Final Report – Rootzone Salinity Workshop, May 31

A total of 17 selected local participants (attachment 1) came together to discuss the latest work being conducted in the field of root zone salinity. The agenda included local speakers who reported on the progress of the Padthaway Salt Accession study which was then followed by an overview of rootzone salinity activities being conducted in the Lower Murray region. An overview of the CRC for Irrigation Futures was also provided and their proposed activities in the South East of SA over the next few years.

Following morning tea the focus shifted to more individual research targets including work within the Clare Valley, Angas/Bremer and Wrattonbully grape growing regions. Grape physiology topics included the issues of sodium and chloride and their effect on grapevine health followed by the effects of rootstock selection on tolerance to salinity. A copy of the entire agenda is provided in attachment 2. All participants were provided with a hard copy of each of the presentations with a provision to take notes. (a copy included with this report).

The day was completed with a workshop gap analysis enabling all participants to have input into the future direction of research into root zone salinity. Notes were taken and collated and are provided in this report (attachment 3). It was decided in concluding the day that a committee be formed to follow the development of a research brief which would consist of the Limestone Wine Industry Council Technical Sub Committee and the Padthaway Salt Accession Study Committee.

At the conclusion of the workshop the convenors (Nikki Harrington, Daniella Conesa and Kerry DeGaris) got together to formulate a brief overview and summary of the main topics of research requiring further investigation agreed in the afternoon. They are as follows:

1. Economic Study into wine industry of the Limestone Coast
2. Salinity risk zone mapping of the major regions within the Limestone Coast
3. Soil dynamics focusing on leaching efficiency
4. Rootstock/vine quality

This list was tabled at the Padthaway Salt Accession committee meeting held on June 13 where it was agreed that the Limestone Coast Wine Industry Council Technical Sub committee (LSCWIC – TSC) should rank these priorities along with suggested research topics that were contributed by the participating speakers from May 31.

This priority list was formulated on July 4 and is presented below:

1. Monitoring of leaching for various soil types across the Limestone Coast (Wrattonbully, Padthaway and Coonawarra in particular – using an approach similar to that used by Amy Richards in Langhorne Creek (monitoring salt accumulation in the rootzone), Tapas Biswas SARDI
2. Economic study – considering aspects such as the cost to industry of high salt wine through blending etc., the cost replanting salt-affected areas on rootstocks, tool to ascertain funding, getting growers on board
3. Rootstock performance analysis – salt/phylloxera resistance/eutypa

4. Salinity risk zone assessment – map overlay project (Tony Thompson)

This priority listing is to be tabled at the first combined meeting of the LSCWIC – TSC and the Padthaway Salt Accession Committee (planned for August 15, 2006). It is envisaged that members of these committee will be allocated a particular priority to investigate the done initiation of a project. This will include establishing existing research, funding, appropriate investigating pesonnel etc. Once the preliminary investigations are complete, project applications will be sought from various funding bodies in conjunction with various researchers.

A concern that has been repeatedly expressed is the lack of a person to champion this project. As this committee is made up of volunteers it is a concern that after the initial 'excitement' phase that people will become distracted by their day jobs and that nothing will be completed within a suitable time frame. Talks with John Bourne from the CRC-IF has suggested that they may be able to provide a PhD student to undertaken some of the work that is on the priority list but this would not be ideal in relation to managing the entire project.

In relation to the workshop held on May 31, feedback has been extremely positive. It has provided all participants with the opportunity to meet with researchers who are currently actively working in grapevine salinity. It has created an enormous amount of interest from a researcher point of view, especially alerting them to the continuing problems of salinity within the Limestone Coast.

Participants Salinity Rootzone Workshop, May 31 2006	
Name	**Affiliation**
Kerry DeGaris	Limestone Coast Wine Industry Council - Technical Sub-committee
Graham Kaye	Padthaway Grape Growers
Ian Ward	Limestone Coast Wine Industry Council
Suzanne McLoughlin	Limestone Coast Wine Industry Council - Technical Sub-committee
David Edwards	Fosters Wine Estates
Jessica Williams	Fosters Wine Estates
Martin Wirper	Limestone Coast Wine Industry Council - Technical Sub-committee
David Hackett	Orlando Wines
Peter Bird	Wrattonbully Grape Growers
Sarah Warner	GWRDC
Caroyln Brown	Padthaway Grape Growers
Daniella Conesa	SENRM
Shannon Pudney	DWLBC
Alex Sas	Hardy Wine Company
Dan Newson	Limestone Coast Wine Industry Council - Technical Sub-committee
Allen Jenkins	Fosters Wine Estates
Brendon Provis	Fosters Wine Estates

Root Zone Salinity Workshop
May 31, 2006
Stonehaven Cellar Door, Padthaway
See overheads of presentations provided at the workshop[1]

Morning Information Sharing Session

Ian Ward
Introduction

- Salinity became an issue in the 70's. Observation bores were installed then by Fred Stadter (formerly DWLBC)
- WHO has NaCl limits on export grapes.
- Raised a $160,000 levy in Padthaway a few years ago to study options such as:
  - diluting groundwater with Morambro Creek (200 ppm) water by injection along the road. M. Creek is ephemeral. M Creek WAP signed off last year. Very little water allocated and not enough available for this option.
  - Desalinisation plant with fresh water injected along the road
  - Importing Murray River water through Tailem Bend pipeline – too expensive
  - Diverting water from drain.
- Recent work has put further investigation of desalinisation plant option on hold. SAP shows that major source of salt is from the Naracoorte Ranges.
- Also have a significant salt concentration in the soil – the reason for being here today.
- We need to establish what we do know and see where to from here.

Jason van den Akker
Padthaway Salt Accession Project: Salt and Water Balance Results

Q: Soil salinity values under pivot?
A: Not much more than vineyards

Q: Salt bulge: when were soil cores taken?
A: In September. Represent a single point in time.

Q: Does the flux under pivot make sense?
A: Yes, there is a steady increase in soil salinity under pivot currently being observed.
Comment: Eventually this will flush, giving a greater salinity impact than stated here. This has been recognised.

Q: 1 tonne/hectare/year for pivot and up to 6 tonne/hectare/year under flood. If at steady state, salt added must = salt going out at bottom. Does this happen?
A: Under pivot, no drainage occurs during irrigation, only at the end of winter. You're applying more salt under pivot, but no leaching.
Only 2-3 years data so far, need to keep monitoring to see if a wet year will flush salt.

[1] Presenters using dark backgrounds in their presentations please consider how they will look in photocopied handouts/notes. Lighter backgrounds are easier on the eye in a photocopy.

Q: vine row vs inter-row: Inter-row seems to have more chloride than vine row. In other regions, low(??) salt levels have been seen in inter-row.
A: calcrete layer, if not ripped, can make vine roots spread to inter-row.

Gerrit Schrale
Overview of the existing tri-state and CNRM projects on managing salt, water and nutrient under precision irrigation

Tapas Biswas
Tools, techniques and observations of managing rootzone salt in Lower Murray horticulture.

- Full stop collects micropore and macropore flow.
- Suction lysimeters collect micropore flow only.
- Full stop gives you bypass flow.

John Bourne
Summary of input from CRC-Irrigation futures into the SE over the next few years.

Kerry has some notes from pre-morning tea presentations.

Tony Thomson
Development of Soil Salinity Risk maps and Irrigation Salinity Management Plans in the Clare Valley and the Use of the FullStop in Managing Irrigation at Angas Bremer

Q: What about disturbance of soil when installing FullStop?
A: Yes, there is some, but all devices have some. Bonus of FS is that it's cheap and easy to use. All devices have their use and limitations.

Q: How was salt measured?
A: Self-testing kits for growers' use. Not completely accurate, but can be calibrated. Wide spread of people testing on their own properties – the growers – community involvement and discussion.

Response of growers in managing their irrigation after getting data through from FS – change in the second year of data collection about 20% have changed their practices in response to the first year's data.

Amy Richards
Soil Salinity Distributions in the Langhorne Creek region using saline water from Lake Alexandrina

Q: What quantity of water was applied?
A: 900mm of water

Q: Did you extend past 1.2 m depth?
A: First 2 years only went to 90cm, increased in 1.2 m later. Agreed may be more salt accumulated at a greater depth.
Interesting to see that and talk about management strategies to put in place

Challenge to get highest leaching efficiency with least amount of water applied. Looking at root zone after winter rains and seeing if more leaching is required.

Depth of water in a 12-hour irrigation – about 1 meter

Rob Stevens
Sodium and Chloride – Issues for Grapevines
Had some other thoughts about distribution of salts horizontally at depth as well as vertically. Another thing to consider.

Rob Walker
Salinity Tolerance of rootstocks under drip irrigation
Concluding that it's a 'salt load thing' that causes stress in the root stocks. Not a rising water table problem as first thought.

Adam Sluggett
Leaching efficiency and modelling root zone salinity
Interest from an industry person in herbicide uptake measured in the ceramic cups. Have the water samples. Can be looked at later.

Ray Correll
Summary of the Wrattonbully Lysimeter project
Site at Yalumba gets 80 – 100mm irrigation. Generally doesn't get a leaching irrigation, as soils are shallow.
Would like to see some lysimeters installed at Padthaway for comparison with Wrattonbully.

Lysimeters are made of fibreglass.

Afternoon Workshop Session

Research Issues / Questions / Knowledge Gaps

- To what level do roots use salt in vines?
    - If we drive salt to a certain level, are we going to be better off?
    - How far down does the salt have to be flushed?
    - How much water do we need to do it?
    - Important with volumetric conversion coming up.
- Have you moved any salt out of the root zone since the end of the season?
    - Probably not. Increase in efficiency in water use has resulted in increased salinity, and we have seen some damage in plants.
    - Most growers do a 12 hour flush after the growing season to get rid of the salt
- Looking at the Enviroscan results, are you able to relate that to salinity?
    - You need to observe changes in the extraction pattern of the plant through the profile at various depths. Often limited to about the 90cm mark. Need to define the active root zone at 0- 90 cm. (Tapas) Where the roots are most active is usually nearest the surface because of drip irrigation not penetrating deeply. This area will have its own pattern of active root depth, and this will vary across the area
    - No-one in Padthaway has Enviroscan at depth.
- Look at specific soil types to see where the root zones/saline zones are: Where are the impermeable layers of calcrete? These are impeding movement of water and salt.
- Top soil is up to 2m thick on the plain near the foot of the Ranges, but much more shallow to the west.
- Work been done on tomatoes that shows plants are able to choose where they take their water from and choose less saline water.
- There are no simple answers. Always going to be variables. About individually understanding the process to be able to manage the salt and water on each block/area of irrigation.
- Enable people to understand what's going on, and teach them to apply the principles to their own properties.
- Soil mapping – need some good accurate information. Some classification already done.
- Maybe make up some rules for certain soil types.
- According to this morning's speakers we heard that good times are ahead in terms of better quality water coming through from the Ranges. However, there is still salt sitting in the profile. Too much water will flush it through to the aquifer which is another problem altogether.
- Separate the irrigation water supply from the root zone so that you don't recycle saline water. Could water be harvested from the roadside etc to water, instead of from under the vines?
    - Possibly, but the water is cleaning itself to the point where it's safe to put it through the profile in the vineyards.
    - Harvesting water from the foot of the range is one of the scenarios that is being modelled by the SAP.

- Fault line – interested in looking at movement of water over the fault. (change from Bridgewater formation to Padthaway formation).
- When we have the data about the evapotranspiration etc that Helen (CSIRO) is working on, will be able to do some sums about the required volume to move the salt below the root zone (to move salt 40 cm deeper, you need to apply 80 mm of water (need to apply 2xdepth needed in mm of water). On the lighter, sandy soils is also the issue of losing quality when putting on more water.
- Annual rainfall is 500mm, 350mm of that falls in winter. Can we maximise the amount of post-harvest rain to reduce salt with supplementary irrigation?
- Wanted to put water on at the end of winter before bud burst. But meter reads will take place at end of June so growers are unwilling to put large amounts of water on at the beginning of the season when the amount of water required for the whole season is unknown. Can we change the timing of meter reads to maybe September/October so that growers are using up the end of last year's water for flushing rather than starting to use the new year's water?

- Is the sustainability issue about the sodium and chloride levels in juice, or is it about tons harvested per hectare? Both critical, and varies from property to property.
    - Also a longer term issue for future sustainability. Increase in groundwater salinity over the next 50+ years.
    - Value of the resource.
    - When the area was planted, weren't thinking about salinity, more like things like phylloxera. Rootstocks weren't chosen for salinity blocking properties. Very expensive proposition to replace rootstocks (evidence indicates that some rootstocks are much better than others at not taking up salts).

- Soils – found some pretty high salinity levels, the deeper we go the more it increases. Is there any work done away from vines and irrigation to compare?
    - A semi-control in the mid-row.
    - But irrigation water spreads out and goes towards the mid-row. Salt Accession Project will be looking at it further.

- When doing point monitoring, where do we put them? Soils are so varied through the area, calcrete layers are so prominent and all over the place. Like a Black Forest Cake of layers of dark roots and calcrete "cream".
    - Can't dig up the whole paddock. Have to accept some natural variability. Can get lots of information from testing with suction cups and Enviroscan to interpret for specific sites. Getting a good handle on the leaching is v important.
    - Put some coloured dye in the water to see where it goes.
    - Could we get some saturated paste (??) soil samples that would give the plant people something to compare with their work? (Rob)

Inter-Row vs Vine row.
Amy's work v interesting in that area

Soil structure – expect to have sodicity and other things. An important part of the whole picture.

Issues / Questions / Knowledge Gaps for the Industry / Limestone Coast Region

- Hydrology is fairly specific to the region.
- Horizontal salt distribution under drip irrigation.
- Would like to look at root stocks in supplementary irrigation areas (other areas in the region). V little idea what happens under supp irrigation or drought conditions. Always done salinity experiments under full irrigation.

- Move water around, harvest from a lower salinity area
- De-salinisation plant for existing water
- Change root stocks to a salinity excluder type
- Cost them all and look for more work that needs to be done
- Economic studies at UniSA will look at all that as part of their studies (Yalumba guy suggested it, will get details for us).

- Mid-row vs vine row leaching.
  - Padthaway is a hotspot area and needs attention now. Problems here may be coming up elsewhere later on. This area could be a model for elsewhere.
  - Developing the best base data we can get. Create the best model. That gives growers here and elsewhere the best basis to go on from.

- How do we apply point research when the area is so variable?
  - Developing concepts from the research, testing the concepts to see if they agree with what you think is going to happen, then looking at ways to apply the concepts to management practices.
  - Rate salt is added, rate it's concentrated (evapotranspiration), soil salinity starting point, what's the canopy like (size), cover crop in the inter-row. What's the variation in water going in and out? Metered water use and rainfall.
- CSIRO Flux tower have had 3 seasons here over a range of sites and have come up with some v accurate numbers about vineyard water use. Should be looking to continue that work. Choose some more sites.
  - Combine with the Phylloxera Board's aerial survey.
  - Rob: breakdown of the evapotranspiration numbers to be provided by CSIRO needs some examination as it may it have some impact on salinity buildup in the soil under vines.
- Neutron moisture probes also showing interesting results around the loss of water early in the growing season
- Helen's work is not specifically related to vine physiology. Will be something for someone else to do.

- EM 38 electromagnetic surveys – what proportion of the area has already been done? Hardy's have done some small areas over years. Fosters Group did some fairly extensive work in Padthaway and Coonawarra. (Allen) Not sure about the value of it because of the depth to limestone.

- There is no cheap monitoring equipment. Is there something we could do about designing cheap, accessible equipment? The private sector is spending loads of money on it, even with SA govt input.
  - Suction lysimeters seem to be the best bet.
  - Yield pattern and variability
  - Gives a feeling of what variability is.

Summary

- Audit of existing capacitance soil moisture sensors required to determine whether existing equipment could be used for salinity research (i.e. need sensors installed at depth)
- General soil sampling required to determine extent of problem. Options:
  - Saturated paste extracts from many properties
  - Install suction lysimeters
  - Take soil cores
  - Conduct EM survey
  - Combine CSIRO Flux Tower ET estimations with phylloxera board aerial photography to do basic salt calculations (Volume pumped – ET = salt load Adjusted for salinity of irrigation water). Idea proposed by Rob Stevens.
- Some agreement that a broadly applied monitoring system needs to be developed.
- Do we know where the salt is sitting (have effective leaching irrigations been performed to date?)
- Is it possible to identify a limited number of key soil types and conduct studies on those?
- Is it possible to develop a 'salt interception' methodology that could prevent salt 'slug' from vineyards contaminating 'freshening' groundwater supply? I.e. is there any way of keeping irrigation water separate from drainage water?
- What is the most effective method for leaching salt (maximising leaching efficiency without compromising grape quality)?
  - Use dye to determine leaching efficiency
- Can SE be 'salinity proofed' by planting to rootstocks that are salt tolerant?? Results from Rob Walkers presentation would suggest that problems in SE are not as significant as other wine regions – what are the other regions doing?
- How are cover crops affecting the salinisation of soil profile
- Much of the discussion towards the end of the session focussed on rootstocks and issues apparently already being addressed by the SAP.

Desired Project Outcomes

- Management strategy – best way to monitor and take into account variability.
- Variance between mid- and vine row.
- Root stocks – Loxton water has a big study going on about the properties.
  - V low adoption rate in Padthaway
  - Salt exclusion and phylloxera resistance necessary for any root stock planted by Fosters Group in Coonawarra.
  - Managing salinity also manages vigour.

- Is there an idea of what is causing unwelcome effects in the wine? Are winemakers specifying what is wrong? There are different solutions to apply for different problems.
- Is there a distinction made between wines with high sodium and high chloride?
  - Not so much of an issue for what we're growing now, but 20 years in the future. Still want to be here then.
  - Still have a lot to learn about the impact of drip-irrigated vines.
  - Need greater understanding of better rootstocks for this environment. Need much more than 3 years worth of funding.
  - No chloride in the vine, salt in the soil, get drop in yield for 3 years. Was actually worse than the period they were salinised.

Who is interested in participating and at what level?

- Lots of potential projects that will come out of today. Maybe need a list of projects that people can choose some involvement from.
- Salt in root zone problem – needs better understanding of the processes in the root zone that cause the problem.
- Given the quality of groundwater here, we will be able to manage for 50 years.
- Highest priority is to help us come up with good monitoring systems that can help us apply the learnings.
- When you have leaching fraction, leaching efficiency
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The next step: A working group to further develop project brief and handle funding applications.

- Next step: steering committee from PSAP tech committee and Limestone Coast Wine Industry Technical Council.
- Some people who have spoken today may be asked for some further comments about how to approach projects
- Look for funding

- Thank you to all speakers, got a lot out of it.
- Thank you Kerry and Nikki
- Thanks for funding for today – great to get so many knowledgeable people together.
- GWRDC requires a report, to be written and circulated to everyone