

TURNING SALT OF THE EARTH INTO WOOL FOR THE WORLD

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FARM OVERVIEW

I would like to begin by saying what a privilege and a wonderful opportunity it is to be involved in this conference. These types of conferences are so important in swapping ideas and coming up with synergistic solutions to help overcome the challenges we face with land and water salinity right across the world.

I manage a family partnership business on the Southern Tablelands of New South Wales, near the village of Rye Park, which is 40 km north of Yass and 30 km east of Boorowa. We own and operate 1189 hectares of land, most of which is light sandstone and granite soils. We have a self-replacing Merino flock, shearing 8-10,000 sheep producing about 40,000 kilograms of 19 - 20 micron wool. Our local area is renowned for the quality super-fine wool it produces, no cropping and very few cattle are run in the area. The average rainfall is 730 mm and the majority of our land has been pasture improved with Phalaris, Ryegrass, Cocksfoot and Sub-clover with a regular history of super phosphate application. We are located at the top of the Boorowa River catchment, considered one of the salinity hotspots for the larger Lachlan River catchment.

Due to the topography and geology of our land, in a normal winter about 200 ha of our property is under water for 2 months. We have however had 3 dry winters in succession and as a result this water-logging has not occurred. Much of our better land is situated on a plateau with a creek running through the centre, however this creek drains through a narrow natural rock barrier at the bottom end, creating a natural dam or bowl. This combined with salt naturally occurring in the soil results in a large area being both waterlogged and saline. These factors, combined with over-clearing in the past, have resulted in 10% or 120 ha of our land being salinity affected and another 10% at risk of becoming saline. The watertable on the saline land is within 30 cm of the surface for most of the year and often well above ground level for many months. The salinity of this watertable is not as high as is seen in many other areas, being usually at 5-6 deciSeimens, however even at these levels dramatic reductions in productivity have occurred. In many ways the salinity issues we face are as much about maximising water usage as they are handling salinity.

SALINITY STRATEGIES: 11 KEYS

Background

Salinity was first recognised on our property 25 years ago. In hindsight however it was occurring and causing productivity losses at least as early as the 1940's. So why am I up here talking to you today? What have we been doing that has created the situation where now our Saline paddocks have been 25% more productive than our Non-saline paddocks for the past 5 years, carrying 11.73 DSE/Ha/Yr compared to 9.39.

Before I begin talking about our strategies I would like to add a note of caution. In no way are we experts, we are still very much learning, making mistakes and trying new things.

So what are the strategies, or what I would prefer to call Keys, that we have been using in our

situation to help combat and to then improve productivity on saline land?

1: Positive Attitude

In the early 1980's, when salinity was just becoming a major issue, particularly in political circles, there was a lot of negative talk about salinity. It was all doom and gloom, there was nothing we could do about it and it was going to send many farmers and communities broke. At about the same time we sat down in our business and had a good look at our situation. If we took what was being said and believed it then we would go out of business. Our productive land base would be reduced to non-sustainable levels and the capital we had in land would be greatly reduced in value. This would leave us unviable and with no way of getting out of it and moving elsewhere. We then made a stand which now appears to have been brave, but back then we saw no alternative, we were going to create a positive out of the salinity challenge in front of us.

I guess people today would see it as being proactive, realistically it was probably only being stubborn. From that point on we refused to see salinity as a problem, but rather as an opportunity. We just needed to find out how to make the most of that opportunity.

It is pleasing to see that there are now more people with positive attitudes to the salinity problems facing us. Conferences like this one show us that there are alternatives to negative defeatist thinking. To you that came here thinking it is all too big to solve, could I encourage you to try and be more positive. Yes we need to be realists and no, things probably won't be the same as they once were, but I am sure there is more to be gained by being positive than negative!

2: Willing to Learn

The second key to what we have achieved is to be willing to learn. I am forever grateful to my parents for passing on this attitude to me. My mother is forever reading and I have taken on that attribute to a lesser degree and my father is always willing to listen and to see what others are doing. As well he is willing to try things, give new ways of doing things a go, trying new pasture species, new grazing techniques, etc. I hope I too have taken on part of that.

In response to the salinity challenge facing us we went seeking as much information as we could. At the time in the early 1980's there wasn't too much known about combating salinity but we gleaned bits here and there. We were one of the first farms to be involved in Prograze, I attended Grazing For Profit schools, chased agronomists and seed companies for seed from new and untried-in-our-area species such as Tall Wheat Grass and Puccinellia, ran little trials ourselves, experimented with deep ripping, read books like "Holistic Resource Management" by Alan Savory, and the list goes on.

A lot of what we learnt we haven't used, some we have adapted, some things didn't work and we made lots of mistakes. But through it all the learning curve was steep. I believe it was Albert Einstein who said that "the thinking that has created the problems now faced by man is not going to be enough, to find answers man needs to reach a higher level of thinking". If Einstein is correct, then I guess we are now at a higher level of thinking on salinity than we were at the beginning. However I would hasten to add that we still have a long way to go and lots to still learn.

3: Reduce Paddock Sizes

The first 2 keys are really attitudes, I believe they are vital and apply across all regions and in all types of salinity. The next 8 keys are actions or physical things that most practical hand-on farmers want to know about. Yet I would say they are less transferable across regions.

One of the first things most people notice when coming onto our farm are the number of paddocks and their small sizes. We have 80 paddocks on our 1189 hectares, the 66 Non-saline

paddocks average 16 ha while the Saline paddocks average 6.4 ha. We are still in the process of subdividing some of our larger paddocks, however the cost of fencing and watering points is a limiting factor to paddock subdivision and is an issue we need to work through.

There are a number of reasons for keeping paddocks small and I believe it can be an advantage, even if salinity is not a problem. It improves the evenness of grazing of a flock of sheep and makes management easier in knowing when to put livestock in and out of a paddock.

We try to fence so that we are creating paddocks of similar soil types and topography. Unfortunately salinity does not develop in nice rectangular shaped areas so in reality it is impossible to do this accurately, but as best as we can, we try not to have too much variation. Sheep are very selective in their grazing habits. If you have a paddock with too much variation this leads to preferential grazing by sheep. Resulting in areas being overgrazed and/or undergrazed which damages the pasture and reduces the stocks production performance.

This Autumn we had stock water problems for the first time in many years. As a result we were forced to leave gates open in one area between a non-saline paddock of 12.6 ha and a saline paddock of 5.9 ha. The saline paddock was already grazed quite hard and had no more than 400 kg/ha of feed while the non-saline paddock had about 1000 kg/ha of feed. Over a period of more than a week we observed two flocks of about 700 sheep, both wethers and ewes, as they grazed those paddocks. In both cases at least 80% of the sheep spent at least 80% of their time grazing in the smaller saline paddock. This very unscientific observational experiment showed that sheep grazed a saline paddock 4 times harder than the non-saline paddock next door with more available feed in it. No wonder that in large paddocks under set stocking the saline areas are bare and eroded, the sheep won't give it a chance! This just reinforced our view that it is vital to subdivide our land into different land and management areas for its potential to be achieved.

4: Identify Saline Areas Early

The earlier a developing saline area can be identified and then managed, the more hope and potential there is to get that area to remain productive or to be returned to production.

It is vital in our area, where the topsoil is so thin and fragile and the sub-soil is so poor and hard to manage, to keep the topsoil on the saline site. Our strategy has been, if there is grass on the site even if it is only sea barley grass and couch to then try to keep it there. It will slow down erosion caused by the wind and water. Fence the area off if the stock are beginning to camp on the area, as they often will, especially in a large paddock. We monitor the site and start thinking about how we are going to manage it.

Following is a table showing the difference between the Topsoil and the Subsoil from soil tests done on a saline site a few years ago.

Soil Tests from a Saline Site		
	Topsoil	Subsoil
Colour	Greyish Brown	Pale Brown
Texture	Very fine sandy loam	Light clay
Depth	0-10 cm	10-60 cm
pH (CaCl)	5.6	5
Phosphorus (mg/kg)	22	5
Total cations	12.2	19.3
Sodium as % of total cations	19.6	25.8
Chloride (mg/kg)	369	867
Electrical Conductivity (dS/m)	3.5	7

Many of you would not want to have either soil on your place, but if you had to make a choice I think most people would prefer working with the topsoil than the subsoil. These tests are from one of the first saline paddocks we began rehabilitating about 20 years ago. This paddock has run 14.3 DSE/Ha over the past 5 years.

These soil test results have highlighted to me why it is so important to keep the topsoil on the saline area. It is much easier to get a pasture to produce on the topsoil that is there than the subsoil underneath. This test shows the structure of the topsoil is a sandy loam that remains consistent under most moisture conditions while the subsoil is a clay that is a soupy slop in winter and set concrete when it is dry. The phosphorus levels are much better in the topsoil at 22 compared to just 5 in the subsoil and the average EC across the paddock is 3.5 in the topsoil compared to 7 in the subsoil.

In areas where the topsoil has been lost we are finding good results from placing sheep manure from under our sheds on the site. This is an expensive exercise and it is much better if action is taken before the topsoil is lost.

5: Rotationally Graze

We don't have any fixed grazing system. There are no particular plans that we go by and each year is different, depending on the seasonal conditions at the time. But as a general rule we don't set stock a paddock for an extended period of time. On average each paddock is grazed for a third of the year.

Rotational grazing does a number of things. It gives a more even graze on the pasture across the whole paddock, it allows more rest for the pasture to then recover its root reserves before the next graze, it causes some soil disturbance by the sheep's hooves due to the larger flock sizes that occur with rotational grazing and it reduces the amount of camping and salt/soil licking that the sheep do.

If a bare saline area is fenced off from stock then the salts cause a crust on top of the soil due to the water-table being at or above the surface and evaporation removing the water and leaving the salts behind. This crust prevents rainfall penetrating, is a poor micro-climate for pasture seedlings and is harsh on growing plants. Sheep in a set-stocked situation either just walk along tracks in and out of the saline area or they camp on the area, lick and scratch the salt and eat the salt and the top-soil, removing it and exposing the sub-soil.

For some reason salt is to sheep like ice-cream is to children, they love to eat it. Rotational grazing means that the sheep are busy getting their share of the grass so they don't spend as much time licking the salt, but they walk across a greater percentage of the crusted area. The action of the hooves disturbs the bare scalded areas enough to enable some of the grass seed that is usually nearby to find a spot that they can try to establish in. The trick is to get enough soil disturbance without getting too much to cause erosion in heavy rainfall. This is where the relationship between paddock size, mob size, grazing pressure and time of grazing all comes into play. It is a science with no definite formulas as far as I can determine.

In the last few years I have noticed that sheep will spend a lot of time camped on bare saline areas during summer. There are a few possible reasons for this, one being that the bare area is more comfortable than dry grass or long grass where blowflies may annoy the sheep. However, I believe the reason is that this is the coolest spot in the paddock, even though there may be no shade there. The water table is closest to the surface on saline areas, this water is at about a temperature of 18°C, thus cooling the ground on summer days. Sheep will even scratch a hole in the ground to lie in so they will be closer to the watertable and the cool earth. And who said sheep were dumb? Of course this tendency by sheep causes erosion and bare areas on our saline

sites and needs to be prevented.

6: Sow Salt Tolerant Pastures

To create a productive grazing system on a saline area there is a need for the right pasture species to be present. We haven't found that 1 or 2 species work in all areas. Our philosophy at present when it comes to sowing pastures is to use a shotgun approach. There is so much variation within a few metres let alone across a paddock that there is no way that we will know what will grow best on any given spot. So we leave that part to God and we provide as much choice as we can.

Having said that, we find the following pasture species usually perform best on quite saline areas:

Tall Wheat Grass (*Agropyron elongatum*)
Puccinellia (*Puccinellia ciliata*)
Tall Fescue, particularly cv. Triumph (*Festuca arundinacea cv. Triumph*)
Strawberry Clover (*Trifolium fragiferum*)
Balansa Clover (*Trifolium balansae*)
Sub Clover (*Trifolium subteraneum*), particularly Leura, Goulburn and Riverina

Tall Wheat Grass needs to be managed quite hard to keep it from going rank and to keep it palatable and growing to maximise water usage, it can almost become a weed if not grazed hard, however it will grow in saline areas where often nothing else will grow and can be a pioneer species which once established allows other better species to also grow on saline areas. Puccinellia is a poor competitor and appears to be the first species grazed when sheep are put in on a pasture, however it often grows on saline areas where even Tall Wheat Grass doesn't grow.

There is a real need to find a legume that will grow well on saline soils, at this stage Palestine Strawberry Clover is the best we have.

The following species are usually considered not suitable for saline areas, however we have found they perform well on some sites so we usually sow them.

Australian Phalaris (*Phalaris aquatica*)

We find in our situation that in most years the phalaris does not go completely dormant over summer but continues to grow due to a high water table at or near the surface. This gives us green digestible pastures on our saline areas during summer when the rest of the property is dry. Most of our young sheep are on the saline areas through summer and autumn as a result. This is one of the most valuable attributes of saline areas, they produce green feed at a time when it is not usually available elsewhere on the property and when our young stock need it most. A Kilogram of green feed in Autumn is worth 5 kilograms in Spring.

White Clover cv. Haifa, Prop and Tahora (*Trifolium repens*)
Perennial Ryegrass (*Lolium perenne*)

We have trialed Puna Chicory and Maku Lotus but to date our results have been poor. In addition we have been using Persian Clover and Salado Lucerne in our mix over the last couple of years. The Persian Clover looks promising. We have found that in a couple of places kikuyu and paspalum have moved in and are performing well. I think we need to look at them closer than we have been.

We have taken the attitude that even if a saline area is predominantly sea barley grass, couch and Yorkshire fog then they are better than nothing. The only grass that uses moisture out of the soil is green grass. In addition, the only ways to remove soil moisture before it gets to the soil

surface and leaves its salt behind as a crust, is either by a bore and pumping the water out, by planting and growing trees or by having green growing grass. All three have their place and we are using trees around saline areas, but the most efficient way on saline areas that we have found is with grass. It is preferable for this grass to be perennial as it stays green and growing for a longer time each year and it is deeper rooted than most annuals. It is important to try to keep this pasture in a short, vegetative growing stage by grazing management for as long in the year as possible. Don't look at barley grass and couch as a curse, until you have the ability to replace them with something better.

7: Fertilise Well

Before you plant your new pasture species on a saline area and after you have planted it you need to put fertiliser on. Really it is no different to any other pasture, if you want it to grow, you need to feed it.

We try to put 125 kg/ha of Single Superphosphate on all our country every year. However in the last few years we have only fertilised two-thirds each year. At the time of sowing pasture, we fertilise with 125 kg/ha of Starter 15. It is important for the seedling to get a quick start so it can get its roots down and develop sufficient leaf area. The nitrogen helps the plant to establish.

The use of sheep manure, as mentioned previously, not only improves the soil structure by adding humus but it also adds nitrogen and phosphorus.

8: Reduce Water Laying on Paddock

We try to get water off the paddock. On our property many of the saline areas are places where water either is running across them during much of the winter, or they are small depressions where water lays during winter and they dry up quickly in Spring. It could be due to the water-logging creating nitrogen and oxygen deficiencies and resulting in poor pasture production, or salts from other areas accumulating there as the water evaporates. We have found by reducing the amount of water over those areas, we have helped heal up saline areas, in some cases quite markedly. The costs needs to be evaluated, but often with a couple of contour banks or a tractor and mouldboard plough a lot can be achieved in some places quite cheaply.

9: Incorporate Trees into the System

We do use trees in our farm system. We have planted many thousands of them, probably over 20,000 by now. Mostly they are in windbreaks on the edge of saline areas or on the tops of ridges in recharge areas. We have had only very limited success with trees growing in saline areas and do not believe they are as efficient in water usage as a good perennial pasture.

In the last few years we have been more deliberate in our selection of tree species and now try to grow more trees that may give us an income in the future through timber and tree seed sales.

10: Whole Farm System

I find it very difficult to talk about salinity on our farm as if it is a separate part of the whole farm. It is not, and in fact is a part of a whole farm system. It is used in combination with the other areas of the farm to maximise production across the whole farm. The saline areas are used for grazing dry sheep during spring, weaners during summer/ autumn and to boost up the ewes prior to joining in autumn. The steeper, drier areas are used for lambing in late winter/spring and to run sheep in mid winter when the low country is covered in water and a quagmire. Without a balance of both land types our farm would be far less efficient.

Like everything else in primary production you need to do your budgets before you start, when you finish and before you do it next time. But how do you budget for things like aesthetics,

pride in what you are doing, maintaining the capital value of land and seeing native species returning.

While on that issue, early criticism of systems like what we are doing were and are that it would damage the environment and lead to loss of species. This is a very difficult thing to measure but I can tell you that in the last 5 years we have seen endangered species that we had not seen before. Now I am not going to tell you what they are or where they are as I don't want environmentalists coming in to study or bureaucratise what we are doing and threaten their survival, but this tells me we might be doing something right!

11: Never Give Up

I want to conclude these 11 Keys by saying that the last one is vital. We need to have the stubborn pig-headedness of never giving up trying. I run the risk of sounding like we have all the answers for how to get saline areas producing on our farm and yours. I want to assure you we still have plenty to learn. I could show you saline areas on our farm where we have spent plenty of money but production is still very low, and other eroded saline areas where we are yet to do anything.

I also am aware that many landholders in West Australia, South Australia and even in New South Wales have salinity challenges that are a lot greater than ours. Probably the strategies needed will be different and maybe production levels like what we have achieved are not possible but I don't believe that is the issue. The issue is how to get yours and our saline areas as productive as possible, whatever that level of production may be.

There has been a tendency in the past, and maybe it still exists sometimes, to place guilt upon any landowner who has a saline area on their place. Don't feel guilty, guilt never achieves anything. Rather use that saline paddock as an opportunity to learn, to grow and to become a better person.

Mostly though don't give up. That achieves nothing.