DRYLAND SALINITY
Information Sheet

Salt Action

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Research on Crop and Pasture Rotations to Manage Watertables and Salinity on the Liverpool Plains

The most likely causes of dryland salinity and waterlogging are clearance of native vegetation, increased rainfall since the late 1940s and long fallow farming practices. Here we describe a research project on the contribution of farming systems to the recharge of groundwater in the Liverpool Plains Catchment.

Although estimations of this have been made using computer simulation models, the effects of farming systems on drainage of water below the root zone into groundwater have not been measured directly. The project, involving NSW Agriculture, CSIRO and the Department of Land and Water Conservation, started in 1993 and will continue until at least 1999.

The aims of the project are to define profitable crop and pasture systems that will reduce deep drainage into groundwater and surface run off, and so alleviate the problems of waterlogging and dryland salinity. The methods involve measuring the water balance of a range of cropping and pasture systems. From this we can estimate the quantity of water that 'leaks' downward beyond the root zone and moves into groundwater ('deep drainage').

The water balance equation to estimate deep drainage is:
Deep drainage = Rainfall - (Evaporation from soil + Transpiration by plants) - Surface run off + Changes in soil water storage.

Rainfall and weather are measured with automatic weather stations, surface run off is collected from small plots and measured automatically, and changes in soil water storage down to 3-5m are measured periodically with a neutron probe and by taking soil cores. From measurements of crop and pasture growth, yields and quality (protein, digestibility and so on) and some chemical properties (nitrate levels, organic carbon), together with the climatic and water movement information, we can calculate the benefits and costs of a range of farming systems in various ways such as $ returns per hectare or per mm of rainfall.

We have two experimental sites located on landscapes identified as areas of significant groundwater recharge in the catchment.

On the first site located on Robert and Edwina Duddy's property "Hudson", in the foothills of the Liverpool Ranges, on a typical heavy clay basalt soil we are comparing:

- Long fallow wheat/sorghum rotations (common since the early 1970's, easy to manage and probably the most 'leaky' system);
- Continuous winter cereal (common since the 1950's on heavy clay soils);
- Opportunity or response cropping where a crop is planted whenever there is moisture to 40-50cm deep (the least 'leaky' cropping system, can be more profitable than long fallow systems but requires more intensive management); and
- Perennial pastures such as lucerne, phalaris and Bambatsi panic, which is the least 'leaky' system overall.

Trough and equipment used to measure surface runoff from an experimental plot planted to sorghum

On the second site located on Ian and Marilyn Carter's property "Connamara", on ridge country near Pine Ridge on a sandy loam, we are comparing:

- Native pasture;
- Native pasture treated with superphosphate and pasture seed;
- Sod seeded improved pasture (Rhodes grass, digit grass, Consol love grass, lucerne, clovers and serradella with superphosphate); and
- Continuous winter cropping, which mimics land use of some of these soils from the late 1800's to the 1950's, to determine the recharge that may have occurred at that time.

Soil moisture data indicate that, on heavy soils, deep drainage under long fallows is very likely, with less chance for deep drainage under opportunity cropping. Under lucerne based perennial pastures, deep drainage appears unlikely in years of average rainfall.

We considered a site on the alluvium, however watertables near the surface (ie, saturated soil in the root zone fed from deeper down) meant we could not accurately measure crop water use and achieve reasonable comparisons.

The Liverpool Plains

With land valued at almost $1,000 million, the Liverpool Plains produces $150-$200 million worth of agricultural product annually. The catchment covers 11,728 km^2, half of which is arable, highly productive self mulching clay soils. Rainfall is 600-700mm per year and is summer dominant, enabling both winter and summer cropping.

Probably around 1,000ha are severely salted with production losses greater than 80%, around 30,000ha suffer lesser losses with watertables within 2m of the ground surface and ultimately 195,000ha are at risk with watertables within 5m.

These problems have been attributed to the clearing of native vegetation, an increase in rainfall since the late 1940's and long fallow farming systems.

To get around this problem, data from the Liverpool Ranges site, together with information on soil moisture characteristics from the alluvial plains, will be integrated using the APSIM (Agricultural Production Systems Simulator) model which has been developed by APSRU (Agricultural Production Systems Research Unit) in Toowoomba. The model setup for the alluvium will be used to compare crops and pastures in that environment once farmers and researchers are comfortable with its behaviour in relation to real farm inputs and yields.

One of the opportunity cropping systems - chickpeas in sorghum stubble

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This research project is part of the National Dryland Salinity Program and is a joint effort by NSW Agriculture , CSIRO Division of Land and Water and NSW Department of Land and Water Conservation in collaboration with APSRU . External funds are provided by Salt Action, The Grains Research and Development Corporation and Land & Water Australia . The research was initiated at the request of local landholders through the Liverpool Plains Land Management Committee.

Salt Action is a New South Wales Government salinity management program involving the community, NSW Agriculture , Environment Protection Authority , Department of Land and Water Conservation .

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