



Duckweed



What is Duckweed?

Duckweed is the common name for a family of small aquatic herbs known as Lemnaceae that grow in fresh water. They have the unique distinction of being the smallest flowering plants on earth. When mature, the smallest species is two mm or less in diameter, and the largest species is about 20 mm in diameter. Duckweed looks like tiny floating leaves on the water surface. There are four duckweed genres: Lemna, Spirodela, Wolffia, and Wolffia – with over 40 species identified to date.

These plants are also unique in that they do not have any stem or leaf structures. The plant is simply a fleshy ovoid or flattened structure that may or may not bear simple roots.

It is often spread by aquatic birds and floods. Commonplace worldwide and quite hardy, it will even tolerate brackish water (up to 4,000 mg/L of total dissolved solids).

Duckweed is ubiquitous to most temperate and tropical regions of the world. They are typically found floating in thick mats of homogeneous populations in quiet streams or ponds containing high levels of organic matter. Another feature of these plants is that they can double their mass in less than two days under ideal conditions of nutrient availability, sunlight and temperature. A small patch of duckweed could theoretically cover the entire surface of a 0.5-hectare pond in less than 50 days.

Often considered unsightly, duckweed blooms can cover an entire water body with a “green blanket” or “mat” containing millions of the small plants. It won’t thrive on sites exposed to wind or where flowing water occurs.

A much maligned plant, duckweed has often been viewed as a nuisance, commonly mistaken for algae and associated with water quality problems in ponds, ponds and stagnant water bodies. But duckweed will remove plant nutrients from water, block sunlight and out compete algae. It can even reduce evaporation loss from a pond.

With optimum conditions duckweed can grow exponentially by consuming phosphorus and out compete algae (phytoplankton), which is lower on the food chain. Duckweed growth, instead of algae, is very desirable since algae pose more problems for water use. Some algae can produce liver or nervous system toxins – for example cyanobacteria or blue-green algae; other green or brown algae species are often so small that they will pass through or plug water treatment filters; and, almost all algae will cause taste and odor problems in water.

Duckweed benefits

Duckweed doesn’t only have water quality control

benefits for ponds. Some studies suggest that a complete coverage of duckweed will reduce water loss from evaporation by as much as 33 per cent when compared to open water bodies.

A natural water purifier, duckweed has also been successfully used to treat sewage by bioaccumulation, removing as much as 99 per cent of the nutrients and total dissolved solids in wastewater.

Perhaps the most important feature of these tiny aquatic plants to freshwater fish farmers is that they are extremely efficient absorbers of ammonia, nitrate, phosphorous, potassium, magnesium, calcium, sodium, chlorine, boron and iron.

Duckweed has also been used very successfully to sustain oxygen levels. Some duckweed species grow in stagnant, polluted waters, which also makes this plant ideal for water reclamation areas.

Managing your pond

When duckweed covers a pond, it’s desirable to check the oxygen levels in the water. If oxygen levels are too low then supplemental aeration is required.

It is recommended that all ponds be continuously aerated year-round using good diffusion systems such as air stones or specially-designed linear diffusers.

A carefully managed pond should include culling or harvesting the dead and decaying plant matter each fall, including the duckweed plants. Do this before water temperatures get too cold. This will remove unwanted nutrients from being recycled into the water body as plant matter decomposes. If duckweed isn’t harvested regularly, the decaying plant matter will turn the pond water a brownish color.

Perhaps the simplest method is the manual removal of the plants using a scythe, rake, hoe or other tool. This technique works well for small patches of weeds, patches located in-between docks and other hard to get places, and in very large lakes or high flow lakes where chemical treatment is impractical.

If a hoe is used, then the method is also fairly permanent because it allows the removal of roots so that the plant is totally removed. This technique can be inexpensive unless you have to pay diver wages. Hand removal also allows the selective removal of certain plant species, leaving others intact. A pool skimmer will work well for removing duckweed and true, floating plants.

It also works along shallow shorelines but is difficult where water depths are greater than 3 ft. In such areas, it may require divers.

The most permanent form of management is to remove the entire plant, including roots. This can be accom-

plished using underwater suction dredges for submersed plants or by using a backhoe along the shoreline for emergent species such as cattails. The equipment generally requires skilled operators and is expensive to operate.

For larger lakes and large beds of aquatic plants, a mechanical harvester may be needed.

Harvesters are expensive, specially designed boats. This technique also results in large amounts of harvested weeds which require disposal. The technique is not species-specific and also produces lots of small plant fragments. For species such as Eurasian milfoil, these plant pieces are easily dispersed and get established elsewhere in the lake. Harvesters do not remove roots, so regrowth and reharvesting is usually necessary within the same season.

With proper management techniques, harvested duckweed from wastewater lagoons may be fed to fish or livestock, including poultry. It is very high in protein. Duckweed can also be composted.

Harvesting also ensures a continuous new supply of healthy, young duckweed plants that are more efficient in the uptake of nutrients than older plants. Over time, these measures will also reduce the growth of plants in the pond.

If duckweed populations are excessive, nutrient inputs into the water body (or internal nutrient recycling within the water body) must also be excessive. To stop external nutrient inputs, it's necessary to limit runoff containing fertilizers, pesticides, animal waste and sediment. This can be achieved using planted bioswales to manage surface water run-off, or by using plants such as rushes to absorb nutrients before they reach the pond.

To manage internal recycling, the water body should receive 24-hour diffused aeration year-round.

Chemical Treatments

Chemical intervention is sometimes used, but repeated treatments would be required since chemicals won't solve the problem of excessive nutrients in the water body.

There are several different chemical dyes available for controlling aquatic plant growth. They are usually inert, vegetable-based dyes, and work by reducing the penetration of plant-preferred light wavelengths to the plants. These are inexpensive and have no negative health impacts.

Chemical shades are less useful in shallow pondshores (less than 50 cm deep and for plants, such as duckweeds, which can get their foliage up to the surface to obtain light. Shades are also not useful for water bodies with a high flushing rate. Most chemical shades require a permit for their use.

A multitude of different herbicides are commercially available however they are almost all based on just seven different chemicals. They can be fairly species-

specific and are easy to apply. Pellet forms are good for more localized use.

Most herbicides require some delay before water can be used for swimming, fishing or drinking. Herbicides, especially in liquid form, do not work as well in systems with a high flushing rate. Rapid decomposition of the treated plants may result in algal blooms or "pea-soup" conditions within the lake. A few studies are linking herbicides to impacts on the health of amphibian populations. Permits are needed.

Sterile grass carp, introduced from Asia, consume large quantities of plants and are useful in the control of some species. Generally fish are stocked at 5 to 10 fish per acre of pond, with fish of 10-12" in length. The cost is relatively inexpensive. Only sterile grass carp are used in order to ensure that they don't escape and invade natural aquatic systems.

The carp have plant preferences and if offered a range of plant options, they may not eat the targeted species. The carp convert the plant biomass into fish biomass and excrete large quantities of nutrients. These nutrients may result in a bloom of microscopic algae. Carp are regulated and a permit is needed for their release. Restocking is generally needed after 5 yrs.