

PESTICIDE-FREE WEED CONTROL

BY ZHIQIANG CHENG
AND JOSEPH DEFRANK

Turfgrass areas (including golf courses, athletic fields, home lawns, creation areas, utility areas, and more) have become a central part of urban and suburban landscapes throughout the US. In Hawaii, the golf and turf industries make a significant contribution to Hawaii's recreation and tourism-driven economy. In 2007, the size of Hawaii's direct golf economy was approximately \$1.4 billion (PGA, 2009).

Among broadly defined turf pests (insects, weeds, pathogens, nematodes, and others), weeds are usually under very high control demand. In fact, weed control is the most challenging problem to turf managers in Hawaii as well as on Guam (PMSP, draft, 2014). Traditional turf weed control oftentimes relies on routine, usually calendar-based, applications of herbicides, sometimes non-selective herbicide such as glyphosate. Although some studies have shown that many modern herbicides, when properly applied, pose little risk to the environment and human health, calls for county- and state- wide bans on certain herbicides in Hawaii highlight the public concerns about these materials and their use around some sensitive turf areas such as golf courses, resorts, public school fields, public parks, and private residences in recent years.

Turfgrass weed control in Hawaii is challenging. Climatic conditions on the islands favor the year-round growth of weed populations. Winter weather does not eliminate weed populations like it does in many places on the continental US. Thus, many species traditionally classified as "annual" act as perennials in Hawaii, competing with turfgrass throughout the year for water, nutrients and light, and growing larger robust plants with succeeding years. It has been reported that weed management was the number one challenge facing golf course superintendents and county based sport



Figure 1. Weed mat covering a weedy turf plot in Magoon Facility, UH Manoa.

turf managers in Hawaii (PMSP, draft, 2014).

Turfgrass mismanagement and overuse can lead to severe weed infestations that require a complete restoration to re-establish the desired turf species. The common first step of turf restoration is to kill the existing weeds and turf in the area with a non-selective herbicide, such as glyphosate (Stier, 2000), followed by removal or soil incorporation of dead weeds and turf. In some sensitive turf areas, non-chemical means of turf restoration are gradually gaining attention, and if anti-pesticide trends continue, may become the preferred option. It is therefore important to address alternative means of restoring weedy turf sites in Hawaii without the use of commercial herbicides.

One of the non-chemical ways to control weeds is through light exclusion (McCarty and Murphy, 2004). Light is required by all plants to survive, and high light intensity is necessary for the germination of many weeds such as crabgrass and goosegrass, which are common turf weeds in Hawaii. This method works best in areas with high temperatures, making it a feasible approach in Hawaii. When properly done, the top several inches of

the soil will heat up, which may kill most weeds, as well as some soil pathogens, nematodes, and insects in the top layer of soil. The high temperature and moisture under the covering materials may also facilitate the decomposition of dead plant materials.

A brief summary of the major steps of light exclusion turf restoration and weed control approach that we will conduct is provided below:

1. Cover existing weedy turf area for a certain period of time to kill off all above ground portions.
2. Remove cover, and then remove dead weeds and turf (and re-establish the desired site grade if necessary).
3. Fertilize to stimulate weed seed germination.
4. Allow for maximum weed seed germination and growth with overhead irrigation.
5. Cover the site a second time to kill newly emerged young weeds.
6. Remove the cover for second time and re-plant new turfgrass.

In Spring 2014 semester, we conducted a turf pest management class laboratory at the Magoon Facility, UH Manoa, using one existing turf plot heavily infested by



Figure 2. New turf (TifGrand) fills in 7 weeks after planting. "Lights out" preparation on the left half, and herbicide spray after dethatching on the right half.

weeds, to test this concept. The materials used for this class demonstration is durable black woven plastic commonly used to keep weeds out of plant nursery production areas (commonly referred to weed mat or plastic weed mulch, Figure 1). The results of this class project indicated that the "lights out" approach for turf restoration and weed control was feasible. Figure 2 shows that turf growth and weed pressure were comparable under "lights out" approach (left half of the plot) and herbicide (Roundup and Fusilade T&O) approach (right half of the plot). A larger-scale field research project to formally test multiple factors (covering materials, covering time, and more) is being planned.

Dr. Zhiqiang Cheng is an Assistant Specialist (Turfgrass and Landscape Pest Management) at UH Manoa. He works on the biology, ecology, and management of turfgrass and landscape pests, as well as on soil ecology, and environmental bio-indicators.

Dr. Joseph DeFrank is a Specialist (Weed Science) at UH Manoa. He works with local turf managers and company representatives to identify effective chemical controls for problem weeds in Hawaii.

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