - SIX EASY STEPS

Grower 5.

Location: BRIA
Latitude: 19°34'44.97"S
Longitude: 147°9'17.25"E
No. of rows: 93
Row width: 1.6 m
Trial block area: 9 ha
Variety: Q208
QDPI Soil type: 6Drc
Soil group/order: Sodic Duplex

Nutrient Status	Unit	Value				
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Zone 4	Mean
pH (1:5 Water)		7.2	7.1	7.1	7.2	**7.2**
Organic Carbon	%	0.43	0.41	0.48	0.55	**0.47**
Nitrate Nitrogen	mg/kg	<1.0	1.6	2.1	2.4	
Phosphorus (BSES)	mg/kg	87	65	73	110	**84**
Phosphorus Buffer Index		44	49	49	57	**50**
Potassium (Amm-acet.)	meq/100g	0.2	0.14	0.16	0.19	**0.17**
Potassium (Nitric K)	meq/100g	2.0	1.9	1.9	1.9	**1.9**
Sulphate Sulphur	mg/kg	1.3	1.2	1.4	1.5	**1.4**

Nutrient Status	Unit	Value				
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Zone 4	Mean
Electrical Conductivity	dS/m	0.03	0.04	0.03	0.04	0.04
Cation Exchange Capacity	meq/100g	9.0	11.2	8.51	12.2	10.2
Calcium (Amm-acet.)	meq/100g	6.0	7.5	5.5	8.0	6.8
Magnesium (Amm-acet.)	meq/100g	2.7	3.4	2.7	3.8	3.2
Sodium (Amm-acet.)	meq/100g	0.1	0.14	0.15	0.19	0.15
Calcium/Magnesium Ratio		2.2	2.2	2.0	2.1	2.1
Clay	%	20	25	21	28	23
Sand (Fine)	%	36	44	46	40	42
Sand (Coarse)	%	26	14	16	12	17
Silt	%	18	18	16	21	18

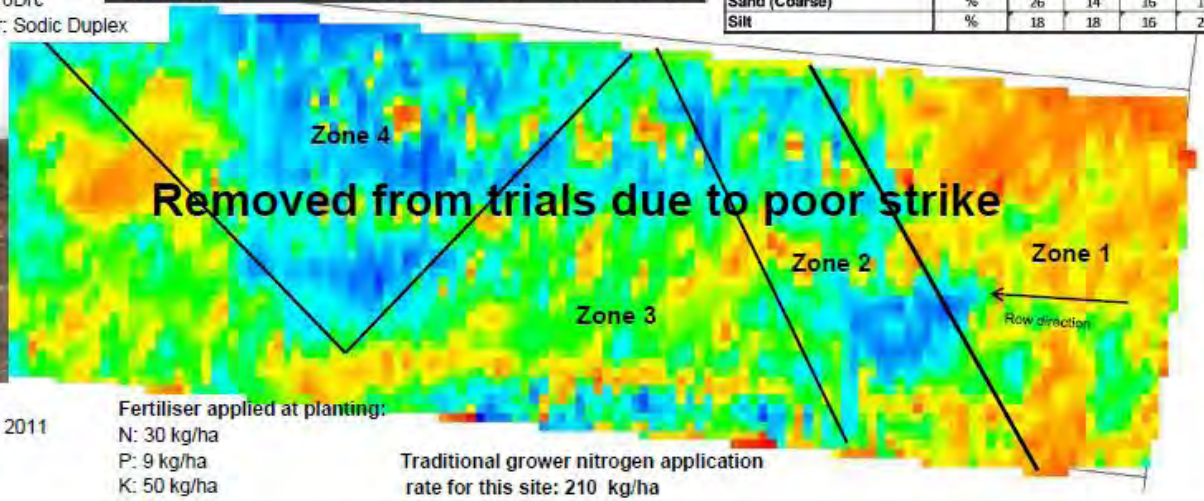


Image 6/7/2011
Planted: 12-16 May 2011

Fertiliser applied at planting:
N: 30 kg/ha
P: 9 kg/ha
K: 50 kg/ha
S: 26 kg/ha

Traditional grower nitrogen application rate for this site: 210 kg/ha

Zone	N rate (kg/ha) DYP = 150 tonnes/ha	N rate (kg/ha) DYP = 180 tonnes/ha	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)	Mg rate (kg/ha)
1	140	170	0	100	25	0	0	0	0
2	140	170	0	100	25	10	0	0	0
3	140	170	0	100	25	0	0	0	0
4	140	170	0	100	25	0	0	0	0
DYP = District Yield Potential									

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Grower 5.
1/8/2011

Grower 6.

Location: BRIA
Latitude: 19°46'49.83"S
Longitude: 147°11'29.39"E
No. of rows: 108
Row width: 1.52 m
Trial block area: 10 ha
Variety: Q183
QDPI Soil type: 2Dyb
Soil group/order: Sodic Duplex

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
pH (1:5 Water)		8.3	7.7	8
Organic Carbon	%	0.79	0.74	0.77
Nitrate Nitrogen	mg/kg	2.4	1.9	2.2
Phosphorus (BSES)	mg/kg	21	17	19
Phosphorus Buffer Index		110	160	135
Potassium (Amm-acet.)	meq/100g	0.2	0.34	0.27
Potassium (Nitric K)	meq/100g	1.3	2.0	1.7
Sulphate Sulphur	mg/kg	6.0	10.0	8

Nitrogen Rates (4 treatments, 72 rows)
Plant: 130kg/ha, 170kg/ha, 210kg/ha, 250kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha, 290kg/ha

Image 11/7/2011

Traditional grower Nitrogen application rate for this site: 200 kg/ha

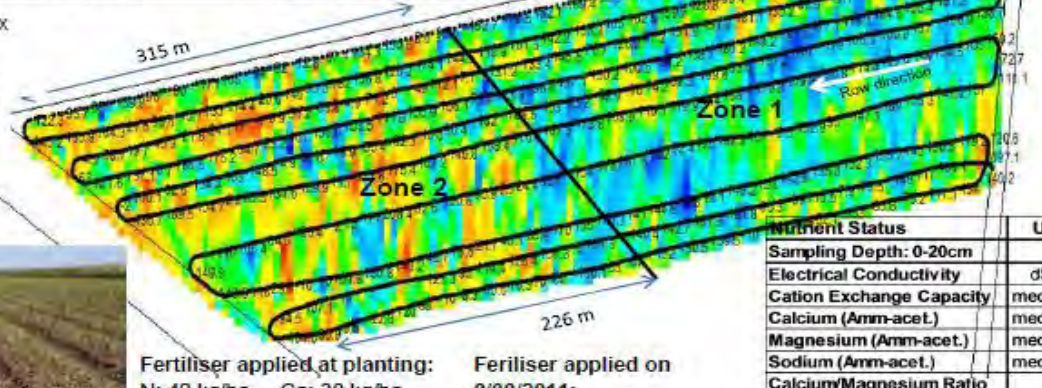


Image 11/7/2011
(Planted 16&17 May 2011)

Fertiliser applied at planting:
N: 40 kg/ha Ca: 38 kg/ha
P: 18 kg/ha
K: 0 kg/ha
S: 0 kg/ha

Feriliser applied on 8/08/2011:
K: 41 kg/ha
S: 18 kg/ha

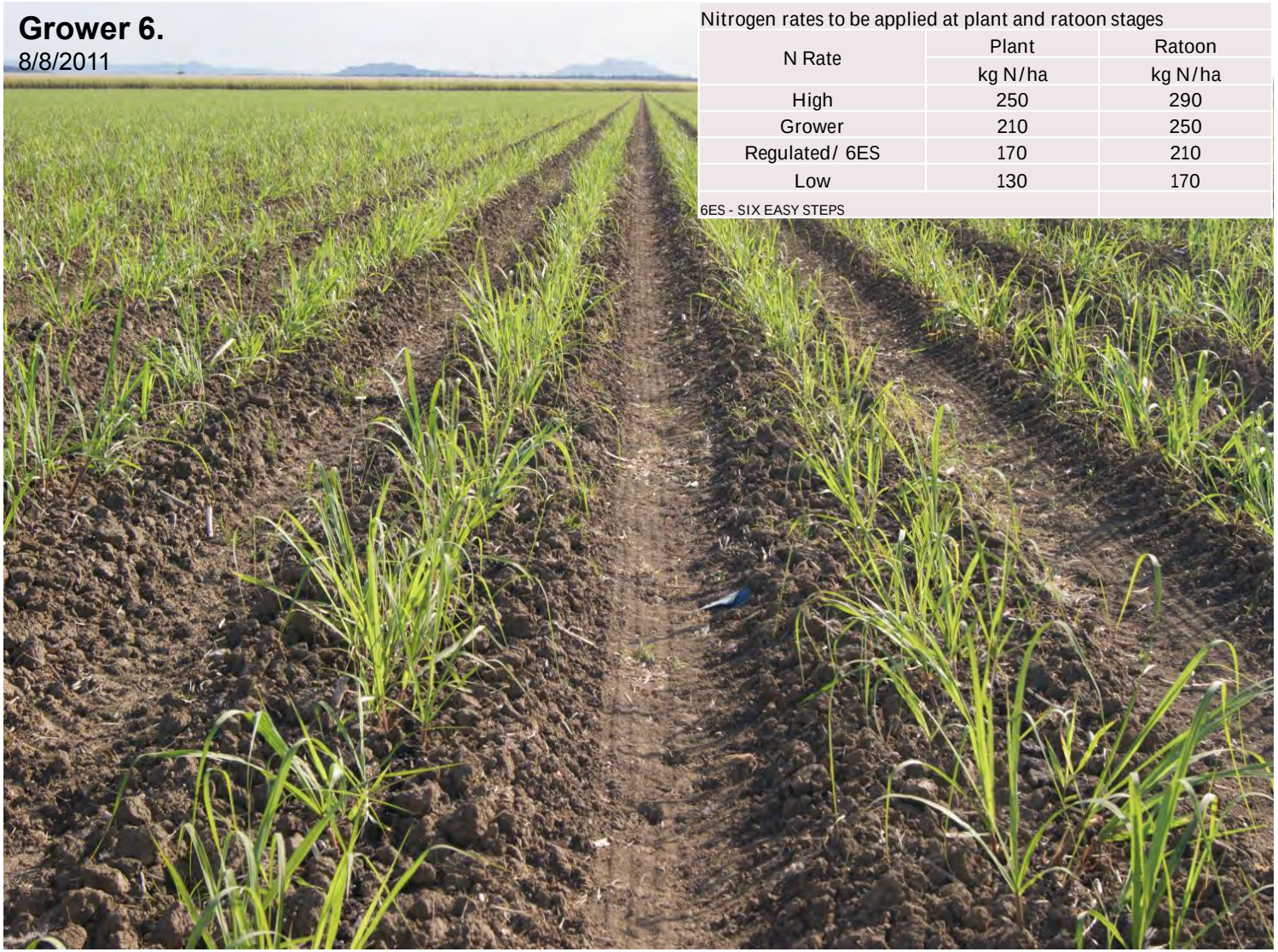
Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
Electrical Conductivity	dS/m	0.1	0.11	0.11
Cation Exchange Capacity	meq/100g	16.7	22.0	19.4
Calcium (Amm-acet.)	meq/100g	10.0	13.0	11.5
Magnesium (Amm-acet.)	meq/100g	5.4	7.7	6.6
Sodium (Amm-acet.)	meq/100g	1.1	0.91	1.0
Calcium/Magnesium Ratio		1.9	1.7	1.8
Clay	%	39	54	46
Sand (Fine)	%	32	21	27
Sand (Coarse)	%	5	2	3
Silt	%	24	24	24

Zone	N rate (kg/ha) DYP = 150 tonnes/ha	N rate (kg/ha) DYP = 180 tonnes/ha	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)	Mg rate (kg/ha)
1	140	170	20	100	15	10	0	0	0
2	140	170	30	50	15	10	0	0	0
DYP = District Yield Potential									

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Grower 6.

8/8/2011



Nitrogen rates to be applied at plant and ratoon stages

N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	250	290
Grower	210	250
Regulated/ 6ES	170	210
Low	130	170

6ES - SIX EASY STEPS

Grower 7.

Location: Delta
Latitude: 19°42'8.46"S
Longitude: 147°25'3.66"E
No. of rows: 80
Row width: 1.52 m
Trial block area: 11 ha
Variety: Q208
QDPI Soil type: CUfc
A.S.C: Brown Dermosol

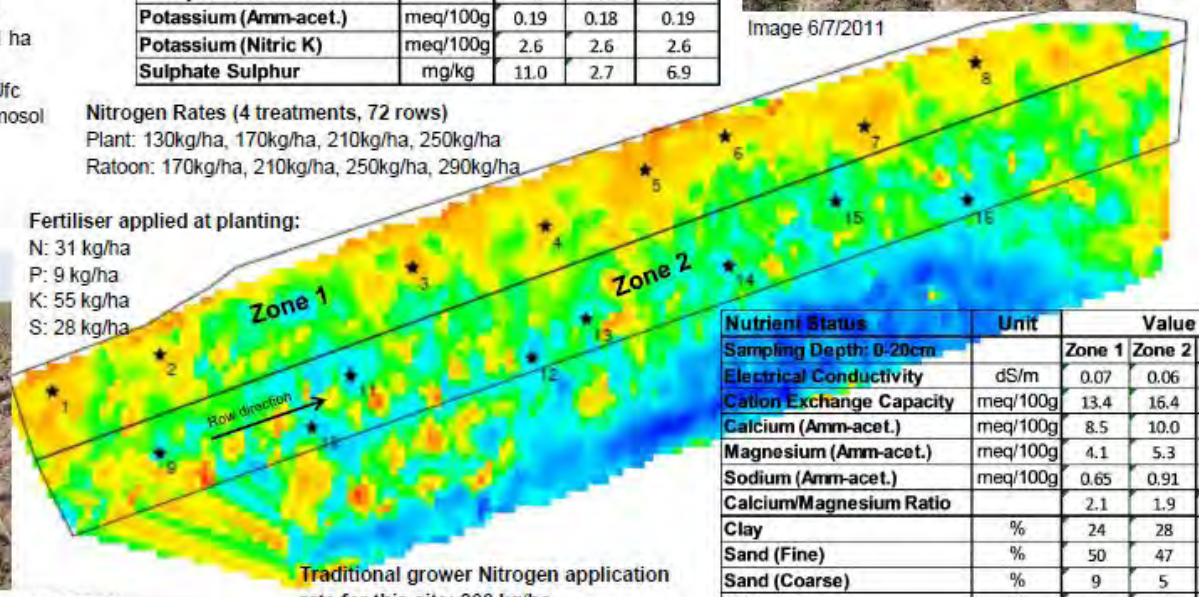
Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
pH (1:5 Water)		7.8	8.3	8.1
Organic Carbon	%	0.51	0.64	0.58
Nitrate Nitrogen	mg/kg	2.3	2.5	2.4
Phosphorus (BSES)	mg/kg	25	17	21
Phosphorus Buffer Index		60	100	80
Potassium (Amm-acet.)	meq/100g	0.19	0.18	0.19
Potassium (Nitric K)	meq/100g	2.6	2.6	2.6
Sulphate Sulphur	mg/kg	11.0	2.7	6.9

Image 6/7/2011

Nitrogen Rates (4 treatments, 72 rows)
Plant: 130kg/ha, 170kg/ha, 210kg/ha, 250kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha, 290kg/ha

Fertiliser applied at planting:
N: 31 kg/ha
P: 9 kg/ha
K: 55 kg/ha
S: 28 kg/ha

Image 6/7/2011 (Planted 19/5/2011)



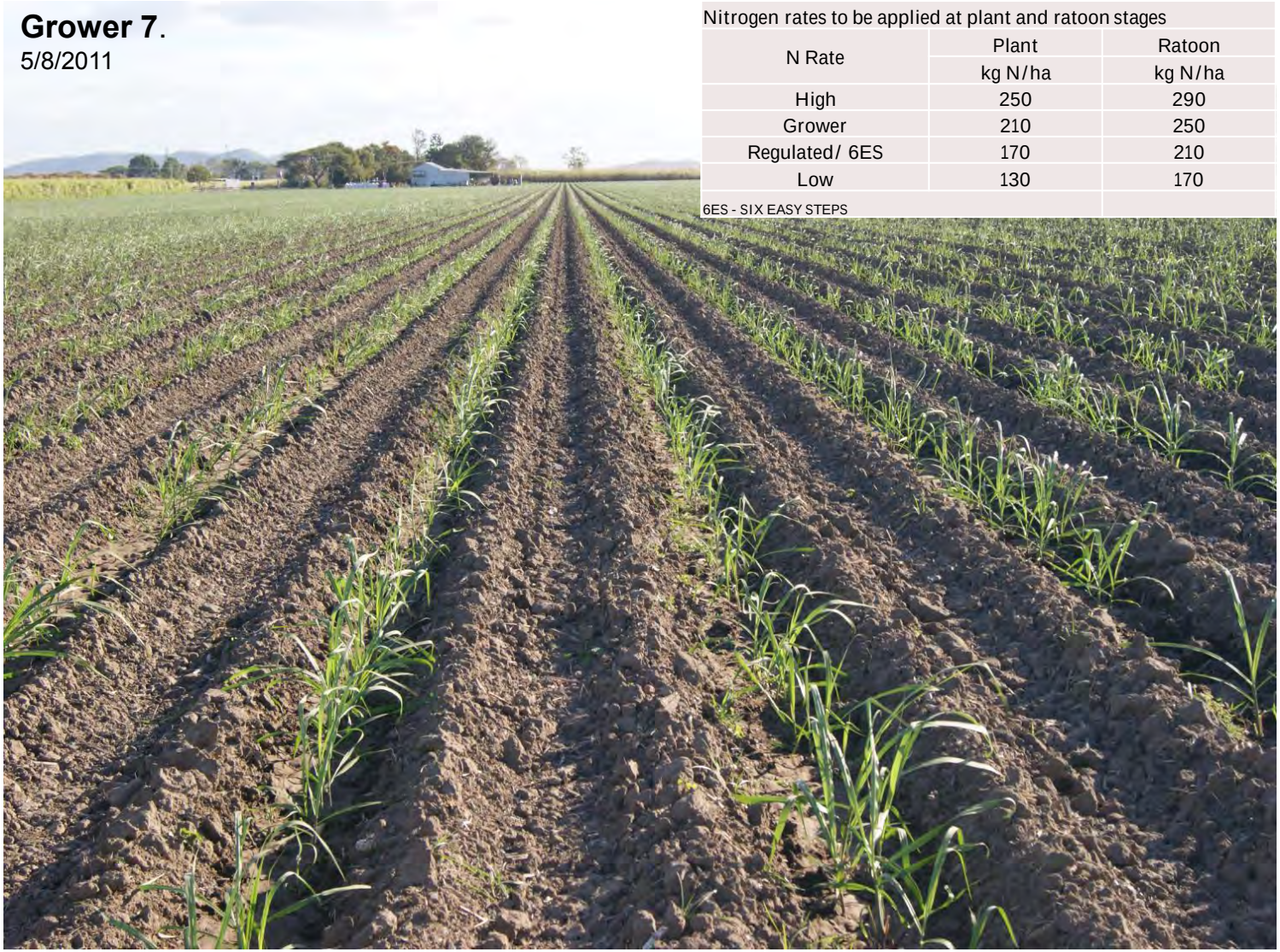
Traditional grower Nitrogen application rate for this site: 200 kg/ha

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
Electrical Conductivity	dS/m	0.07	0.06	0.07
Cation Exchange Capacity	meq/100g	13.4	16.4	14.9
Calcium (Amm-acet.)	meq/100g	8.5	10.0	9.3
Magnesium (Amm-acet.)	meq/100g	4.1	5.3	4.7
Sodium (Amm-acet.)	meq/100g	0.65	0.91	0.78
Calcium/Magnesium Ratio		2.1	1.9	2.0
Clay	%	24	28	26
Sand (Fine)	%	50	47	48
Sand (Coarse)	%	9	5	7
Silt	%	18	21	19

Zone	N rate (kg/ha) DYP = 150 tonnes/ha	N rate (kg/ha) DYP = 180 tonnes/ha	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)	Mg rate (kg/ha)
1	140	170	20	100	10	0	0	0	0
2	140	170	30	100	25	10	0	0	0
DYP = District Yield Potential									

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Grower 7.
5/8/2011



Nitrogen rates to be applied at plant and ratoon stages

N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	250	290
Grower	210	250
Regulated/ 6ES	170	210
Low	130	170

6ES - SIX EASY STEPS

Grower 8.

Location: BRIA
Latitude: 19°43'28.09"S
Longitude: 147°13'24.80"E
No. of rows: 84
Row width: 1.65 m
Trial block area: 11ha
Variety: Q208
QDPI soil type: 2Ugg
Soil group/order: Vertosol
(Group 1)

Nitrogen Rates (4 treatments, 72 rows)
Plant: 130kg/ha, 170kg/ha, 210kg/ha, 250kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha, 290kg/ha

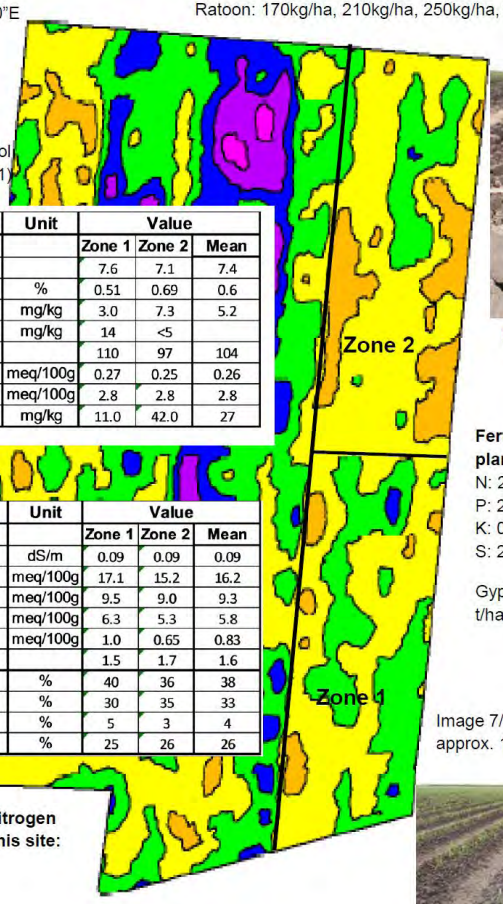


Image 7/7/2011

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
pH (1:5 Water)		7.6	7.1	7.4
Organic Carbon	%	0.51	0.69	0.6
Nitrate Nitrogen	mg/kg	3.0	7.3	5.2
Phosphorus (BSES)	mg/kg	14	<5	
Phosphorus Buffer Index		110	97	104
Potassium (Amm-acet.)	meq/100g	0.27	0.25	0.26
Potassium (Nitric K)	meq/100g	2.8	2.8	2.8
Sulphate Sulphur	mg/kg	11.0	42.0	27

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
Electrical Conductivity	dS/m	0.09	0.09	0.09
Cation Exchange Capacity	meq/100g	17.1	15.2	16.2
Calcium (Amm-acet.)	meq/100g	9.5	9.0	9.3
Magnesium (Amm-acet.)	meq/100g	6.3	5.3	5.8
Sodium (Amm-acet.)	meq/100g	1.0	0.65	0.83
Calcium/Magnesium Ratio		1.5	1.7	1.6
Clay	%	40	36	38
Sand (Fine)	%	30	35	33
Sand (Coarse)	%	5	3	4
Silt	%	25	26	26

Fertiliser applied at planting:
N: 25 kg/ha
P: 28 kg/ha
K: 0 kg/ha
S: 2 kg/ha

Gypsum applied at 2.5 t/ha pre plant

Traditional grower Nitrogen application rate for this site: 170 kg/ha

Image 7/7/2011 (Planted approx. 16/5/2011

Zone	N rate (kg/ha)	N rate (kg/ha)	P rate	K rate	S rate	Zn rate	Cu rate	Lime	Mg rate
	DYP = 150 tonnes/ha	DYP = 180 tonnes/ha	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(t/ha)	(kg/ha)
1	140	170	30	80	10	0	0	0	0
2	140	170	40	80	0	0	0	0	0
DYP = District Yield Potential									

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Grower 8

4/8/2011

Nitrogen rates to be applied at plant and ratoon stages		
N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	250	290
Grower	210	250
Regulated/ 6ES	170	210
Low	130	170
6ES - SIX EASY STEPS		

Grower 9.

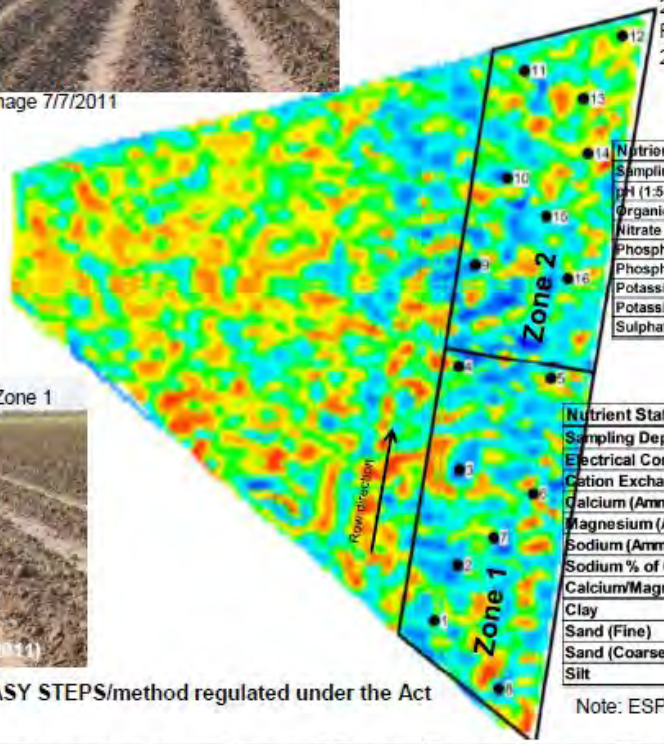
Location: BRIA
Latitude: 19°46'21.19"S
Longitude: 147°8'20.96"E
No. of rows: approx. 80
Row width: 1.65 m
Trial block area: 10 ha
Variety: KQ228
QDPI soil type: 2Ugd
Soil group/order: Vertosol (Group 1)

Fertiliser applied at planting:
N: 25 kg/ha
P: 28 kg/ha
K: 0 kg/ha
S: 2 kg/ha
Gypsum applied at 2.5 t/ha pre plant

Image 7/7/2011

Traditional grower Nitrogen application rate for this site: 170 kg/ha

Nitrogen Rates (4 treatments, 72 rows)
Plant: 130kg/ha, 170kg/ha, 210kg/ha, 250kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha, 290kg/ha



Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
pH (1:5 Water)		7.6	5.7	6.7
Organic Carbon	%	0.46	0.71	0.59
Nitrate Nitrogen	mg/kg	1.9	3.3	2.6
Phosphorus (BSES)	mg/kg	7	14	11
Phosphorus Buffer Index		120	120	120
Potassium (Amm-acet.)	meq/100g	0.23	0.2	0.22
Potassium (Nitric K)	meq/100g	1.3	1.2	1.3
Sulphate Sulphur	mg/kg	190	480	335

Nutrient Status	Unit	Value		
Sampling Depth: 0-20cm		Zone 1	Zone 2	Mean
Electrical Conductivity	dS/m	0.36	0.46	0.41
Cation Exchange Capacity	meq/100g	20.7	12.9	16.8
Calcium (Amm-acet.)	meq/100g	11.0	7.0	9
Magnesium (Amm-acet.)	meq/100g	7.1	4.5	5.8
Sodium (Amm-acet.)	meq/100g	2.4	1.1	1.8
Sodium % of Cations (ESP)	%		8.5	
Calcium/Magnesium Ratio		1.5	1.6	1.6
Clay	%	50	40	45
Sand (Fine)	%	24	30	27
Sand (Coarse)	%	5	6	6
Silt	%	21	24	23

Note: ESP >6% in Zone 2 for 0-20cm

Zone 1


Image 7/7/2011 (Planted approx. 23/5/2011)

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Zone	N rate (kg/ha) DYP = 150 tonnes/ha	N rate (kg/ha) DYP = 180 tonnes/ha	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)	Mg rate (kg/ha)
1	140	170	30	100	0	10	0	0	0
2	140	170	30	100	0	10	0	0	0
DYP = District Yield Potential									

Grower 9.
5/8/2011

Nitrogen rates to be applied at plant and ratoon stages

N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	250	290
Grower	210	250
Regulated/ 6ES	170	210
Low	130	170

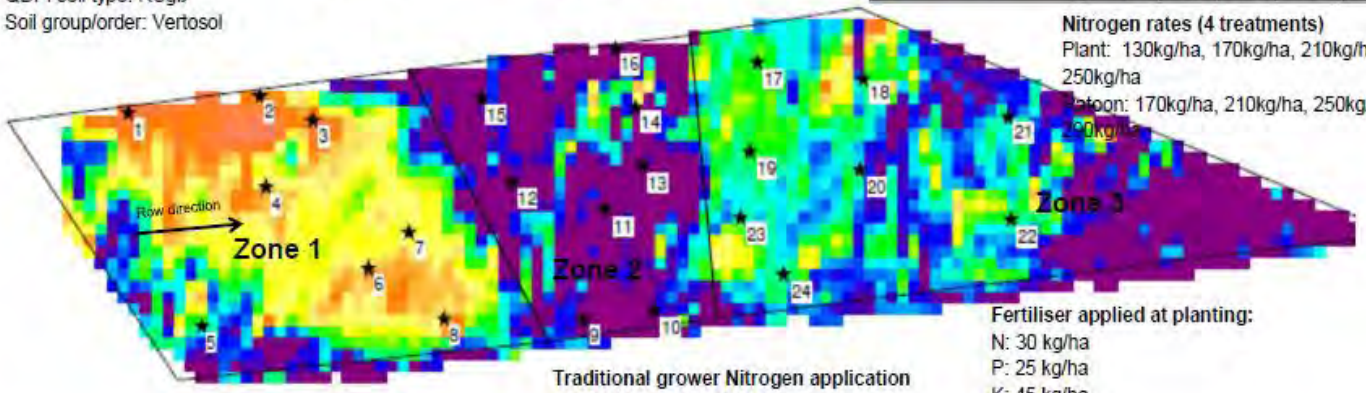
6ES - SIX EASY STEPS

Grower 10. (Late Plant)

Location: Delta
Latitude: 19°42'13.27"S
Longitude: 147°28'15.36"E
No. of rows: 76
Row width: 1.58m
Trial block area: 5.5 ha
Variety: Q208
Planting date: 3-4 August
QDPI soil type: RUgb
Soil group/order: Vertosol

Nutrient Status	Unit	Value			
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Mean
pH (1:5 Water)		7.6	7.9	7.9	7.8
Organic Carbon	%	0.76	1.0	0.76	0.84
Nitrate Nitrogen	mg/kg	2.6	4.4	3.8	3.6
Phosphorus (BSES)	mg/kg	17	33	60	37
Phosphorus Buffer Index		67	73	79	73
Potassium (Amm-acet.)	meq/100g	0.25	0.25	0.29	0.26
Potassium (Nitric K)	meq/100g	2.4	2.5	2.5	2.5
Sulphate Sulphur	mg/kg	3.7	5.1	3.9	4.2

Nutrient Status	Unit	Value			
Sampling Depth: 0-20cm		Zone 1	Zone 2	Zone 3	Mean
Electrical Conductivity	dS/m	0.06	0.11	0.11	0.09
Cation Exchange Capacity	meq/100g	12.7	16.8	16.8	15.4
Calcium (Amm-acet.)	meq/100g	7.5	9.5	10.0	9.0
Magnesium (Amm-acet.)	meq/100g	4.4	5.9	5.9	5.4
Sodium (Amm-acet.)	meq/100g	0.57	1.1	0.65	0.77
Calcium/Magnesium Ratio		1.7	1.6	1.7	1.7
Clay	%	23	30	29	27
Sand (Fine)	%	28	34	44	35
Sand (Coarse)	%	29	15	6	17
Silt	%	20	21	21	20



Nitrogen rates (4 treatments)
Plant: 130kg/ha, 170kg/ha, 210kg/ha, 250kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha, 290kg/ha

Traditional grower Nitrogen application rate for this site: 240 kg/ha

Fertiliser applied at planting:
N: 30 kg/ha
P: 25 kg/ha
K: 45 kg/ha
S: 11 kg/ha

Fertiliser rates for each zone are determined using SIX EASY STEPS/method regulated under the Act for plant cane.

Zone	N rate (kg/ha) DYP = 150 tonnes/ha	N rate (kg/ha) DYP = 180 tonnes/ha	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)	Mg rate (kg/ha)
1	140	170	30	80	25	10	0	0	0
2	130	160	20	80	10	10	0	0	0
3	140	170	0	50	25	10	0	0	0

DYP = District Yield Potential

Nitrogen rates to be applied at plant and ratoon stages

N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	250	290
Grower	210	250
Regulated/ 6ES	170	210
Low	130	170

6ES - SIX EASY STEPS

Grower 11

Location: BRIA
Latitude: 19°41'20.90"S
Longitude: 147°13'19.21"E
No. of rows: 144
Row width: 1.5 m (Controlled traffic)
Trial Block Area: 21 hectares
Variety: KQ228
QDPI soil type: 6Drc
Soil group/order: Sodic Duplex

Fertiliser applied at planting:
N: 38 kg/ha
P: 43 kg/ha
K: 36 kg/ha
S: 19 kg/ha

Fertiliser applied on the 13th July:
N: 33 kg/ha
S: 64 kg/ha

Traditional grower Nitrogen application rate for this site: 180kg/ha

Nutrient Status	Unit	Value
Sampling Depth: 0-20cm		
pH (1:5 Water)		7.3
Organic Carbon	%	0.9
Nitrate Nitrogen	mg/kg	11
Phosphorus (BSES)	mg/kg	73
Phosphorus Buffer Index		103.7
Potassium (Amm-acet.)	meq/100g	0.47
Potassium (Nitric K)	meq/100g	2.49
Sulphate Sulphur	mg/kg	5.1

Nutrient Status	Unit	Value
Sampling Depth: 0-20cm		
Electrical Conductivity (1:5 H2O)	dS/m	0.08
ECEC	meq/100g	20.9
Calcium (Amm-acet.)	meq/100g	12.1
Magnesium (Amm-acet.)	meq/100g	7.4
Sodium (Amm-acet.)	meq/100g	0.9
Sodium % of Cations (ESP)	%	4.3
Soil Texture	Light Medium Clay	

Nitrogen Rate (3 treatments x 16 rows/treament =144 rows
Plant: 130kg/ha, 170kg/ha, 210kg/ha
Ratoon: 170kg/ha, 210kg/ha, 250kg/ha

Fertiliser rates determined using SIX EASY STEPS/method regulated under the Act for plant cane.

N rate (kg/ha) DYP = 150 tonnes/ha	N rate (kg/ha) DYP = 180 tonnes/ha	P rate (kg/ha)	K rate (kg/ha)	S rate (kg/ha)	Zn rate (kg/ha)	Cu rate (kg/ha)	Lime (t/ha)	Mg rate (kg/ha)
130	160	0	0	20	0	0	0	0
DYP = District Yield Potential								

Grower 11.
1/8/2011

Nitrogen rates to be applied at plant and ratoon stages		
N Rate	Plant	Ratoon
	kg N/ha	kg N/ha
High	210	250
Grower/Regulated/ 6ES	170	210
Low	130	170
6ES - SIX EASY STEPS		

Thank You

BSES Limited

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