

Irrigating with blue-green algae affected water

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Water & Irrigation Unit

Many landholders use river water and farm dams to irrigate crops. These water sources are vulnerable to blue-green algal (BGA) blooms and may become contaminated. This Primefact is designed to assist irrigators who may irrigate with BGA-contaminated water.

What are blue-green algae?

Blue-green algae, also known as cyanobacteria, are the most ancient of all photosynthetic organisms.

Only a few species of blue-green algae produce toxins that are harmful to humans, stock, domestic animals and fish, but these species are common in still waters in New South Wales. The toxins can cause liver and nerve damage and may lead to death.

Blue-green algae cells, scums or mats can clog irrigation syphons, filters, valves and sprinklers. Any produce irrigated with BGA-affected water may well be scrutinised for health impacts on consumers, because of possible toxins. Care is required to manage risks associated with using BGA-contaminated irrigation water.

Does my farm dam or river contain blue-green algae?

If you suspect a water source contains blue-green algae or if you observe any of the following signs, you should not touch or use the water in any way until the algae have been identified by an expert (in the field or in the laboratory). 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.

BGA blooms discolour the water. Surface scums may be present, and the water can appear olive, greenish-yellow, or white. Blooms may look like

paint, oil slicks, ropy lines, or tiny green flecks in the water. This appearance may change with the time of day or changing weather conditions. In some cases scums may not be visible at all.

Surface scums can be blown around by the wind, and so may be concentrated at different places at different times. Some algae contain gas vacuoles to regulate buoyancy. This means the algae may be found at different depths during the day, depending on their light and nutrient needs, and you may not always see a surface scum.

You may also notice an unpleasant odour. For example, the water can smell musty or earthy.

How can BGA-contaminated water affect health?

Algal toxins can affect human and animal health when swallowed, through skin contact (such as handling irrigation equipment), or when contaminated spray mist is inhaled.

People with a high exposure to blue-green algae, such as water treatment plant staff, have a greater risk of developing skin and other health problems. Skin irritants in blue-green algae affect approximately 30% of people, and those who have asthma, eczema or hay fever are thought to be more susceptible to blue-green algae. If you have occupational exposure to blue-green algae, seek advice.

If anyone has any medical conditions, such as gastroenteritis or skin rashes, that might have been caused by body contact or from eating vegetables irrigated with BGA-contaminated water, they should seek medical advice.

How can BGA-contaminated irrigation water affect plants?

Are toxins produced by BGA taken up by plants when they are irrigated with BGA-contaminated water?

We are not certain!

Through the roots: Current evidence suggests that toxins can be absorbed through the root system of plants.

On leaves and surfaces: Fruit and vegetables with enclosed edible portions are not known to absorb toxins. Toxins may remain viable on the surface of plant parts for long periods and can also lead to physical and cosmetic damage.

Of most concern are the leafy vegetables, such as lettuces and cabbages, where water may pool on the vegetable surface and leave a dried, concentrated residue. Toxins produced by blue-green algae are heat-stable. Research has shown that dried blue-green algae cells may remain toxic for several months.

The general guidelines for edible plants are:

- Do not use a BGA-contaminated water source on edible plants if you have an alternative supply;
- If you have no other supply, avoid direct overhead spray irrigation on the edible part of the plants.

Irrigating crops with BGA-contaminated water

Potential for BGA toxins to accumulate in plant tissue, soil and groundwater at the field-scale requires investigation. Research on risks from BGA and associated toxins in irrigation water is generally based on small-scale laboratory studies on seedling plants. Applying this information to the field-scale or commercial context is challenging. Toxins may potentially accumulate in some soil types and threaten groundwater quality.

Risks must be assessed if considering use of water contaminated by blue-green algae for irrigation. **Commercial producers** are advised to undertake a food safety risk assessment. Methods for sample preparation and analysis of toxins in produce, and suitable sampling procedures to confirm food safety, will likely require specific development.

Where there is no direct water contact with the edible parts of the plant, for example where under-tree sprinklers are used (such as stone fruit), or with a drip irrigation set-up where water does not touch the edible parts of the crop, levels

of risk from irrigating with BGA-contaminated water are likely reduced. Some investigations have shown toxin uptake by plants. Factors affecting potential risk vary and include:

- type and concentration of toxins in the irrigation water at each irrigation;
- amount of in-crop rainfall relative to the amount of irrigation;
- type of crop (perennial or annual, tree or herb, tendency to absorb and translocate toxin, and capacity to metabolise or detoxify);
- soil type, its capacity to bind toxins, and presence of soil bacteria able to degrade toxins; and
- amount of produce eaten (portion/serving size, preparation, and how often the food is eaten) (potential daily dose).

Vegetables and fruit

It is recommended that water contaminated with BGA should not come in contact with plants being grown for food. This is particularly important with plants such as grapes, strawberries, cabbages, lettuces, tomatoes and other salad vegetables, as toxins may be concentrated on surfaces.

Consumers should note that, before use, all fruit and vegetables, particularly salad vegetables which are consumed raw, should be thoroughly washed and rinsed with fresh, clean water.

Algal toxins are water soluble and have been shown to be taken in by plant roots but the degree of toxin absorption by leaves and other surface plant parts wetted during irrigation or translocated from the roots is not known. Algal blooms are generally associated with poor water quality due to a range of factors and thorough washing of fruit and vegetables with clean, fresh water is recommended to reduce potential for harmful effects associated with plants irrigated with water of unknown or poor quality water.

Pasture and livestock forage/fodder crops

As toxin level cannot easily be assessed, risk may be reduced by:

- Irrigating soon after grazing or harvest when leaf area is small as new growth can dilute toxin levels;
- Avoiding repeated irrigations with BGA-contaminated water;
- **Keeping stock off pasture irrigated with BGA-contaminated water for at least seven days after irrigation ; and**

- Ensuring the suspect feed makes up only a small proportion of an animal's diet and that drinking water is BGA-free.

A deferment period of at least seven (7) days between irrigation and grazing has been used as an advisory guideline for some years and no adverse effects have been reported.

This precautionary guideline is comparable to the grazing deferment periods of between 5 and 14 days applied when irrigating from supplies having other water quality-related concerns (such as sewage treatment plant waste-water and dairy shed effluent).

BGA residue (including toxins) may remain on dry pasture for a long time following irrigation, until there is a rain or further irrigation with an uncontaminated supply. However, pastures and livestock forage/fodder crops irrigated with water containing blue-green algae are unlikely to cause problems in livestock after seven days.

Note: There is not enough research information to provide a reliable guideline period of grazing or harvesting deferment to reduce risk to livestock eating pasture and crops irrigated for forage or fodder conservation purposes with water containing blue-green algae. Research indicates that sun-dried algal cells (and their associated toxins) may remain toxic for several months.

The risk posed to livestock grazing pastures or eating conserved fodder (such as hay and silage) irrigated with blue-green algae contaminated water will depend on the toxin concentration of the plant dry matter. Effective sampling and measurement of this at the paddock-scale is difficult.

The risks to livestock eating contaminated dry matter will likely increase with:

- increasing algal bio-volumes (and associated toxins) in the irrigation water;
- repeated irrigations with BGA contaminated water;
- amount of plant dry matter (size and number of leaves) present at irrigation;
- growth rate of pasture (the potential for more leaves to grow after irrigation and dilute the toxin concentration in the existing dry matter);
- type of livestock eating the pasture or fodder (horses are more sensitive);
- quantity of the contaminated pasture or fodder eaten; and
- algal toxins present in drinking water supplies.

Factors that may reduce risk to livestock include:

- Rainfall following irrigation or irrigation with water from non-contaminated sources to rinse leaves and promote additional growth;
- Irrigation soon after grazing or fodder harvesting so that less plant material is exposed to contaminated water and new growth will dilute concentration;
- Supplementing feed with dry matter from other sources to limit the proportion of daily intake by animals of potentially contaminated dry matter;
- Ensuring drinking water supply is not also contaminated by blue-green algae.

Turf

Algae-contaminated water does not infect turf grasses, but the algae are highly invasive and may out-compete grasses for space in wet or shaded environments.

Algal scum can cause chronic problems on greens, especially those with poor air circulation, compacted soils and wet areas. Algal growth is encouraged by extended periods of rainy, overcast and warm weather. Algal scums slow water infiltration, keep thatch wet for extended periods, and impede oxygen and other gas diffusion into and out of soils.

Cautions for spray and micro systems

Spray drift: To avoid spray drift irrigation affecting neighbouring properties and people, irrigate in the evening when the air is generally still.

Filtration: The use of an activated carbon filter on the irrigation line is recommended to remove the toxins.

The high organic load of algae-contaminated water can block irrigation equipment. The algae can clog pumps, meters, valves, pipes, filters, sprinklers and micro outlets of irrigation systems, reducing irrigation system efficiency.

Potential for accumulation of irrigated BGA toxins in soil and groundwater

Where BGA toxin load to soil is excessive, or particular soil bacteria able to degrade BGA toxins are not present, toxins may remain soluble, mobile and persistent, with potential polluting effects on soil and groundwater, Research information is limited.

Further reading

Further information on the following topics is available on the [WaterNSW](#) website.

- What are algal blooms?
- Identifying algal blooms
- Key to algal blooms
- What causes algal blooms
- Dangers and problems
- Prevention and control
- Guidelines for algae
- Algal contacts

Related Primefacts

- [Managing blue-green algae in farm dams](#)

More information

For further information contact your local DPI office.

Acknowledgments

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For updates go to

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