Adaptive learning through five strands of root-zone knowledge

NPSI Case study

February 2011

Prototype automated soil solution sampling and measurement tool to locate salt in the soil profile

Situation

Subject: Dr Andrew Skinner

Location: Adelaide, SA

Enterprise: Measurement Engineering Australia Pty Ltd in collaboration with CSIRO

Irrigation product: Developing an automated soil measurement probe

Link with NPSI

The NPSI project Adaptive learning through five strands of root-zone knowledge project, managed by Dr Richard Stirzaker, in a joint CRC IF and CSIRO project, involved linking existing grower and researcher knowledge to create new insights into irrigation management, regarding soil solution sampling and soil moisture management. The aim was to develop an automated soil solution monitoring tool that could readily be used by irrigators. This would allow them to measure the extent and location of salt in the soil profile – thereby guiding them in their irrigation activities. The purpose was to allow them to minimise salt build-up and 'park salt' at a level in the soil that would not unduly interfere with plant growth.

In order to commercialise the research and create such a tool, collaboration also occurred with a private company, Measurement Engineering Australia (MEA). It was proposed that such a tool would replace the only currently available manual probe that is manufactured in Germany. While the research and MEA relationship progressed well, the key element of the tool, the EC sensor, did not reach the stage of a product for commercial release during the project life, due to issues related to the durability of the EC probe itself (the four platinum probes on the chip).

All members of the team engaged collaboratively on the project and as there is an emerging groundswell of interest in soil moisture monitoring, it is expected that MEA will continue the work to take the current successful prototype into final production in the future.

The soon to be commercialised prototype Soil Salt measuring tool developed jointly by Dr Andrew Skinner and Dr Richard Stirzaker using NPSI seed funding. The probe is inserted in the black cylinder to pre-determined soil levels then measures the salt levels which are electronically dumped onto grower computers.

"It is critical for irrigators to minimize salt build up and know where to 'park salt' at a level that won't unduly interfere with plants growth."

Changes made as a result of NPSI influence

The prototype came about due to pooling of resources and skills, plus recognition by Dr Stirzaker that an 'instrument maker' was a necessary part of the project team. As Dr Skinner reports 'it is a really tough thing to commercialise a scientific idea; the instrument maker becomes the middle-man between the scientist and grower'.

The development of the prototype has helped to 'mainstream' the idea of irrigators undertaking soil moisture monitoring and increase recognition that unless irrigators track the location and quantity of salt in the soil profile, then manage appropriately, the soil will become 'poisoned' and unusable for irrigated agriculture.

It is expected that the next step of creating a fully automated tool, to replace the current tools, will result in soil moisture and salt monitoring being undertaken by over half of irrigators.

Costs of making changes

The project pooled the unique knowledge sets of Dr Skinner and Dr Stirzaker, or as Dr Skinner comments 'we needed to join knowledge about salt and circuits with knowledge about salt and soils' to create this automated tool.

The NPSI project funding of $96,000 was augmented by over $50,000 in cash from MEA, as well as access to the more than 20 years of specialist and unique experience of MEA in this discipline.

In addition MEA is working on development of technologies to allow the data obtained from such sensors to be delivered direct to irrigator and farmer computers so they have readily available data on which to base management decisions.

This work will further leverage the NPSI funding in the final commercialisation of the soil sampler probe.

Benefits of making changes

Dr Skinner has noted the serious adverse effects of salt on agricultural production during his more than 20 years experience in developing environmental management systems. In his view the importance of salt management can be summarised as 'after serious salt build-up, it is very difficult to keep soils 'alive'. This makes it critical to 'park the salt' somewhere in the soil profile where the adverse effects are minimised'.

He reports that Dr Stirzaker's work 'is pioneering' in that the development of an automated soil measurement probe, that becomes a general purpose tool for irrigators to use on a daily basis, can give the irrigators a pictorial representation of 'where the salt has gone in their particular soil'.

It is for these reasons that MEA plans to 'continue where Dr Stirzaker left off' in order to create a tool that goes into production and is based on the prototype that now exists from the joint NPSI, CSIRO and MEA venture.

Raf Iacobelli and Jonathon Schmidt, MEA, collect readings of soil salt levels using current non-automated technology.

"The existence of this new product will support 'mainstream' salt measurement by irrigators and by growers more widely – with application to at least 40-50% of those in salt effected regions."

Impacts of the work

Until this work occurred it was a specialist function to measure salt levels. The German probe was the only pre-existing system which will be far surpassed by the commercialisation of the Australian prototype.

The existence of this new product will support 'mainstream' salt measurement by irrigators and by growers more widely. Andrew is confident that the work of MEA on similar tools, the leverage from the current Aus-industry funded work combined with the learning's from the NPSI funded work, will make it significantly easier for irrigators to manage their soil salt levels.

Relevance to others

It is expected that at least 40-50% of irrigators and growers in related industries and in salt effected regions will find the tool supports them in their management of potentially salt effected soils.

References for further detail

Skinner, A.J. and Lambert, M.F. (2010). 'An automatic soil salinity sensor based on a wetting front detector.' IEEE Sensors Journal, Vol. 11, Issue 1, p245-254, January 2011

Irrigation Australia Journal, Summer 2010 Edition, pages 10-11.

(Please note that this case study is anecdotal in nature and based on reporting key concepts rather than full details)

Further information

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