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IRRIGATION AREAS

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Many irrigation schemes throughout the world have turned into unproductive saline flats and swamps. This dramatic change can occur within a few years of irrigation starting and has been part of irrigation schemes from earliest times up to the present day.

The main cause of this salinisation is normally excess irrigation water use combined with poor drainage. Any form of waterlogging will have an adverse effect on plant growth.

In Western Australia's south-western irrigation area, soils with clay sub-soils or some other impediment to drainage are the most prone to waterlogging. Any form of drainage will have an adverse effect on plant growth.

In summer the watertable must be kept at least 50 centimetres below the soil surface for healthy plant growth. In summer the watertable should preferably be 150 cm below the soil surface, especially where salinity is a problem.

Drainage can also be improved by land-forming and laser-levelling poorly designed, existing irrigation paddocks. Land-forming can lead to improved irrigation efficiency, and the chance to sow better pasture plants.

Drainage methods

Free-draining soils in the south-western irrigation area which are flooded by rain or irrigation are drained by the Water Authority of Western Australia's open drainage system. The main drainage methods used in irrigation areas are:

- Open surface drains,
- Buried tube drains of perforated plastic pipe or tile drains, or
- Pumping the aquifer.

All drainage systems should have drainage channels to remove the excess water. Man-made drains are installed in government irrigation areas, but in private irrigation schemes landowners must ensure that surplus water is not led on to a neighbour's property where it can cause damage or be a nuisance. If a suitable outlet is not available, some arrangement must be made for the safe disposal of effluent.

The Water Authority or the Department of Agriculture should be consulted if there is any doubt about where to dispose of the excess water.

Open surface drains

Open surface drains can remove large quantities of water quickly and efficiently provided the land surface is conducive to surface flows. Where duplex soils occur and the surface soil is free draining, open surface drains can assist in lowering watertables.

Surface drains are relatively cheap to build and are easily maintained. These drains are generally 'U'- or 'V'-shaped and are built with a back-hoe or grader. A tail drain should be built at the lower end of each paddock to remove surplus water. Some farmers with border check irrigation use shallow spinner drains between the borders to help remove surplus surface water.

Tube drains

Perforated plastic drainage pipe consists either of slotted P.V.C. in six-metre lengths fitted together or corrugated, perforated polyethylene coils up to 200 m long. Corrugated piping is easy to lay and is the most widely used piping in the State's irrigation areas.

The plastic piping is laid in a narrow trench, either directly on the trench floor or preferably on a shallow bed of filtering material such as coarse sand or gravel. After the pipe has been laid a filter, preferably of washed gravel varying from five millimetres to 20 mm in diameter and which does not contain any fine material, is laid on top of the pipe. The gravel filter should be at least 10 cm deep. The remainder of the trench is filled with the removed soil.

This type of drain, particularly when sited under permeable topsoils, would normally be between 1 to 1.5 m or more deep. In heavy clay soils the drains are sometimes shallower at 0.6 to 1 m deep.

Gradients of the pipes can vary from 0.1 to about 5 per cent or greater. Gradients below 0.5 per cent can often cause silting in the pipes.
Further reading

Drain spacing and the size of the drain should be considered carefully. Farmers should consult a Department of Agriculture district office for advice on site assessment before starting any work.

Mole drainage
Mole drainage is mainly used to control topsoil waterlogging of heavy soils. A channel is formed by drawing a bullet-shaped implement— the mole— through the soil at a depth of 400 to 500 mm. The depth is usually limited by the heavy draught caused by the mole and the following expander as it is pulled through the soil. A successful mole drain is one in which a stable channel is formed which keeps its shape while continually going through wet and dry periods.

The soil should have a minimum clay content of 30 per cent and be free of large stones. For efficient operation there should be a surface fall or grade greater than 0.4 per cent.

The soil moisture content down the profile is critical to the success of mole drainage. Timing of the operation depends on soil moisture status. The soil surface should be dry enough for efficient traction, and the sub-soil at treatment depth firm but should be plastic enough to be compressed into a channel.

Moles drains are usually constructed one or two metres apart. Such close spacing can cause installation problems from tractor wheel marks if the wheels are not positioned carefully between the drains.

In Western Australia, mole drains normally discharge into an open drain which must allow the mole-formed channels to drain freely and not back water up along the tube, causing it to collapse. Overseas, a combined system of mole drains and tube drains covered with permeable backfill is used. The mole drain channels are drawn over the tube drains so that the bullet of the mole plough penetrates the permeable backfill. Water passes down through the melting fissures to the mole channel and then through the permeable backfill into the drain.

Spacing of the tube drains varies from 20 to 80 m apart depending on soil type, clay content of the subsoil and slope of the land.

Mole drainage is a relatively cheap and simple operation which can effectively drain clay soils provided certain conditions are met.

- The tractor used must be powerful enough to draw the mole channel evenly and continuously through the soil at the specified depth.
- There should be no reverse grades in the area to be drained.
- The plough is designed and adjusted so that the mole travels parallel to the general surface slope, otherwise a distorted and weak channel will result. The expander must leave a smooth channel of adequate size.

- Pipe mains must be constructed to provide an outlet for mole channels in depressions.
- Ditches must be maintained to ensure that the pipe drain outfalls are always clear and submergence of the mole channels avoided.

Irrigation farmers in the Dardanup district have used mole drains for several years. The mole channels must be remade every year at a cost exceeding $100 per hectare for spacings two metres apart. The effects of these drains are not as good as was expected, although waterlogging has been reduced in parts.

Groundwater pumping
Groundwater pumping for drainage is not yet practised commercially in Western Australia, but experimental work has started at Waterloo in the south-western irrigation area and in the wheatbelt. Bores are either laid out on a grid pattern or sited to tap a particular aquifer and pumped to reduce the water level. When the aquifer is 'free' or of high hydraulic conductivity, the groundwater level can be reduced over a considerable area when pumping demand is kept at or near optimum levels.

Work in Victoria by private land owners in the Shepparton district has shown good results from pumping. Watertables are about one metre below the soil surface, and salinity levels are less than 3 300 milligrams per litre total soluble salts (T.S.S.). The pumped water can be reused after dilution with supplied water to give salinities of 440 to 880 mg/L T.S.S.

In the Kerang irrigation area, the pumped water has salinities of 16 500 mg/L T.S.S. and effluent has to be pumped to waste. A similar condition occurs at Mildura.

At Tongala, watertables covering an area of 610 hectares have been controlled by private pumping. Most of this shallow water is suitable for reuse, but two Government controlled pumps have to pump effluent to waste. The cost of private pumping was $20 to $25 a megalitre in 1982-83.

Similar schemes are operating in New South Wales in the Murray Irrigation Area and Murray River Districts. Dilution factors of one part effluent to five parts new water are the maximum feasible in these schemes.

Drainage of orchards
Most orchards in Western Australia are reasonably well drained although wet areas occur on many orchards in the South-West. Drainage of these wet areas using buried slotted P.V.C. or corrugated polyethylene pipe would be beneficial. Cut-off drains would be needed in most orchards to prevent waterlogging downhill and to drain some marshy areas.