Dam Water Quality Workshop: How to manage algae, aquatic weed and iron issues in dams

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A workshop on dam water quality was organised on 20 March 2024 by Local Land Services (LLS), New South Wales Department of Primary Industries (NSW DPI), Berries Australia and Landcare. The workshop took place on John and Amrit Atwal's farm in Sandy Beach, NSW where we had more than 30 growers and industry representatives attend the workshop.

Issues surrounding source water quality and potential rectifications were discussed in great depth. We also had the 'Dam Doctor' available to answer questions on rectifying water quality issues. In John and Amrit's case, their dam had been taken over by Water hyacinth (*Eichhornia crassipes*), which is classified as an invasive weed. They had been struggling to control and remove the weed from their dam for some time, even with herbicide applications.

Weeds not only reduce the amount of dissolved oxygen (DO) in the water, but the breakdown of plant parts also leads to increased turbidity and blockages in the filter. Blocked filters are a common issue almost all growers face, which leads to poor fertigation pressure in the block, reduced distribution uniformity in fertiliser application, commonly resulting in reduced productivity and in extreme cases plant death.

The reduction of DO in irrigation water is also well documented to increase susceptibility to certain pathogens and reduce nutrient uptake efficiencies.

Due to the scale of the water hyacinth affecting the dams surface area, killing the weeds with herbicide would only increase plant decaying matter and turbidity, and would take a significant amount of time to self-rectify. Therefore, the best solution was to mechanically remove the majority of weeds before spot spraying the remaining weeds.

Poor water quality can be avoided by understanding and addressing individual issues. The following are common issues that affect water quality and ways to maintain or rectify the issues.

(Top) Workshop attendees viewing the dam where the dam doctor showcased some aeration technology (Bottom) Water hyacinth invasive weed has taken over a substantial surface area of the dam.
Photo credits: Melinda Simpson & Gaius Leong, NSW DPI

Algae

Algae are small forms of plant life that exist in a wide range of habitats. In water sources, algae occur quite naturally in both fresh and brackish waters. Like all plant life, algae respond to sunlight and fertilisers, and when environmental conditions are right, excessive algal growth will occur.

When algae die, their decomposition depletes the oxygen levels in the water source. If too much oxygen is lost, further water quality problems can arise, including the release of iron and nutrient from sediments.

As little as 0.01 mg/L phosphate in freshwater sources stimulates the growth of algae and other aquatic life that may clog irrigation systems

Figure 2. Algae on dam. Photo credit: Canva

How to PREVENT algal blooms in water sources

The best way to manage algal blooms is to prevent them from happening. A key long-term strategy is to improve nutrient management and erosion control on your farm.

Nutrient management

Algal blooms are often fuelled by excessive nutrient levels, particularly phosphorus and nitrogen.

Implementing best management practices to reduce nutrient inputs into the dam can help prevent algal growth.

Vegetative buffer zones

Establishing vegetative buffer zones around the dam can help filter out nutrients and sediments before they reach the water.

Planting native vegetation along the shoreline can also help stabilise soil, reduce erosion, and provide habitat for wildlife, further contributing to water quality improvement.

Aerobic bacteria

Aerobic "oxygen-loving" bacteria are naturally occurring organisms and already live in your dam; their populations are just very tiny. Encourage their populations to grow and the bacteria will consume more organic material (a.k.a. sludge) and pull more nutrients from your water. Eventually, these microbes consume so much of the available nutrients that the algae starve and die.

Aerobic bacteria feed on the organic material in sludge (e.g. dead leaves, aquatic weed seeds, algae spores) breaking it down, so it begins to disappear altogether

How to TREAT algal blooms in water sources

Aeration

Aeration systems can help increase oxygen levels in the dam, which can inhibit algal growth and promote the growth of beneficial aerobic organisms. Surface aerators, diffused aeration systems, or fountain aerators can be installed to enhance oxygenation and circulation in the water.

Probiotic treatments

A probiotic treatment (like Biostim®, REGEN-Sediment® or Bioenzymes Pond Maintain®) involves actively feeding the "good" microbes in your dam. This encourages populations of aerobic bacteria to grow. They eat the sludge on the floor of your dam and consume nutrients like nitrogen and phosphorus, thus outcompeting algae.

Floating islands

Floating islands are made up of buoyant mats which are planted with vegetation. The islands help with nutrient reduction much the same way as aeration and biological treatments. The key is the large, exposed root mass of the plants, which draw phosphorous directly from the water and provide habitat for bacterial populations that consume nitrogen.

Algaecides and peroxide based treatments

Algaecides work by releasing chemicals that attack algae cells and break them down preventing reproduction and spread. There are many products available, with some of the most common commercially available products in Australia being COPTROL®, Cupricide®, Kuparimine® and REGEN-Algaemaster®. (Please note: other products may be available and effective, these are provided as they are commonly used options).

It is important to note that algaecides do not clean up the algae once it's dead. This dead material eventually decays, adding more nutrients to your dam that can feed future algal blooms. Therefore, it should be used in conjunction with a probiotic treatment that will help to break down the dead algae before it adds additional nutrients to the water.

Peroxide based treatments like AlgaeLift® helps lift algae off surfaces and makes it easier for naturally occurring bacteria to degrade it. AlgaLift® is best used with in combination with probiotic treatments and aeration.

Figure 3. Aeration system installed in a dam at a berry farm. Photo credit: Melinda Simpson NSW DPI

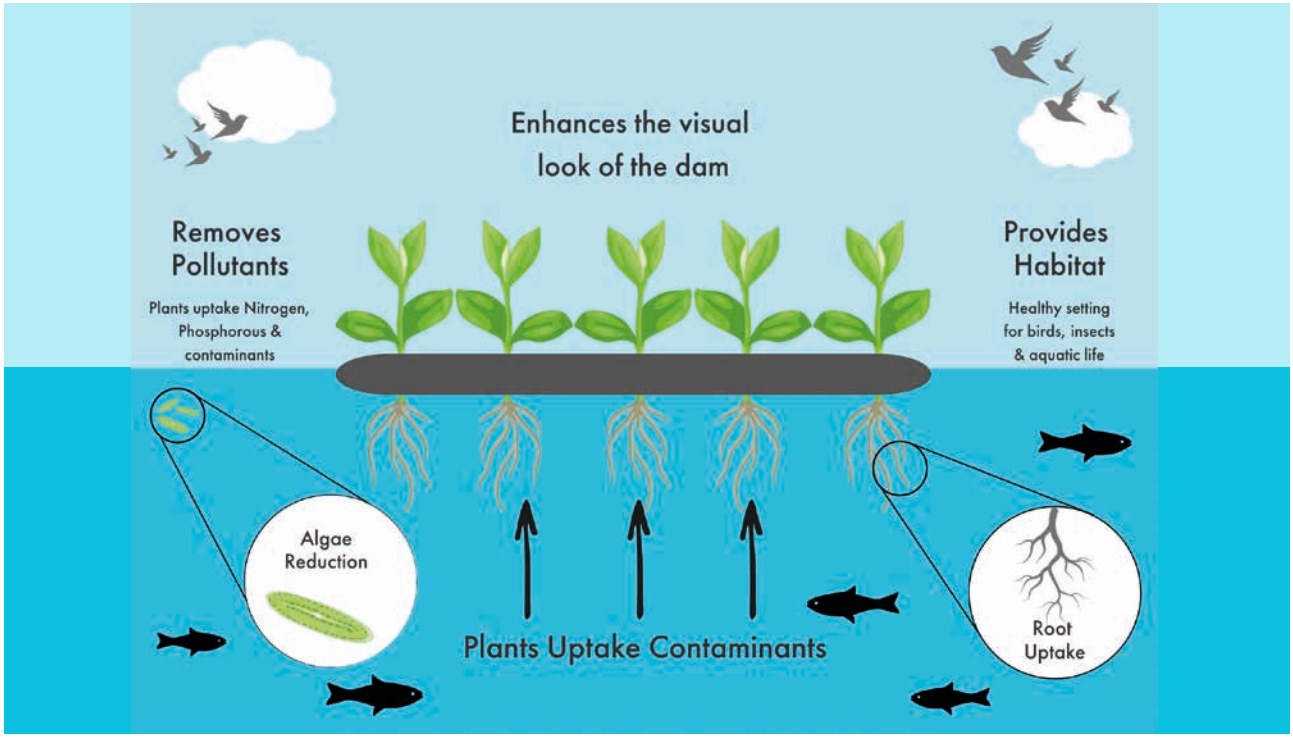

Figure 4. What a floating island can achieve in a dam

Aquatic weeds

Aquatic weeds are plants that invade watercourses, dams and wetlands. These weeds are extremely detrimental to the aquatic environment, where they choke waterways, alter oxygen levels and reduce light penetration.

Figure 5. Water hyacinth on a dam in Woolgoolga, NSW. Photo credit: Melinda Simpson NSW DPI

Some water weeds need to be reported. Report suspicious weeds to the local council weeds officer.

How to treat or prevent aquatic weeds

Aeration

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Probiotic treatments

A probiotic treatment (like Biostim® or REGEN-Sediment®) involves actively feeding the "good" microbes in your dam. This encourages populations of aerobic bacteria to grow. They eat the sludge on the floor of your dam and consume nutrients like nitrogen and phosphorus, thus outcompeting aquatic weeds.

Mechanical removal

Mechanical removal involves the removal of the plant biomass from the water body using specially designed harvesters or equipment. The benefit of mechanical removal is that there is less plant material to break down and provide nutrients for aquatic weed growth furthermore the water can be used straight away compared to restricted use following herbicide use.

Figure 6. Mechanical removal of aquatic weeds using an excavator. Photo credit: Melinda Simpson, NSW DPI

Herbicide

Killing weeds and leaving them in the dam is likely to release a lot of nutrients and make the water less attractive therefore using herbicides is generally a last resort and should only be used in extreme cases or only for spot spraying.

Not all herbicides can be used on aquatic weeds. Check labels before applying in aquatic areas. If using the water source for irrigation, ensure the product chosen and its use will not affect the crop you are irrigating.

There are specially designed herbicides for aquatic environments and therefore you should always read the label before use. Table 1 outlines herbicides that can be used for aquatic purposes.

Iron

Soluble iron and iron-loving bacteria can cause blockages in pipes, drippers and sprinklers and can damage equipment such as pressure gauges. If water with high soluble iron is applied by spray, it can discolour leaves and reduce the efficiency of transpiration and photosynthesis.

Figure 7. A net is used to clean up the remaining floating weed after the excavation has finished
Photo credit: Melinda Simpson, NSW DPI

Figure 8. Iron sludge in pipe. Photo credit: Canva

Irrigation systems used for fertigation should not use water high in iron. Injecting unchelated phosphates or calcium salts into the water will accelerate the precipitation of iron and should be avoided.

Table 1. Aquatic herbicides and their uses

Active	Example products	Targeted aquatic weeds	Comments
Diquat as diquat Dibromide	AQ200 Aquatic Herbicide®	Submerged aquatic weeds	Spray diluted evenly across the water's surface
Diquat as diquat Dibromide and wetting agent	AQ200 Aquatic Herbicide® and wetting agent	Free floating aquatic weeds	Spray diluted product and wetting agent mix directly onto aquatic weeds
Glyphosate	Roundup Biactive®	Aquatic weeds	Avoid spraying across moving bodies of water, or where weeds do not exist

How to reduce iron in water sources

Iron is soluble in water where there is little or no oxygen. Oxidising the iron makes it form solid particles that can then settle out of solution or be caught in a filter. The recommended treatment to remove iron is oxidation, sedimentation and then filtration.

Aeration and settling

Aeration and settling is an inexpensive method of iron removal. Aeration can be done by either spraying the water into the air, bleeding air into the intake side of a pump, agitating the water with propellers or paddles or cascading it over baffles into a settling tank.

The iron then settles out of the aerated water. As iron is more soluble at lower pH values, the best precipitation is likely to occur at a pH of 7.2. You can add hydrated lime, that is, calcium hydroxide $Ca(OH)_2$, to raise the pH values.

In dams, problems caused by iron can often be reduced or eliminated by attaching the suction pipe of the pump to a raft or drum to bring it within 20 to 30cm of the surface.

You can read about a simple chlorine dosing system used to manage bacterial iron in bore water on the website Resource Library at berries.net.au/resource-library by typing 'chlorine' into the Search box.

Oxidation

Iron in water is often present in a soluble, ferrous (Fe^{2+}) form. Oxidising agents such as chlorine, potassium permanganate, or hydrogen peroxide can convert soluble ferrous iron into insoluble ferric (Fe^{3+}) iron, which can then be removed by filtration.

Chlorination can be used to control iron deposits if pH is below 6.5 and the iron concentration is less than 3.5 mg/L (3.5 ppm). If pH is above 6.5, the iron concentration must be below 1.5 mg/L (1.5 ppm) to use chlorination effectively. Chlorine also kills iron bacteria on contact.

Potassium permanganate is often used with manganese greensand, which acts as a filter, trapping the oxide. The main advantage of potassium permanganate oxidation is the high rate of reaction, which is many times faster than that of chlorine. The reaction is not sensitive to pH within the range of 5 to 9.

References and more information

NSW DPI 2014, Farm water quality and treatment, Agriculture NSW Water Unit
https:/www.dpi.nsw.gov.au/__data/assets/pdf_file/0013/164101/Farm-water-quality-and-treatment.pdf

The Dam Doctor
https:/thedamdoctor.com.au

Water quality solutions
https:/waterqualitysolutions.com.au

Love my dam
https:/lovemydam.com.au

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