Non-chemical turf renovation for schools, parks and public sport venues in Hawaii

By: Dr. Joseph DeFrank.

Public concern over the use of commercial herbicides has resulted in a ban on these pesticides in many public landscapes in Hawaii such as schools, parks, and city-managed sports venues. Many of our schools have turf areas that are heavily used and provide an important function for physical education activities and other school functions. Due to neglect and a lack of knowledge in the maintenance of healthy turf, these lawns turn into a weedy mess with irritating thorns and bunch-type weeds that pose a tripping hazard for active students.

At the Honolulu School for the Deaf and Blind (HSDB), the turf area had fallen into an undesirable state and a Physical Education faculty member (Paul McDonnell) contacted the College of Tropical Agriculture and Human Recourses for assistance. Upon my first visit to the site, it was clear that weedy grasses had colonized the site and no turf-type grasses could be found. My discussions with Paul led us to agree to an on-site demonstration where the weedy species could be removed and a new Bermuda grass patch installed.

Figure 1. Area outlined with the yellow oval was the location for the non-chemical turf renovation demonstration at the Honolulu School for the Blind and Deaf on Oahu, Hawaii in 2023.

The first step in the non-chemical turf renovation project was to provide a consistent source of irrigation. Without water, there is no hope for the efficient removal of weedy species and the re-establishment of a desirable turf surface. One of the legacy irrigation portals was modified to supply water through both drip irrigation tubing as well as overhead irrigation. *(See Figure 2.)*

Figure 2. The legacy plug-in irrigation riser system was modified to supply water with both landscape drip tubing as well as overhead sprinkler. Both methods could be used separately or together to provide maximum flexibility with on-campus activities.

The hard dry spot selected for this demonstration responded rapidly to the application of water and produced a lush stand of grass and broadleaf weeds. It is important to note that this first step in the renovation process provides an important function. This initial soaking of the site stimulates many dormant weedy plants both living and emerging from seeds to activate and present an easy target for termination in the next phase of the process. The lush stand of weeds was covered with a black woven geotextile fabric commonly referred to as weed cloth or weed mat (tarp). Woven fabric is preferred over film-type plastics because it allows overhead irrigation to pass through and enhances the drip tubing's ability to keep soil surface moist. (See Figure 3.) Once the site is covered, it is important to maintain good soil moisture so that worms, soil insects, and microbes can help to consume the weedy roots and stems terminated due to a lack of light and intense heat. As we found out later, dry areas under the tarp were difficult to rake off due to a lack of decay, while areas with good moisture were easily raked clean to present an open debris-free surface.

Figure 3. Lush weed growth, activated with abundant irrigation, is terminated by covering it with woven black plastic fabric. Fabric is held in place with water-filled fire hoses and lay-flat blue irrigation hoses filled with sand.

After the tarp was removed for the first time, all remaining plant parts were raked off and moved to the school's garden compost system. Since no chemicals were used, these dead weeds make an ideal contribution to compost systems. Also, students can help with raking off the site and add to their ownership of the new lawn. Once a debris-free surface is produced, fertilizer (2-4 lb. of 16-16-16/1000 ft2) and irrigation are applied. *(See Figure 4.)* Fertilizer applied to open soil will stimulate weed seed germination to further purge the site of undesirable plants. The weed spectrum that emerges after fertilization is composed of species that are specialists in rapidly absorbing nutrients and moisture, just like any gardener can confirm. The weeds that germinate and grow at this stage in the process serve to convert the applied chemical fertilizer into nutrient-rich plant tissue (both roots and shoots). Think of this phase as "site nutrient banking" by the newly germinating weeds. Allow 30-35 days for maximum weed seed germination and reapply the tarp just as weed flowers emerge to prevent any new seed formation. *(See Figure 5.)* The tarp and irrigation remain in place for at least 35-40 days to allow weeds to break down (by soil insects, worms, and microbes) releasing nutrients to the soil surface. Once the tarp is removed for the second time, weeds can be easily raked off to provide an open soil surface for seeding the new Bermuda grass lawn. If time allows, more cycles of weed growth and termination with tarping will greatly reduce weed pressure once the new turf species is seeded.

Figure 4. The top image shows dead weeds after 22 days of coverage with the tarp, 2nd image shows students and faculty member Paul McDonnell moving dead grass to school's compost heap, 3rd image shows fertilizer application to bare ground for "site nutrient banking" via weed growth and the bottom image shows reinstallation of both drip and overhead irrigation.

Figure 5. The top image shows weed growth stimulated by fertilization and irrigation, bottom image shows tarp coverage to terminate weed growth. Multiple cycles of weed growth and tarp termination will reduce weed pressure once new lawn seeds are planted.

At this demonstration site, I wanted to determine the optimum Bermuda Grass (cultivar: 'Transcontinental' provided by Susan Owens of Ko'olau Seed) seeding (2, 4 & 8 lb./10002) and fertilizer rates (.5, 1 & 2 lb. N/10002 using 16-16-16 fertilizer) to minimize the time needed for soil cover and improved weed exclusion. This non-chemical turf renovation technique is an excellent way for educators to introduce students to applied agricultural research while providing students with hands-on experience in a school environment that directly improves their on-campus experience.

At 68 days after seeding (bird netting recommended), both Bermuda grass and some weeds had completely covered the demonstration area. *(See Figure 6.)* The weeds present at this stage of the project are easily controlled with close mowing. The results on seeding and fertilizer rates indicated that both 4.0 & 8.0 lb. of seed per 1000 ft2 provided acceptable coverage across all fertilizer rates. (See Figure 7.)

Figure 6. The top image shows weed and Bermuda Grass growth 68 days after planting, the middle image shows mowing with Maruyama landscape head to provide clean cuts with minimum turf damage, the bottom image shows Bermuda Grass stand after weedy growth is cut and removed.

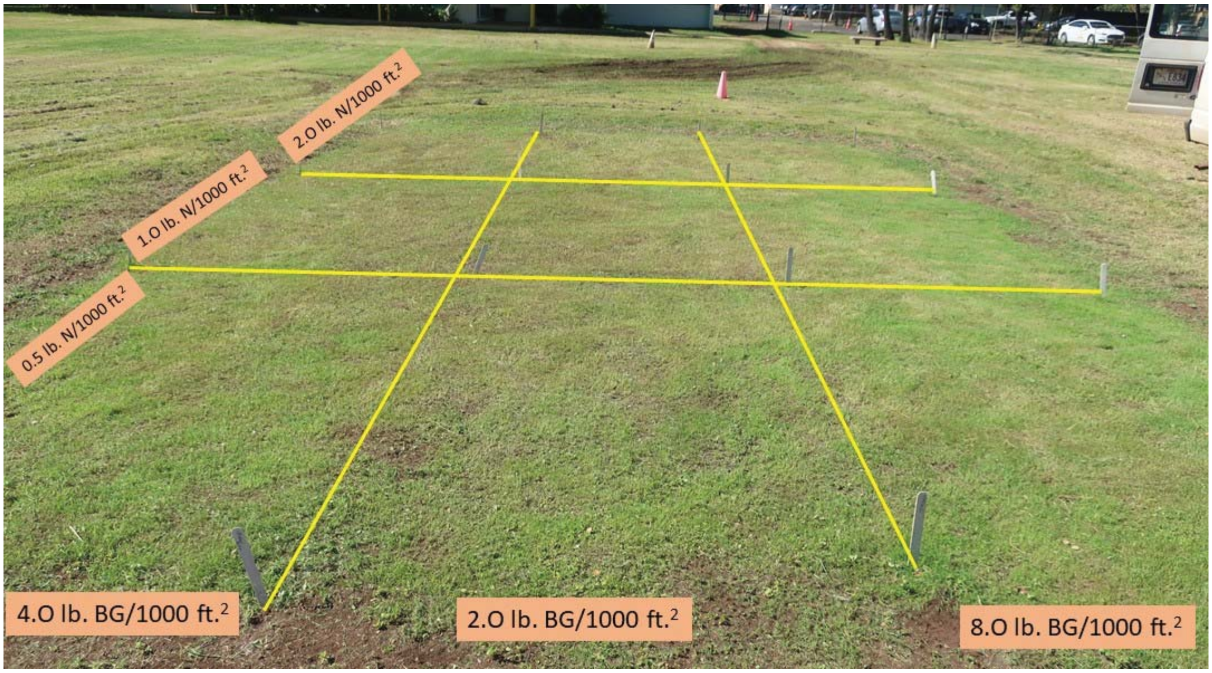

Figure 7. Response of 'Transcontinental' direct seeded Bermuda grass to three rates of 16-16-16 fertilizer (0.5, 1.0 & 2.0 lb. N/1000 ft.2) and three seeding rates (2.0, 4.0 & 8.0 lb. /1000 ft.2) 68 days after planting. Both 4.0 and 8.0-pound rates provided acceptable coverage across all fertilizer rates.

Although this renovation project works well as a student participation exercise, scaling up for larger areas may require the work of commercial landscape contractors. It was my objective to demonstrate that non-chemical turf renovation can be accomplished if time, controllable irrigation, and materials described here can be employed to restore long-neglected turf areas to a level of safe use and a higher degree of institutional pride. Perhaps non-chemical turf renovation can become a new service offered by landscape contractors as well as a highly visible project for the school's ag programs.

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By: Keith Weiser