



Farm drainage

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February 1998

AG0233

ISSN 1329-8062

Waterlogged pastures over winter and early spring are a common sight on many Victorian farms in high rainfall areas.

Catchment requirements

Drainage of land however can have significant impact on the physical and environmental characteristics of receiving waterways. Drainage works do need to be undertaken with regional oversight and good planning. They should not be developed as a reaction to a single problem.

Catchment Management Authorities have regional drainage powers to enable improved management of catchment drainage for both agricultural requirements and waterway requirements. Land managers should contact the local Authority before embarking on drainage works.

The problem of water logging (or poor drainage) is usually a seasonal problem caused by a relatively impermeable layer at some depth through which water moves only very slowly.

Some of the questions that need to be answered about poor drainage are:

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1. Does this happen each year or is it only a problem in very wet years?

Obviously if it is a regular problem, and lasts for many weeks then it is more important to do something about it, than if it that only happens intermittently.

2. Is there a sufficient outlet?

This is probably one of the most important factors to be considered.

In some areas where the land is relatively flat, there are insufficient main drains either through paddocks or on roadsides to take away excess water quickly.

A further complication is that often these are not deep enough, which limits the ability of the farmer to drain land on his own property. If this is the problem then the only solution is for landholders to have group drainage schemes that enable sufficiently deep and large main drain systems to be dug over a large area, and which are properly maintained so that no harm is done to the environment.

However, on many farms, there is sufficient fall to have adequate outlets so that internal drainage systems can function properly.

3. What type of system should I have?

There are two basic types of drainage systems:

a) **Surface.** This is the first thing that should be looked at in any drainage scheme. Surplus water running over farmland will keep it saturated for longer, reducing pasture growth and increasing problems such as pugging and tractor mobility.

Thus, a paddock should only have to deal with the rainfall falling on it, not also the rain that fell on the paddocks further uphill from it.

Therefore, adequate surface drains need to be installed along fence lines, laneways, depressions etc. so that surface water can be controlled more effectively. Care must be taken to ensure that potential problems such as scouring and erosion are not created by concentrating flows. In some cases surface drains will need fencing off so they can be protected from stock and tractor damage.

For some soils however, surface drainage is not enough, because the soil itself remains saturated once wetted up.

b) **Subsurface.** Once you have taken care of the surface drainage, look at improving the drainage through the soil profile.

The first thing to do is dig up enough soil cores to at least a metre depth, so you have an understanding of what soil types are below the surface. You should then be in a position to assess the kind of drainage system that will best suit your soil type.

Remember that soil drainage aims to take away only the surplus water in the soil. Therefore, you need to know what the soil type is before any works start.

How fast water moves through the soil depends on the soils inherent makeup. Soil texture is perhaps the most important in deciding which system you should use.

Texture describes the amount of clay, silt and sand in a soil, and is usually measured in the field by feel. In general a clay soil which is composed of many fine particles does not let water move through the soil as quickly as a sand which has much coarser particles.

A clay soil holds water better than sand and that is why they are slower to grow pasture after the autumn break and hang on longer in late spring.

Generally soils under pasture have better structure than those often cropped because their higher organic matter content helps hold the soil particles together more effectively. Poorly structured soils make drainage harder.

In many areas compaction caused by stock and tractors is also a problem. You can test this for yourself by pushing a steel rod into the soil. You will notice a hard layer about 100 mm below the surface. This compacted layer slows the movement of water downwards and makes the soil liable to pugging.

The permeability of the actual soil (or hydraulic conductivity) is best measured in spring by auguring a hole in moist soil. This should be done when there is no surface water present. If the hole fills quickly with water (as is the case with sandy and loamy soils) then pipe drains spaced at regular intervals across the paddock is the recommended control. If however, water enters the auger hole only slowly as in a clay soil, then mole drainage is the recommended control. In this case the mole plough physically disrupts the soil profile by heaving and cracking the clay soil creating thousands of tiny cracks through which water will pass down into the mole channel and away.

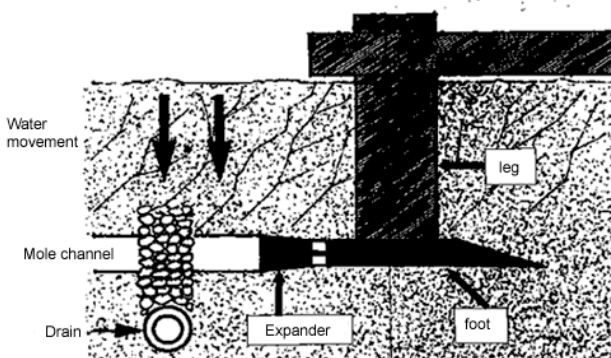


Figure 1. Mole drainage system

For mole drains to work successfully they must be drawn in a stable clay about 400-500 mm below the surface. Spring is the ideal time to pull them as the soil at surface level needs to be dry enough for traction but at moling depth needs to be plastic (so that a pencil like ribbon can be rolled between the palms). If the soil is too wet, the moles are likely to seal over and block, and if too dry, then the channel will collapse prematurely.

There is only a limited time in which to do this. The soil needs to be monitored closely when it is starting to dry out, so that the job is not left too late. The bigger the leg, foot and expander the more horsepower is required and the greater depth needed to ensure a proper channel is formed. A 20 mm leg width, 40 mm diameter round foot and 70 mm diameter round expander should be effective (see Figure 1).

Costs

Pipe Drains

Cost depends on drain spacing, slope and depth which depends on:

- Hydraulic conductivity of soil;
- depth to impermeable layer;
- how quickly you want to get rid of the water; and,
- rainfall incidence.

For drains spaced at 20 m intervals the total cost for trenching, pipe, pipe laying, gravel backfill is about \$2 500 per hectare.

Mole Drains

The major capital cost is for the installation of subsurface collector drains of about \$7 per metre for pipe, gravel, trenching and backfilling. Depending on site conditions (slope, length etc) you would need \$600 - \$1 000 per hectare for these collectors. You can save on this cost in some cases by pulling moles directly from open drains, creeks etc, but the outlets need protection from stock and rodents, and you can only pull one way, thus doubling the time taken.

Moling itself is mainly time and diesel and needs to be done whenever the moles fail which could be as often as yearly on poorly structured soils or hopefully not more than every 4-5 years on better soils.

There are a number of contractors in the Western District who have the necessary machinery and experience to install these drainage systems. Pasture production improvements have been measured by the increased number of grazings over winter and spring. Much of the increased growth occurs in September and early October when it is really needed. A 30% improvement is not uncommon.

There are other advantages such as being able to cut silage and hay and prepare ground for fodder crops at the right time.

Planning

a) **Plan ahead.** Don't expect the drainage contractor to sort out for you a properly designed system in the middle of summer. Get in touch with the contractor when there is a problem (winter) so they can inspect and discuss the options with you more thoroughly. This will give you plenty of time to organise finance and set priorities, and fit into the contractor's work schedule.

b) **Plan it on paper.** Make sure locations of pipes are marked on a farm plan. After a few years you cannot see where the pipes have been laid, so you need a permanent record. Markers on fence lines are also a good idea. Contractors have been known to dig up existing drains because their locations have not been marked. A farm plan is essential if you are to invest in drainage.

Other points to remember

1. Drainage should not decrease the amount of growth over summer. Drains only take away the excess soil

water that can't be held normally within the soil pores. In fact, better drainage leads to deeper root growth and hence better (over time) summer growth.

2. Don't expect a drained paddock to be perfect in that no treading damage will occur when grazed on wet days.
3. It is best to try a small area first before committing yourself to a large investment.
4. Drainage works may qualify for 100 per cent tax deductibility in the year of expenditure. Contact your accountant for details.

References

Argent R.M. and Ewing S.A. (1996)

NRE (1998) Rural drainage in Victoria : Scoping Study.

Department of Natural Resources and Environment.

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