

## Aeration Deficit

The following table is a summary of the key issues relating to aeration deficiency. This table is intended for use by field staff as a quick reference tool.

<p><b>Abiotic Disease:</b></p>	<p style="text-align: center;"><b>Aeration deficit</b> can be either <i>Acute</i> or <i>Chronic</i>.</p> <p><i>Acute</i> deficits occur when oxygen levels are well below a critical level for a short period such as a few hours or days. Symptoms include wilting, leaf drop, necrosis, blackening of soil and roots, a foul odour may come from the soil and/or roots. These symptoms can cause the death of a plant in a short period. Acute deficits are more likely to be caused by <b>anoxic</b> conditions (no available oxygen)</p> <p><i>Chronic</i> deficits persist over an extended period perhaps weeks or months. The oxygen levels are slightly below the critical level causing a slower decline of vegetation. Symptoms include initial slow plant growth and reduced shoot elongation and leaf size. This can be more difficult to diagnose as the symptoms and conditions affecting the tree are less obvious. Occasionally in some adaptable tree species lenticels may develop on the stem and adventitious roots may appear. In some species cankers may appear with exudate coming from the canker. Chronic deficits are more likely to be caused by <b>hypoxic</b> conditions (little available oxygen)</p>
<p><b>Symptoms:</b></p>	<p><b>Above ground:</b>      Necroses, reduced shoot elongation and leaf size, wilting, overall anaemic appearance,</p> <p><b>Below ground:</b>      Rotten egg smell in soil and roots (sulphur gas), blackening of the roots and soil, change in plant tissue colour (purple-black), roots are flimsy rather than firm and rigid, saturated soil</p>
<p><b>Look alike disorders:</b></p>	<p style="text-align: center;">Root infection, salt burn, gas injury, herbicide injury, <b>water stress</b>, nutrient deficiencies</p>
<p><b>Diagnosis:</b></p>	<ul style="list-style-type: none"> <li>• Check soil moisture content by digging, probing or using a tensiometer</li> <li>• Ask local grounds staff about irrigation practises, and perform an infiltration test</li> <li>• Check the colour and smell of the soil</li> <li>• Check the colour and feel of root</li> <li>• Determine surface drainage, does water pool in a low laying area</li> <li>• Check the sub drainage is there a hard pan preventing drainage</li> <li>• Check bulk density of the soil against the texture class, is it above the critical level</li> <li>• Check whether surface grade has fill placed over the top of the original level</li> <li>• Evaluate soil organic content, is there too much</li> <li>• Evaluate hard surface area, can adequate oxygen enter the soil around the roots</li> </ul>

<b>Cause of Aeration Deficit:</b>	<b>Solution to problem:</b>
<b>Over irrigation</b>	Monitor irrigation rate, determine infiltration rate and adjust irrigation levels to suit, allow soil to dry between cycles.
<b>Soil interface problems</b>	Remove excess potting soil from around root crown area before planting stock and backfill with site soil. Avoid over irrigation around planting area and provide sub drainage beneath new plantings by cultivation or/and installing a porous sub base, Or provide drainage via mechanical means by incorporating Ag pipe into the plantings to allow water movement from the area.
<b>Poor Drainage</b>	Install drainage pits or water collection points such as ponds, alter gradient, install drainage lines
<b>Fill over the top of original soil level</b>	Attempt to remove fill back to original level, pull back soil from trunk and install retaining wall at least 5x trunk diameter away from trunk to reduce level of fill over TPZ, if fill is to be used apply coarser soil texture.
<b>Area covered in Hard surfaces</b>	Wear possible limit hard surfaces and replace with mulched garden beds, replace hard surface with porous material. Use segmented paving to allow some porosity between connections around plantings.
<b>Compacted soils</b>	De-compact soil via radial trenching, probe soil with air spade and backfill with loamy sand, incorporate organic material, cultivate surface where appropriate, and replace soil where appropriate with greater porosity soil type.
<b>Excessive organic matter</b>	<p>Although rare, if abnormally high amounts of organic matter is mixed into or covers the soils surface an oxygen deficit can occur. Microorganisms use oxygen throughout the decomposition process and this may cause a deficit. The heat generated during this process may also cause decline.</p> <p>Organic matter should never be buried, waterlogging would be almost inevitable.</p>



Over irrigation and poor drainage



Purple sulphur bacteria, stains live tissue purple in anoxic conditions



Soil interface issues, water pooling between interface



Buried organic matter saturated with water





Buried organic matter saturated with water



Buried organic matter saturated with water

**References:**

Costello, Edward, Matheny, and Henry, 2003, Abiotic disorders of landscape plants, a diagnostic guide.

Roberts, Jackson and Smith, 2006, Tree roots in the built environment

**Photographs:**

Mark Hartley 2009

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