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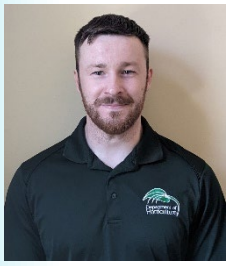

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Managing Algae and Moss Inside Greenhouses

Greenhouses are structures commonly used to grow a wide variety of plants ranging from ornamentals to food crops. Within these controlled environments, growers are better able to control parameters such as light intensity, photoperiod, light quality, air and root-zone temperature, irrigation quantity and frequency, humidity, and plant nutrition. Weeds can propagate within a greenhouse and are commonly found in or around cultivated crops.

Figure 1. Algae covering the benches and shade cloths within a propagation greenhouse at Michigan State University (Photo credits: Charlie Smith, 2024).

Two varieties of weed that may often be neglected when discussing weeds in a greenhouse are algae and moss. Both algae and moss can thrive inside the greenhouse under moist conditions and can spread very quickly. This makes them a problem for growers that tend to overwater. They are also extremely prevalent in propagation environments (Fig.1) where the warm air and root-zone temperatures, low light intensities, high humidities and media moisture levels, and frequent waterings create an environment that is highly suitable for the proliferation of algae and moss.

Algae are autotrophic (capable of performing photosynthesis) and eukaryotic organisms. Algae belong to the lower group of plants (Fig.2) meaning that they lack true stems, roots, and leaves. They also lack the vasculature of xylem and phloem that exist in higher plants. Algae can grow anywhere. They can grow in aquatic environments such as oceans, streams, or lakes and also in terrestrial conditions. In a greenhouse, algae populations typically arise as a green mat or film that grow across a wet surface.

Mosses also belong to the lower group of plants and grow in terrestrial settings in areas that, typically, have a high level of moisture and low light levels, such as underneath the dense canopy of a rainforest. Mosses belong to the group of plants known as bryophytes. These plants reproduce by spores, not flowers like most terrestrial plants. While mosses lack roots, they feature rhizoids that anchor them to the ground or other surfaces. Within a greenhouse, they are found in wet shaded areas such as underneath benches, in corners, or even within pots (Fig.3), shaded by a cultivated crop.

Why are Algae and Moss Problematic in a Greenhouse?

Algae and moss in a greenhouse pose a myriad of problems. If growing on the greenhouse glazing itself, moss and algae could limit the amount of light penetrating through to the crop below (Royal Horticultural Society, 2024). Situations where algae grows up and onto shade cloths can cause the cloths to block additional light than intended, again limiting the amount of light hitting the crop (Fig.1). By limiting the light intensity radiating onto the crop, the photosynthetic capabilities of the crop, and from that yield, would be negatively impacted.

Figure 2. Cells of Volvox, a type of algae, under microscope.

Figure 3. Moss growing underneath the shade of a bougainvillea plant within a container under greenhouse conditions. (Photo credits: Charlie Smith, 2024).

Figure 4. Thick, slippery layer of algae covering a bench within a propagation greenhouse at Michigan State University. Notice the green discoloration of the perlite in the growing media (Photo credits: Charlie Smith, 2024).

Figure 5. Thick layer of algae can prevent applied nutrients and water from reaching the root zone of the crop plant.

Figure 6. Algae staining the clothes and leaving a residue on the skin of a greenhouse worker at Michigan State University (Photo credits: Charlie Smith, 2024).

Algae and moss may serve as a food source or breeding ground for other pests and/or pathogens. For example, the larva of fungus gnats may feed on algae (Cranshaw and Cloyd, 2009). The larva and adults of shore flies both feed on algae as well (Smith, 2015). As fungus gnats and shore flies procreate best in moist environments, and these are the same environments where algae grows, the presence of algae would exacerbate issues caused by these pests by providing them a food supply. These pests may also reproduce in moss and the larva of fungus gnats, being generalists, are known to eat moss (Bessin et al., 2014).

In a propagation setting, thick algal mats or sheets of moss can pose as a barrier to seed germination. During times when crops are small enough, moss may even outcompete seedlings for light. These weeds may also, like other weeds, directly compete for nutrients applied to a crop or prevent all applied nutrients from reaching the root-zone (Fig. 5). Algae can cause surfaces to become excessively slippery. This poses a safety issue to greenhouse workers that may slip and injure themselves on the algae (Fig. 4). Algae may also stain clothes and skin if workers come into contact with it. This algae may even cause skin irritation to workers with sensitive skin both upon initial contact and when it dries (Fig. 6). Furthermore, algae and moss are generally considered undesirable and can reduce aesthetic values of crops. As such, when crops, especially ornamentals, feature algae on them or in their pots or containers, they lose market value and may not be saleable.

How to Manage Algae and Moss Inside Greenhouses:

Using cultural practices to reduce or eliminate growing environments suitable for algae and moss to grow are an easy and effective strategy for managing them in a greenhouse setting. As algae and moss grow in wet environments, it is important to ensure that one is not overwatering the crops or creating pools of water on surfaces within the greenhouse. By limiting the availability of excess water in the growing environment,

moisture levels may drop below those that are necessary for the survival of algae and moss. Also, by ensuring that water is only going on the crop and not onto other surfaces or structures such as the floor under benches or shade cloths, this will eliminate aqueous environments from forming, again limiting the ability of moss and algae to grow within a greenhouse. If humidity is high, this may prevent plants from transpiring and prevent water from evaporating both from the soil and from wet structures and surfaces. In these high humidity situations, greenhouse exhaust fans may be used to remove the excess moisture from the air. This should allow plants to transpire more, reducing the moisture levels of the root-zone and more evaporation from the concrete structures.

If a grower has an existing population of algae and/or moss and wants to eliminate it, a simple solution may be to let the greenhouse growing environment dry out. This could be done by limiting or ceasing irrigation and turning on ventilation fans to dry the air. It is important to regularly scout the greenhouse to look for existing algae and moss populations but also to look to identify environments where algae and moss may grow. Also, growers need to scout the new stock plants and liners that are coming in and check for any new algae and moss in them. To emphasize, controlling excessive moisture levels in the greenhouse may be the most powerful strategy for managing algae and moss within a greenhouse.

Another useful strategy to prevent the spread of algae is to make sure that any reused pots or growing containers are thoroughly sanitized with an algicide prior to them being used again. Green-Shield® II is a commonly used algicide and disinfectant with main ingredients of alkyl dimethyl benzyl ammonium chloride and alkyl dimethyl ethylbenzyl ammonium chloride. Such algicides may also be sprayed onto surfaces or even shade clothes to kill and prevent the reemergence of algae populations. This functions by disrupting the cell membranes of algae and moss, causing cell death. TerraCyte® PRO is another chemical weed control that can be used to manage both moss and algae. Its active ingredient is sodium carbonate peroxyhydrate. Hydrogen peroxide may also be applied to help manage the spread and emergence of algae. Many quaternary ammonium chloride-based algaecides are available commercially to manage both algae and moss chemically in a greenhouse. Other simple ways to ensure a clean greenhouse growing environment is maintained is to use hydrogen peroxide foot baths for workers entering the greenhouses and making sure tools are sanitized. Bleaching surfaces and structures such as shade cloths is another way to manage algae and moss within a greenhouse. When using chemical mitigation strategies, it is crucial to follow the directions on both what rates to apply and how to apply the pesticides on the labels of those that are used. As moss depends on low light conditions to grow, one may increase the light intensity in the greenhouse to manage it. This could be done through the application of supplemental lighting fixtures, such as metal-halide lamps or light-emitting diodes. This can artificially increase the light levels within a greenhouse. In a propagation setting where light levels generally must remain low to successfully produce some crops, the employment of ultra-violet (UV) radiation may be a strategy to use to control algae and perhaps even moss (Alam et al., 1998).

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