Farmers gather to see the latest results from the Sodicity Trials

Another June frost welcomed a great turnout of 40 people with farming, agronomic, soil research, pasture seed and gypsum supplying expertise who came to see for themselves what the Keilira Farm Management Group is doing to manage and stop the spread of sodic soils.

With a warm cup of coffee in hand, Adelaide Research and Innovation speakers Melissa Fraser and Pitchu Rengasamy gave attendees a refresher on saline/sodic soils, describing how they form, their dispersive nature, and the effects that gypsum applications have on both replacing sodium with calcium on clay particles, and stopping clay particles from pushing each other apart when wet by elevating the Electrical Conductivity (EC or salt) of the soil.

At Trial Site 1, (pictured below) participants were able to see able to see the damaging effect of sodicity: high sodium but low EC (or salt concentrations) causing soils to disperse and its structure to break down. The larger soil aggregates have been blocked by the smaller dispersing clay particles preventing plant roots from penetrating the smaller pores and therefore limiting how much water and nutrients the plant can access for growth. The soil pores will eventually become too small so that soil water will be bound so tightly to the particles that a waterlogged environment will result, preventing most plants from surviving. Structural fertility of a soil is determined by a balance of pore sizes ranging from small to large. Any soil dominated by any one of any size class lacks physical fertility, and if the soil is structurally weak and compacts, then this will significantly reduce the effectiveness of any drainage works, and severely restrict plant growth.

Structural stability refers to a soils ability to resist changes due to external stresses such as trampling and tillage. Soil structure deteriorates by slaking and dispersion of clays and by mechanical stresses. These processes have the capacity to change the pore size and distribution in soil. Dispersion in these susceptible sodic soils is essentially irreversible and the adverse effects on porosity are usually permanent. The Project is being proactive by focussing on attempting to stop these areas from developing and spreading. Trial planting strips of pasture species expected to be tolerant to these conditions have been established, and rates of gypsum (stabilising calcium replaces sodium) from 1 to 10 tonnes per hectare have been applied across the pasture species trial strips. It is hoped that these management measures will overcome any antagonising of the soils structural breakdown that is currently occurring in the untreated areas.

The best guide to determining soil structure is by observing the abundance and depth of roots in the soil profile. Tim Prance, Senior Consultant Pasture and Grazing Systems for Rural Solutions SA, demonstrated the structural problems on the visually affected sodic patches by digging around the root system of a chicory plant. Even the strong tap root of the plant could not penetrate the hard layer which had formed over time at 15cm and the root was growing sideways along the top of the layer. However this effect may also be partially attributable to the high pH of the soil at this depth, and the influence of salt over the preceding summer.

Studies are currently being conducted to find a relationship between EC, exchangeable sodium percentage and soil dispersion in the soil, which will enable us to test other sites and determine if structural breakdown is occurring, and if so, stop it before plant growth is further retarded and the area turns into a boggy mess as shown in the photograph.

Moving onto the drained 1 year old pasture species trial, plants were ranked in order for each species with dry matter production, seed set and surrounding companion plant growth on non-saline land assessed and the standout species in the pasture trials were:

- SARDI 7 lucerne, Cropper 9 lucerne
- Choice, Grouse, Puna Chicory (although Puna is the most persistent variety)
- Antas sub-clover
- Santiago medic
- Dundas tall wheat grass (strong competitor and easy to establish)
- Extreme AR6 ryegrass (highly palatable)
- Porto cocksfoot
- Tonic plantain
- Palestine Strawberry Clover
- Gosse sub-clover.
- Resolute fescue

At the saline – non drained site – we noted the differences between the sites species, with Phalaris, Tall Fescue (Resolute 1st, Quantum 2nd), and Extreme AR6 Ryegrass were the most successful grasses (in decreasing order). Gala Grazing Brome grass was very poor at both sites, and Porto Cocksfoot and Dundas Tall Wheat Grass only grew successfully at the non-saline site.

Many of the high yielding clover and medic varieties, particularly Bolta, Nitro, and Prolific Persian clovers, performed so well that they out competed all other pasture and weed species including silver grass and marshmallow. It is therefore best to establish the perennial species in the first year, and to establish the selected clover and medic varieties by broadcasting with fertiliser in the following year.

To lower the height of the grasses , another grazing with ewes and lambs is about to commence on the non-saline trial paddock which currently has approximately 1300 kg/ha dry matter present. This will also make use of the high quality lucerne/chicory feed available and will encourage increased clover germination and growth in the lead up to spring.

Preliminary results of the Electromagnetic Induction (EM) and Ground Penetrating Radar (GPR) research trials which had been undertaken at all the trial sites were shown to the group with further work to be completed over the next few months to interpret the data after calibrating the results with the soil samples. EM data is used to establish the spatial distribution of soil water, salt and boron concentrations in soils. These techniques can reduce the need for expensive time consuming soil sampling techniques that are currently employed to determine such variability. GPR can be used to detect variability in soil properties such as horizon depth, textural and structural contrasts, and also detect the presence and depth of rocks/bedrock up to depths of 15m, without the need for costly drilling and coring.

For more detailed information please contact Jack England, Saltland Catchment Agronomist, on 8767 5071.

Rob England outlining the sequence of events leading to the development of soil structural problems at trial site 1.

Philip Mill "Ecophyte Technologies" conducting EM and GPR surveys.