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Deep drainage as a method for treating saltland

By Eric Bettenay, CSIRO

In some situations, deep drainage may be warranted to return salt-affected land to full production. This method is being investigated at CSIRO's Yalanbee Experiment Station.

In agricultural areas some 400,000 ha of saltland occurs naturally and a further 167,000 ha of previously productive farm land is no longer suitable for crop and pasture. In addition to loss of production from farm lands, salt encroachment can lead to the loss of a further valuable resource, good quality water.

Normal methods of handling saltland include:

- no special management;
- fence and manage as a saltland pasture;
- near surface water control with grade or contour banks; and more recently—
- using trees as pumps to lower the water table.

A method for reclaiming saline seeps, not popular because of its expense, is deep drainage such as is common in irrigation areas. However, where control of a seep is desired to protect particular assets, such as roads, farm buildings, home gardens, or water supplies, or for aesthetic reason, expenditure on drainage may be warranted. In some cases it may even be economical to drain saltland to return it to normal agricultural production. In handling saltland it is important to decide first what is the aim for management, and then what methods of control are most likely to produce the desired result.

The CSIRO is experimenting with deep drainage at Yalanbee, its Experiment Station at Baker's Hill. In paddock Ki, which was cleared in 1967, a saline seep first appeared in 1976 (Fig. 1). Since then there has developed an area of bare moist land, which is encrusted in salt in the summer months. Associated areas have deteriorated to less desirable pasture species, marked first by a decline in clovers, and later by a dominance of sea barley grass.

Preliminary drilling of this site indicated that the seep resulted from a barrier of clay formed by the weathering of a dolerite dyke which banked back saline water. This water, forced to the surface at this point, has spilled over and moved downslope, increasing the area of salt affected land (Fig. 1).

Early in October, 1977 a drain about 3 metres deep was dug with a back hoe. The main arm cut through the clay barrier and extended upslope some 90 m to beyond the area of affected pasture. From this point arms were dug in the form of a V, to extend across the slope some 40 m on either side to intersect water moving downslope into the seep. Preliminary drilling had indicated that groundwaters in this area were under pressure. Before making the drain, six wells of about 25 cm diameter were drilled to some 10 m depth and back-filled with sand so that when the drain was made they would flow into it.

Slotted "Draincoil" pipe of 60 mm diameter was laid in the bottom of the trench and covered by coarse sand some 20 cm thick. From below the bar the drain was connected to polythene water pipe buried to below cultivation level and discharged to a natural stream outlet some 370 m away.

Water flow from the drain has since been measured, and the salinity of the water determined periodically, to calculate both water and salt export.

Some early results are:

- Salt affected area—2.49 ha
- Average discharge—5 cubic metres per day; 1,825 cubic metres per year
- Average salinity—13,280 ppm total soluble salts
- Weight of salt export—24.2 tonnes per year

The drain is therefore exporting a large volume of saline water before this water has a chance to concentrate by evaporation at the soil surface. A similar drain constructed in paddock Kh (see Figure 2) which has become saline over the past few years, also appears to be working well. It is considered that these drains should control the salt patches and enable a return to normal clover based pastures, and crops. If so, drainage is a practical method of controlling some saline seeps. With predictions based on an understanding of the landscape, it may be used to prevent development of other seeps.

Some saline seeps occur in relatively flat areas covering many hectares of land, and cannot be easily drained in the way described as low gradients of the water table and low soil permeability mean that they are effective only over a local area.

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Fig. 1.—Diagram showing effect of natural clay and rock barrier in banking back saline groundwater and the development of a saline seep
In two such areas on Yalanbee, seismic surveys have indicated the nature of the basement rock. In both of these, high points in the basement form barriers behind which the saline groundwater is banked to form a seep (Fig. 3). Production wells will be drilled to intercept deep weathering zones behind the rock bars, and salt water will be pumped or syphoned to a natural outlet. No results are yet available, but earlier syphoning from a dam which had become salinised gives hope that the method may be effective.

Fig. 2.—Y shaped drain extending above saline seep (dark area) in paddock H, and draining to a naturally salty watercourse.

Fig. 3.—Aerial photograph of saline seep at Yalanbee; outcrops of basement rock behind which saline groundwater has been banked back are indicated.