Waterlogging in soil

Symptoms and causes

Waterlogging occurs when the soil profile or the root zone of a plant becomes saturated. In rain-fed situations, this happens when more rain falls than the soil can absorb or the atmosphere can evaporate.

Lack of oxygen in the root zone of plants causes their root tissues to decompose. Usually this occurs from the tips of roots, and this causes roots to appear as if they have been pruned. The consequence is that the plant’s growth and development is stalled. If the anaerobic circumstances continue for a considerable time the plant eventually dies.

Most often, waterlogged conditions do not last long enough for the plant to die. Once a waterlogging event has passed, plants recommence respiring. As long as soil conditions are moist, the older roots close to the surface allow the plant to survive. However, further waterlogging-induced root pruning and/or dry conditions may weaken the plant to the extent that it will be very poorly productive and may eventually die.

Many farmers do not realise that a site is waterlogged until water appears on the soil surface (see picture above). However, by this stage, plant roots may already be damaged and yield potential severely affected.

Key points

- Waterlogging occurs when roots cannot breathe due to excess water in the soil profile.
- Water does not have to be on the soil surface for waterlogging to be a potential problem.
- Improving drainage can decrease the time that the crop roots are subjected to anaerobic conditions.
- Open trenches are the simplest drains and are the first requirement of a drainage system with more intensive drainage such as underground pipes, raised beds or hump and hollow, providing more effective drainage.

Background

Waterlogging can limit agricultural productivity in many areas of Tasmania as the State enjoys relatively high rainfall which normally occurs with an excess of rainfall over evaporation in winter and spring. Many soils experience parts of the year when they are saturated due to high regional water tables, low rates of water conductivity, perched water tables or seepage. Waterlogging occurs whenever the soil is so wet that there is insufficient oxygen in the pore space (anaerobic) for plant roots to be able to adequately breathe. Other gases detrimental to root growth, such as carbon dioxide and ethylene, also accumulate in the root zone and affect the plants. Plants differ in their demand for oxygen and a plant’s demand for oxygen in its root zone will vary with its stage of growth.
Identifying problem areas

Diagnosing your waterlogging problem is the key to achieving success with any drainage. You need to know the source of the water and where it is moving in the soil. This will ensure correct selection of drain type to install and depth of installation. In winter it is easier to identify the limits of wet areas, particularly seepage areas, and to identify soil horizons on which a perched water table occurs. For the initial investigation, dig a series of holes up to one metre deep in and around wet areas. A number of pegs are useful to mark out drainage lines and potential drain locations. Signs of waterlogging to look for on the soil surface include ponding, pugging by stock and ruts from machinery, poor crop establishment and growth, and patches of excessive weed growth.

Benefits of improved drainage

Reducing the length of time soils remain waterlogged by the installation of appropriate drainage systems, results in greater ease of soil management, increased plant growth by improving aeration and soil temperature, plus control of plant diseases. Improving drainage results in the soil becoming friable rather than plastic, and less likely to be compacted or pugged. A more aerated soil encourages organisms which metabolise organic matter and stabilise soil aggregates. Improved drainage increases the depth of aerated soil allowing plant roots to explore a greater soil volume. This increases the pool of nutrients available, and with a greater volume of soil to draw on for water, plants are able to continue growing for longer during dry summer periods, which is often one of the unexpected benefits of improved drainage. Drainage can lessen the incidence of fusarium and phytophthora root rots which can occur when plants are stressed by waterlogged conditions and poor aeration. Poor soil drainage may be limiting plant growth to the extent that no responses are gained from increased fertiliser use. Drainage is also an important way of improving working conditions by removing the unpleasantness of muddy, wet soil.

Types of drainage

Drainage is carried out either on the surface or underground depending on the diagnosis of the problem. Surface drains can be open arterial ditches, grassed waterways or hump and hollow. Underground drains can be pipe drains, mole drains, or deep ripping. Surface drains are a minimal investment, last a long time provided stock are excluded, and can always be deepened or moved. Different soil types require different solutions to drainage problems. Plan your drainage in the winter, but install drains in the summer.

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