

## Aeration in nursery water storages

Water storages in nurseries used for the collection and holding of wastewater from crop production activities will require aeration to maintain water quality over time. Any process that is capable of adding oxygen to the water could be considered a form of aeration. Oxygen dissolved in the water is a major factor in maintaining water quality in any water storage facility, and is utilised by fish and other aquatic organisms as well as the aerobic bacteria that decompose organic matter.

Aeration of lakes, dams and ponds occurs naturally with air exchange at the water surface, through inflows of oxygen rich water from drains and streams and via the release of oxygen from actively growing aquatic plants. Storages containing nursery wastewater generally need assistance to maintain suitable oxygen levels. Nursery wastewater storages generally contain high levels of nutrients derived from container leachate that can vary throughout the season. Nutrient rich wastewater can enter the storages during rain events or irrigation especially after major planting activities causing algae and aquatic weeds to flourish. Fine organic particles from the growing media are also often introduced into the water storage after rain or irrigation again particularly immediately after planting activities as the growing media settles in the containers. These organic particles add to the turbidity levels in the water before eventually settling on the bottom of the storage and decomposing.

Nursery wastewater storages regularly become thermally stratified, maintaining temperature layers at different depths and not mixing together. The lower layers of stratified water are protected from surface wind movement and wastewater inflows which maintains the bottom layer as the coldest in summer and often the warmest during winter. Storages can sometimes invert or turnover during Autumn causing the anaerobic bottom layers to come to the surface.

Air can be introduced into a water storage facility at the surface in a number of ways to both reduce the stratification and increase the dissolved oxygen improving the water quality.

Fountains aerate by collecting the surface water and propelling it into the air via an impeller or pump to form small droplets with a large surface area through which oxygen can be transferred before the drops fall back to the water surface. Fountains provide a pleasing aesthetic appearance however they produce a limited area of oxygenated water and provide little de-stratification or circulation of the water.

Paddlewheel aerators (most often used in aquaculture) stir up and splash the water surface causing oxygen transfer to the disturbed water. Paddlewheel aerators are similar to fountains in producing some degree of oxygenated water with little de-stratification and also increase evaporation losses.

Bubble aerators introduce air from a compressor onshore through a hose to diffusers located on the bottom of the water storage. The bubbles can be large or small, releasing oxygen into the water as they make their way to the surface resulting in some localised circulation and mixing of the stratified layers. Small bubble aerators are more efficient in introducing oxygen into the water than large bubble aerators due to the increased surface area of the bubbles and longer time taken by the smaller bubbles to reach the surface, however large bubbles circulate more water causing some mixing of the layers.

Circulation aerators utilise an impeller to circulate the water while injecting air into the water stream usually through a venturi to de-stratify and aerate the water simultaneously. The units are generally mounted on floats on the water surface and the units can be angled to circulate into the deeper water forcing it to mix with the various stratified layers.

Aeration within water storages in nurseries is undertaken to improve the water quality and increase the aerobic bacteria population. De-stratifying the storage is encouraged to minimize the development of

anaerobic zones that may affect water pH and contribute to algal growths causing filtration and disinfection issues.

Circulation aerator systems commonly seen in nursery water storages are designed to fully turn over the water storage three to four times each day. This full turn over can be achieved using off peak electricity however during summer when the stratification potential is at its peak, some system operation should be conducted during the daylight hours.

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