FINAL REPORT

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

CSO201

A simple device for determining the deep drainage in soils

PROJECT DETAILS

PROJECT CODE:	CSO201
PROJECT TITLE:	A SIMPLE DEVICE FOR DETERMINING THE DEEP DRAINAGE IN SOILS
START DATE:	01.01.1999
END DATE:	30.06.2002
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Summary

Irrigation and grain growers have found it difficult to manage the effects of their cropping and irrigation practices on the amount of water that drains below the crop root zone to recharge groundwater. Such drainage causes water tables to rise causing sub-surface salt deposits to be mobilised, leading to dryland salinity and increased salt in rivers. To overcome these problems, this project has developed a monitoring tool named the 'Drainage Meter'.

Report Disclaimer

Old or Archival Reports (Projects that concluded in 2007 or earlier)

The information contained in these older reports is now several years old, and may have been wholly or partially superseded or built upon in subsequent work funded by GRDC or others. Readers should be aware that more recent research may be more useful for their needs. Findings related to agricultural chemical use are also potentially out of date and are not to be taken as a recommendation for their use.

Conclusions

A prototype instrument has been developed to monitor deep drainage. The instrument was designed specifically to operate within the constraints imposed by grain farming operations. It is maintenance free and capable of being permanently and completely buried beneath the maximum extent of an annual crop's root zone.

The drainage meter received comprehensive testing at Wagga Wagga and Griffith, New South Wales (NSW) where comparisons of its performance were made with ceramic cup tensiometers, neutron probes and capacitive soil moisture sensors. Testing at Wagga Wagga showed that the meter was capable of measuring the soil water potential and soil water potential gradient to the accuracy required to apply Darcy's Law to estimate the moisture flux. Testing at Hanwood in Griffith in a free draining medium clay subsoil showed that the meter can measure the moisture flux accurately, provided the soil water potential in the subsoil was wetter than -10 kPa. At a soil water potential of -10 kPa in the Hanwood subsoil, the lower limit of moisture flux range for the meter was 0.16mm/day. For subsoils that drain more freely than the Hanwood subsoils, such as the sands of the Mallee or Western Australia (WA), the lower limit of operation of the meter is greater than 0.16mm/day. For subsoils less permeable than the Hanwood subsoils, the lower limit is much less than 0.16mm/day.

During the project, the meter has been in demand by researchers and grower groups. A limited quantity of instruments was manufactured, distributed and installed in order for the technology to be exposed to a wide audience. In the future GRDC project 'Commercial Development of the Drainage Meter', this instrument will be commercialised and made publicly available.

Recommendations

1. To further develop the drainage meter to have the following additional features;

- soil solution sampling of the drainage water
- a wider range in soil tensions, thus a lower limit for the range of moisture flux that it can measure
- ability to measure the hydraulic properties of the subsoil *in-situ*.

2. To proceed with commercial development of the device.

Outcomes

Environmental Outcomes

The Drainage Meter will allow growers, farm advisers, researchers and regulators to monitor deep drainage beneath both rain-fed and irrigated farming enterprises. This information will provide feedback so that the impact of present and future farming systems on deep drainage can be continuously and rapidly assessed.

Other research

The drainage meter has application in irrigated agriculture as a tool to monitor moisture and solute (salt and nutrient) fluxes.