Department of Primary Industries
primefact

Farm water quality and treatment: Algae

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Agriculture NSW Water Unit

Farm water comes from a number of different sources and so its quality varies. Water sources include dams, bores, wells, rivers, town water, channels and recycled water.

Water from various sources may be of an unsuitable quality for its intended use for irrigation, stock, household or other farm activities.

It is important to identify and correct water quality problems that may affect on-farm use and productivity.

Knowing your water quality

If you have any doubt about the quality of water you intend to use for irrigation, stock or domestic purposes, get it tested by an accredited laboratory. You should have your water tested before you plan to irrigate potentially sensitive crops, and at various other times, as required.

Your Local Land Services advisory officer can assist with information which is relevant to your farm system and options to manage specific problems in your water supplies.

Knowing your water quality allows you to plan for water treatments to avoid problems such as poor plant growth, blocked irrigation or stock watering pipes, staining and other undesirable effects of poor water quality.

Water quality issues

Problems with water quality may be chemical (for example, acidic or alkaline water or concentrations of certain elements) or physical (for example, plant growth such as algae). Some problems may be more obvious than others, and some may require more extensive treatment.

Water quality can affect plants, soils, livestock, irrigation equipment, domestic use and general farm activities.

This Primefact discusses the issues related to the treatment and control of algae.

Algae

Algae are small forms of plant life that exist in a wide range of habitats. They are commonly thought of as aquatic organisms but many are terrestrial or live in association with other organisms like fungi and animals. They lack roots, stems and leaves, but, like other plants, have **chlorophyll** as their primary photosynthetic pigment.

Algae occur naturally in both fresh and brackish water sources. Like all plant life, algae respond to sunlight and fertilisers, and excessive algal growth will occur when environmental conditions are right. For example, excessive algal growth (Figure 1) can occur when nutrients, particularly phosphorus and nitrogen, pollute the water. As little as 0.01 mg/L phosphate in freshwater lakes and streams stimulates the growth of algae and other aquatic life that may clog irrigation systems and make water unpalatable to stock.

As well as responding to excessive nutrients, algal blooms are most likely to occur when:

- the water is calm
- the water temperature is warm (above 20 °C)

- there are low or no flows
- the water is fairly clear
- pH is slightly alkaline
- dam water layers are stratified and do not mix.

Algal blooms have occurred even when the above conditions were not present.

Figure 1. Algal growth can block irrigation equipment and may affect human health.

Excessive algal growth can affect the taste of drinking water, produce odour problems, block pump foot valves, clog filters, reduce the aesthetic and recreational amenity of water bodies and affect water treatment processes.

Some algae produce toxins that can cause stock deaths and affect human health.

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; harmful effects on fish and other aquatic animals; and the production of noxious gases such as hydrogen sulphide.

A considerable range of algae species is found in freshwater. These include green algae, blue-green algae, diatoms, dinoflagellates and cryptomonads.

- Green algae are the most diverse and may be microscopic or present as large clumps or mats of tangled filaments.
- Diatoms, dinoflagellates and cryptomonads are generally only visible under a microscope.
- Blue-green algae are also microscopic but large colonies and aggregated filaments can be visible in water.

Algal blooms result from the excessive growth of a particular algae species. The most obvious sign of an algal bloom is a discolouration of the water. For example, diatoms and dinoflagellates discolour the water to a brown hue; green and blue-green algae make it appear green; and some cryptomonads make the water appear red.

All algal blooms can cause water use problems. However, those caused by blue-green algae are the most concerning as a number of these are toxic.

Blue-green algae

In Australia, there are a number of genera of cyanobacteria, or blue-green algae that are toxic. They include *Dolichospermum* (formerly *Anabaena*), *Microcystis, Cylindrospermopsis* and *Nodularia*. In NSW,

Dolichospermum and *Microcystis* are the most common types of freshwater blue-green algae causing blooms. *Dolichospermum* generally grows in rivers and lakes and *Microcystis* is often found in lakes and reservoirs.

Blooms may be seen as a green colouration in the water or as a surface scum. Scums are often green or blue-green and vary in consistency from paint-like slicks to small green floating dots.

Toxic blue-green algae can produce three different forms of toxins:

1. Hepatotoxins attack the liver and other internal organs. They can cause gastroenteritis, nausea, vomiting and muscle weakness.

2. Neurotoxins affect neuromuscular performance and can lead to paralysis and respiratory arrest.

3. Lipopolysaccharides are skin irritants that can cause dermatitis and conjunctivitis. They may also cause stomach cramps, nausea and fever if consumed.

If you suspect blue-green algae are in your water, contact Local Land Services or the NSW DPI Water for advice. Confirming the species present, cell count or biovolume per volume of water and, if required, presence of toxins, are key steps to determine the risk to water quality and associated uses. In the interim, do not use the water for stock watering or domestic or recreational use, and do not allow stock to graze algal mats.

Effects on irrigation water

Risks must be assessed if considering use of water contaminated by blue-green algae for irrigation. Human and animal health may be threatened if contaminated water is applied directly to crops and pastures as many toxins are very slow to break down and may be incorporated into vegetative matter and then ingested. Do not use water that has blue-green algae in it directly on plants being grown for human consumption. This is particularly so for spray-irrigated salad and leafy vegetables, as dried algal cells on the leaves can remain toxic for several months. As a rule, all fresh produce such as fruit and vegetables should be washed thoroughly with clean uncontaminated water before eating, regardless of water source and conditions.

Potential for BGA toxins to accumulate in plant tissues, soil and groundwater at the field-scale requires investigation. Toxins may potentially accumulate in some soil types and threaten groundwater quality.

Effects on livestock

Livestock can die from drinking contaminated water. The toxins can cause scouring, red urine, liver damage and sudden death in cattle and sheep. Surviving animals show photosensitivity, which is a form of sunburn restricted to white areas of cattle and the nose and ears of sheep. This may affect feeding and result in cows refusing to suckle their young. Milk production may decrease in dairy cows. Scouring occurs with poultry, resulting in reduced egg production. Deaths have also been recorded in bees and dogs, and toxic algae have been implicated in the death of wildlife.

Effects on domestic usage

You should not cook, bathe, wash your clothes or swim in water affected by BGA. Skin contact through showering or swimming may result in skin irritations, swollen lips, sore throats, eye and ear irritations, rashes and hay fever symptoms. Drinking affected water may result in diarrhoea, nausea, vomiting and muscle weakness. Boiling the water will not reduce the effect of blue-green algae toxins. See your local doctor immediately if you experience symptoms you think result from blue-green algae in your water.

Treatment

If an algal bloom is suspected, you should find an alternative supply of water for domestic, stock and irrigation use until the algae is identified. 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. This will help control blue-green algae in your farm dam and assist with management of blue-green algae in rivers and creeks.

Algae will not grow in total darkness, so cover the top of domestic storage tanks to exclude all light. Do not use translucent fibreglass tanks.

Artificial aeration can help mix up the water and add oxygen in farm dams. This may help control accumulations of soluble iron, ammonia and hydrogen sulfide, as well as help to control algal blooms.

Aeration can be achieved in a number of ways. The simplest method is to cascade the water into a holding dam or tank. Alternatively, an aerator like the one pictured in Figure 2 can be used.

Figure 2. An aerator will help keep algae levels low

Chemical dosing to control algae

At the time of publication (2017), in NSW, only Coptrol Aquatic Algicide®, Cupricide Algicide® and Cupricide 110 Algicide® are approved for the control of blue-green algae, green algae, diatoms and flagellate algae. These products must be used in strict accordance with their label conditions and directions. These products contain copper as mixed complexes and are registered for use in farm dams, rice paddies and irrigation conveyance systems. **They must not be used** in rivers, streams, creeks, wetlands, lakes or billabongs, and water treated with these products must not be allowed to spill into these water bodies. Their conditions of use further prevent their application when birds are feeding on algae or in water containing fish.

As with all chemicals, read the instructions before use and wear the appropriate safety equipment.

Note: Do not treat drinking waters used by farm animals grazing on heliotrope or ragwort.

Alum and gypsum as a combined dose may be used to protect small dams from blue-green algae, as they remove phosphorus from the water. Gypsum appears to be less effective if pH values in the water are below 10.

Dosing procedure (farm dams only)

Add the granules of alum crystals to the water and mix well. You could perhaps use a boat with an outboard motor to mix in the crystals. Let the water stand for a few hours, and add the gypsum granules. Let the water stand for at least 24 hours, or until it clears. If it does not clear within two days, add 25 to 50 per cent of the recommended dosage of alum and gypsum to promote settling. After dosing, check the pH of the water with a swimming pool testing kit. The pH should be in the range 6–9. If it is not, allow the water to stand two days and check again.

Dosing with alum and gypsum is only appropriate for farm dams, and must not be applied to natural waterways. Ideally dosing should be carried out before summer, and certainly before a bloom has developed. The recommended dose for a farm dam is 50 kilograms of alum and 50 kilograms of gypsum for each megalitre of water. Because of variations in water quality and algae, it is advisable to conduct a preliminary trial in a “44-gallon drum” (200 litre container) to establish the correct dosage.

Activated carbon

Activated carbon filters have long been used to improve the taste of, and reduce odours in, domestic water supplies. They can also be used to remove many types of blue-green algae toxins.

Activated carbon is a processed form of charcoal and comes in two types— granular activated carbon (GAC) and powdered activated carbon (PAC). GAC filters offer the better method of treatment, particularly when algal blooms are a regular occurrence. The level of toxin removal is dependent on contact time, flow rate and the extent to which the filter has previously been used.

In-line GAC filters are commercially available for use at a domestic level. Filter the water through a conventional sediment filter before passing through the carbon filter. This will remove larger particles and increase the life of the carbon filter.

Further reading and references

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