



Sugar Research  
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Research Funding Unit

## SRA Final Report

**TITLE: Sodic Soils and Rising Groundwater Management in the Burdekin**

**Project Number: BPS002**

**Burdekin Productivity Services**

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A statement of confidentiality N/A

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## **Executive Summary:**

Sodic soils are a production limiting issue for large areas of the Burdekin region. Saline soils, saline groundwater and rising groundwater tables also have a high possibility to further limit yield potential. Rising groundwater levels are a very serious threat and there is some urgency in being able to efficiently deal with the issue. Many growers and advisors in the region are not well educated about the interaction between all of these factors, as well as the most appropriate management strategies.

This project developed structured workshops to build awareness and understanding by growers and advisors in the underlying science of sodic and saline soils and groundwater interaction. It presented and discussed management options for a range of scenarios. The workshop help to identify the best amelioration strategies (gypsum, lime, mill mud) for growers and with gypsum prices increasing significantly (from \$100 to \$180/T spread over the last few years) the most cost effective solution needs to be adopted to promote more sustainable farming systems.

The project assisted the private consultant Roger Shaw to travel to the Burdekin region and share his knowledge on the issues described. These workshops were facilitated by Rob Milla (Burdekin Productivity Services) and attended by 22 technical advisors and 39 growers. The workshops were an excellent opportunity for growers and advisors to increase their knowledge and be able to discuss practical management options with a very experienced consultant.

Collective agreement with advisors and growers was that an industry wide (and industry led) approach is required to address the very serious and potentially production limiting issue of rising groundwater and conjunctive use of this high conductivity water with low conductivity channel water.

### **Background:**

Research from Nelson and Ham (2000) demonstrated yield decreases by 2.1T/Ha for every 1% increase in ESP (exchangeable sodium percentage). Between 10-50% yield reductions are estimated from Burdekin soils with ESPs of > 6%. These soils have been mapped and show that 43% of the Burdekin Haughton Water Supply Scheme (BHWSS) have an ESP > 6% (Day K, Lio J and Christianos N (1995)). The effect of saline soils can further reduce yield potential and saline groundwater needs to be very carefully managed in order to not further limit yield or degrade the soil resource. Groundwater levels are rising very quickly (at a rate of up to 0.5 to 1.2m/year) and need to be managed to ensure the long term viability of cropping lands in the region.

Many growers are looking for advice on the best amelioration strategy (gypsum, lime, mill mud) and with gypsum prices increasing significantly (from \$100 to \$180/T spread over the last few years) the most cost effective solution needs to be adopted. Conjunctive use of saline groundwater (particularly in areas of high water tables) with channel water is another issue that needs to be managed in order to move to a more sustainable farming system.

In terms of addressing these issues, local industry representatives have identified rising groundwater, salinity and irrigation management with regional, state and federal government programs (eg: Reef Rescue 2, local NRM programs) as high priority issues.



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### Objectives:

The main project objective was *to educate growers and advisors in the underlying science of sodic/saline soils and groundwater interaction and discuss management options in a range of scenarios.*

Grower and advisor feedback suggests that this objective was met with many stating their level of understanding of these issues was increased.

Key learning's and areas of improved advisor and grower knowledge and understanding :

Soil structural/stability issues (eg: dispersion, compaction, flocculation, shrinkage/swelling) and the how these are affected by various irrigation water qualities.

The effect soil sodicity has on soil water penetration and extraction and crop production.

Salt concentration in soil and how this affects soil responses to irrigation.

Key soil physical properties for irrigation including plant available water capacity, infiltration rate and deep drainage and how these affect decisions around irrigation management.

Groundwater recharge and shallow water tables and their effect on limiting crop production.

Some areas of the Burdekin are in very high danger in the near term of having significant crop limitations due to very high groundwater levels (less than 2m from the surface) and subsequent salt impacts.

Leaching fraction that can contribute to groundwater rise, and the need for improved irrigation performance to minimise groundwater rise.

Use of gypsum, lime, mill mud for amelioration as well as use of dissolvenators.

### Methodology:

Roger Shaw is a private consultant with experience in assessment of soils for irrigation in Queensland for over 40 years and more recently on groundwater issues in the Burdekin irrigation area. Roger provided further training and education for advisors in the Burdekin region, as well as growers in a workshop format to help manage some of the yield limiting issues specific to their farming operation.

The project Itinerary is detailed below, with information regarding the workshops following.

**3/7/13**

Flight Bris – Townsville (Roger Shaw)

10am-4pm Technical advisor education workshop (involving representatives from BPS,BSES,

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Farmacist, local Agribusiness, gypsum retailers, NQ Dry Tropics, DAFF, Incitec, Sucrogen, Ravensdown)

6pm-9pm MAFIA group meeting to discuss groundwater rise in the Mulgrave area and dewatering strategies

#### **4/7/13**

9am-1pm Grower education workshop (Clare Club) – aim to invite around 100 growers from areas affected by sodic/saline soils and rising groundwater tables

Flight Tsv-Bris (Roger Shaw)

The workshops covered the following topics in detail:

- Background to soil structure and physics
- Soil/water interactions
- Water infiltration
- Groundwater tables
- Sodic soils
- Saline soils
- Irrigation effects on soil sodicity and salinity
- Groundwater use for irrigation
- Practical discussion and management options for real life examples.

The advisor workshop covered sodic soils, saline soils, groundwater rise and conjunctive use of saline and channel water in significant detail. This allowed local extension advisors to have a more thorough understanding of the science behind these issues as well as discuss some management strategies for growers. The grower workshop covered similar topics, but in less detail and with more focus on management implications and discussion and planning to manage production limiting soils, irrigation and groundwater issues. The project also had an added (and unplanned) benefit of participating in an additional meeting with the MAFIA (Mulgrave Area Farm Integrated Action) group and discussing rising groundwater and its management in detail for the Mulgrave region in the Burdekin.

A basic survey (asking most and least useful information presented as well as overall ranking for usefulness of the workshop) was conducted at the completion of the grower and advisor workshops, with details of the results in the expected outcomes section of this report. Overall, many advisors and growers stated that their knowledge level had increased, as well as awareness of production limiting issues (particularly rising groundwater levels), and appreciated the need to have collective industry action to prevent future potential production losses.

#### **Outputs and Outcomes:**

The workshops provided an important learning experience and capacity building opportunity for growers and advisors which will have flow on financial and environmental benefits for farming enterprises in the Burdekin region, specifically;

#### *Economic:*

Reduction in the yield limitations of sodic/saline soils and areas with rising groundwater tables.



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*Environmental Benefits:*

Improved crop growth and therefore uptake of nutrients and better utilisation of the soil and water resource which should lead to less losses from the farm.

*Social Benefits:*

Excellent networking opportunity for local agronomic advisors to communicate with researchers, as well as for growers to discuss real on farm problems with researchers.”

At both the advisor, grower and MAFIA workshops, there were significant discussion around conjunctive use of saline groundwater (particularly in regions with high groundwater levels) to improve irrigation infiltration into sodic soils. Most growers and advisors considered this to be the key learning and point for further investigation. Using saline water mixed with channel water (very low electrical conductivity) has the potential to significantly impact on 2 major production and profitability limiting issues:

- Halt and reverse groundwater rise in some areas of the Burdekin that have risen at alarming rates (up to 1m rise per year) that have potential to seriously limit production.
- Improve irrigation water quality applied to sodic and surface sealing soils leading to improved crop production – this would also mean some growers could decrease their reliance on gypsum as the only form of amelioration, hence saving input costs

One of the challenges with conjunctive use is to ensure that the groundwater is of appropriate quality when mixed (considering electrical conductivity and residual alkali) and understanding mixing ratios, as well as the fact that many of the areas with groundwater rise are difficult to pump (bore yields can be quite low, even down to 3-5 L/s). It may not be economic for an individual grower to justify installing a dewatering bore, yet the impact that numerous bores installed strategically across the region would be significant on reducing groundwater rise.

The main outcome and plan to move forward from the workshops was to engage with grower collectives, local ground and surface water managers and industry partners to discuss and consider the best way to install dewatering bores and use this water conjunctively. This will require government assistance and approval. Local extension staff have flagged the issue with the Australian Government’s Reef Rescue 2 program to consider allowing funding of this type of activity as it directly impacts on crop production and water quality.

**Intellectual Property and Confidentiality:**

N/A – although the workshop notes are the property of Roger Shaw.

**Environmental and Social Impacts:**

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The main economic benefit is the reduction in potential yield limiting issues through improved understanding and management of sodic and saline soils as well as improved irrigation principles and water quality. This then has a flow on environmental benefit due to the fact that increased production will lead to greater uptake of nutrients of concern (N and P) and less losses of these from paddocks. There was a very large social benefit from this capacity building project with increased networking opportunities with the advisors and growers, and particularly the ability for local growers to have face to face discussions with a high profile consultant to improve crop production.

### **Expected Outcomes:**

The meetings have been described in the summary above, and attendance numbers and feedback summaries are below.

- Technical Advisor Workshop –22 attendees, average usefulness of workshop was 7.8/10
- MAFIA meeting – 14 attendees, less formal discussion, although verbal feedback indicated that growers very much appreciated the opportunity to engage with an expert that understood practical issues.
- Grower Meeting – 25 attendees, average usefulness of workshop was 8.5/10.

Some growers who attended the workshop have already approached Burdekin Productivity Services requesting assistance and support for information regarding most appropriate rates of gypsum for amelioration of sodic soils, irrigation scheduling advice and best mixing ratios for high and low conductivity irrigation water sources. Burdekin Productivity Services have also noticed an increase in requests for soil testing since the workshop. This may be due to increase of staff numbers at Burdekin Productivity Services in combination with increased awareness of growers as a result of the workshop. Ongoing one on one extension support is required to assist local growers in this often complex area of management.

### **Future Research Needs:**

Members from NQ Dry Tropics (regional NRM body) attended the advisors workshop and other local industry representatives are communicating with NQ Dry Tropics staff to ensure that management these issues highlighted for future projects in the region (eg: Reef Rescue 2).

### **Recommendations:**

BPS in partnership with Farmacist (local consultant group) and NQ Dry Tropics (regional NRM organisation) are conducting grower productivity shed meetings. There are approximately 20 grower groups across the Burdekin that will meet up to 3 times annually to discuss productivity issues. As at the time of reporting, issues learned from the workshops are being discussed at the end of season meetings, particularly in relation to the following issues:

- Irrigation management and efficiencies to maximise production and minimise groundwater rise.
- Application of gypsum or other ameliorants to manage sodic soils.
- Discussions around the concept of installing dewatering bores and conjunctive use of saline groundwater.



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Future shed meetings will allow further opportunity to present more information from the workshops that were part of the capacity building project to local growers and industry stakeholders. Much of the information learned at the workshop is being passed on to local growers through one on one extension from various advisors (BPS, Farmacist, QDAFF, Agribusiness, BBIFMAC).

### List of Publications:

Powerpoint presentations and pdf documents of the information presented at the workshops are available from Rob Milla (BPS). Growers and advisors that attended the workshops all have copies of the presentations, and some growers who were unable to attend have received copies (a copy is attached to this report). Information learned from the workshops will be distributed to growers through one on one extension, group and shed meetings (more detail in next section).

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