

## WEED MANAGEMENT IN TURF—PAST, PRESENT AND FUTURE

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Turf weed management could be said to have changed immensely or almost not at all over the last “100 years”.

In the distant past, turf was the village square or resident vegetation that wasn't eaten by the livestock that grazed upon it. It was originally supported by the elite in China and was imported to Europe. In 1830, a mower was developed to periodically cut the turf to keep it shorter, to have a play field. When I visited China in 1988, many public parks were being cut with hand scythes and weeds were being pulled by hand in turf areas. There was a great interest in weed management and cultural practices for amenity turf.

### **Weed control methods.**

Most all the weed control methods that we use today have been used for many years. Mowing, fertilizing and irrigation principals have not drastically changed. The turf types, and in particular varieties that have been selected increase the competition for water and nutrients against the weeds. Turf species have shifted from common bermudagrass or Kentucky bluegrass to more perennial ryegrass and turf-type tall fescue. These species have many new selections that are very competitive and can reduce weed invasion and establishment. There have never been more varieties available to choose a fine turfgrass.

### **Weed problems:**

Weed problems have changed. In an extension paper for weed control in turfgrass in 1936 the principal weeds listed were divided into two categories, short stem types and spreading types. The short stem types included dandelion, plantains, shepherd's purse and chicory. The spreading types included crabgrass, bermudagrass, knotweed, chickweed, oxalis, speedwell and spotted spurge. Most of these sound very familiar today. In a paper presented to the California Weed Conference in 1959, Bill Bengyfield from the US Golf Association indicated that kikuyugrass, goosegrass, Dallisgrass, English daisy and annual bluegrass were five major weeds in California that needed additional work for control. Sound familiar? In 1963, V. Youngner, UCR indicated at the same conference that the major weeds were Dallisgrass, kikuyugrass, knotweed, burclover and black medic, Australian brass buttons, prostrate spurge, crabgrass and goosegrass were the major problems in turf. These weeds are still present and troublesome but now we also have other introduced species that are problems; notably green Kyllinga, Sporobolus, Setaria, etc. There are many species which have not been mentioned such as yellow and purple nutsedge, creeping woodsorrel, white clover, and broadleaf and narrowleaf plantain, to name a few. Are these all new weeds or are they being found more frequently now because there are more people looking at the turf? There are concerns about many of the same weeds as there were many years ago, such as crabgrass, annual bluegrass, plantains, dandelion, etc.

Current major turf weed problems:

Grasses:

Dallisgrass, kikuyugrass, bermudagrass, annual bluegrass, crabgrass, and goosegrass. Of lesser importance, but severe where they are found: Sporobolus, rescuegrass, knotgrass, velvetgrass, bentgrass.

### Broadleaf weeds:

Dandelion, English daisy, creeping woodsorrel, plantains (broadleaf and narrowleaf), white clover, bur clover, black medic, knotweed, speedwell, brass buttons, spurweed, prostrate spurge, and wartcress. Of lesser importance, but severe where they are found: healall, cudweed, cheeseweed, henbit, sow thistle and prickly lettuce.

### Herbicides:

The greatest change in weed management strategies has been the development of selective herbicides. This is not only for the control of broadleaf weeds in grasses but the selective control of grasses in grasses. Another aspect is the volume of herbicide used for the control of specific weeds. In 1971, Madison developed a list of herbicides and their rates of application (Table 1). I have modified this table to include herbicides in the 1980's and 1990's (Table 2). What will the rates and materials look like in the 2000's? I predict there will be fewer herbicides and less application of herbicides. Another area of change is that the characteristics of the herbicides have changed. When the arsenical herbicides were available (lead arsenate, calcium and tricalcium arsenate), these herbicides had multiple sites of action (competitive uptake and activity wherever phosphorus was used in the plant. With the introduction of 2,4-D, MCPP, MCPA, 2,4,5-T and Silvex, there was an introduction of multiple site of action materials. With an increase in regulatory action to "safen" materials and reduce herbicide use, there has been a major movement to "single site of action" herbicides and lower use rates, thus greater activity per unit of application. We are no longer using herbicides that require 10's or 100's of pounds per acre but are in ounces per acre. Specifically the ALS inhibitors are examples. During my career at the University we have had little concern about weed resistance to herbicides, because we had not been confronted with this problem. "It only was a problem with insecticides and fungicides." Today and in the future, it is a real concern with the introduction of single site of action herbicides.

Table 1

Herbicides, rates and timing of applications of herbicides used in turfgrass in the 1950 and 60's.

Herbicide	Rate (lb/A)	Timing	Weeds	Comments
lead arsenate	400-1000	annual/semi-annual	annual bluegrass, crabgrass	thins turf, may sterilize soil
calcium arsenate	375-550	annually	crabgrass, annual bluegrass	erratic control, thinning of turf
chlordan	60-340	annually	crabgrass, goosegrass	erratic control, not injurious to turf
bandane	17.5 -50	annually	crabgrass	some injury to turf
bensulide*	7.5 - 10	annually	crabgrass, annual bluegrass	safe on turf, "long residual"
terbutol	5 - 20	annually	crabgrass	injures bentgrass
siduron	5 - 20	annually	crabgrass	seedling turf tolerant
DCPA*	5 - 10	annually	crabgrass, Veronica,	safe to turf except bentgrass

\* Herbicides with current labels.

Table 2. Current herbicides for weed control in turfgrass.

Herbicide	Rate (lb/A)	Timing	Weeds	Comments
pendimethalin	1.5 - 3	spring or fall	annual grasses and broadleaves	sometimes used twice per year
dithiopyr	0.25 - 0.5	spring or fall	annual grasses and broadleaves	pre or early postemergence
prodiamine	0.75 - 1.5	spring or fall	annual grasses and broadleaves	can thin some turf species under stress
fenoxaprop	0.25 - 0.33	up to 2 tiller stage	crabgrass	stressed grass not controlled
halosulfuron	0.03 - 0.06	post emergence	nutsedge	two applications usually needed

In a presentation at the California Weed Conference in 1961, crabgrass materials listed consisted of chlordane, lead arsenate and calcium arsenate as the preemergence herbicides and dalapon and trichloroacetic acid (TCA) as the non-selective post emergence herbicides. Even today many may not remember DCPA for crabgrass, monuron for oxalis control and diphenamid for grass control in dichondra, or endothal for annual bluegrass control in grass turf.

Many weeds can now be controlled. With the introduction of glyphosate as a non-selective herbicide that would kill annual and perennial grasses, the potential for total renovation became a possibility. An herbicide could be used that would kill bermudagrass without leaving a residue in the soil that would affect subsequent planted turf, either from sod or seed. This was a major development in restoring weedy turf to a fine turf. There have also been methods developed to control crabgrass, goosegrass, kikuyugrass, Dallisgrass, dandelion, plantains and many other species.

**Application Equipment:**

Application equipment has changed. The changes may not have seemed great, except because of the type of application, application has had to change from large quantities of powder forms of lead arsenate or calcium arsenate at 100's of pounds per acre to spray applications of 0.03 lb/A. Equipment for liquid and powder formulation application have improved to allow more uniform application. Light sprayers with booms and flat fan nozzles with low pressure are available to accurately apply very small quantities uniformly over large areas.

**Changes in formulations**

Early formulations were powders that were either applied by hand, or through a drop spreader. Powder formulations were changed to granular formulations to reduce or eliminate dust. Some powder formulations (wetable powder) have been reformulated to flowable (liquid) or to water dispersible granules (WDG) to further reduce dust and make it easier and safer for the worker to handle. Herbicides have been formulated with fertilizers. These formulations allow application of a herbicide for the control of the weed, and also a fertilizer that gives the turf some nutrients to increase vigor. With increased turf vigor, there is a reduction of weed encroachment and establishment.

**Attitude change:**

Is a weed still a weed? Are we reverting or progressing back to the future? There are more areas not being treated with herbicides thus there is a return to the sward or village green attitude in some areas. There is a divergence of attitudes between people who want a “well manicured”, lawn with no weeds, and a uniform texture and surface and those who either don’t care what it looks like, more the diversity of plants in the turf, or consciously decide they don’t want pesticides used and there is no economic alternative to remove the weeds. There are even those that are choosing to find alternatives to grass as a lawn (even lawn is not the right word). They ask what to plant that doesn’t require “pesticides and herbicides”, doesn’t need irrigation or fertilizer and will grow in a sunny location and take some traffic. What would your answer be?

Will this move continue, Yes! Will it last forever, No! At what time it will turn around, I don’t know and also I don’t have an idea what turn it will take. For a time there will be greater divergence with those who chose to use herbicides for weed management in turf and those who chose to try other means for turf management such as competitive varieties, mowing, etc. Eventually the amount and application of nitrogen will also have the same or more regulatory inspection.

Will turf management eventually move from current practices to “Mandatory IPM”, or imposed “Best Management Practices”? This probably will occur first in all turf with public access, followed by homeowner turf? I see movement in that direction. There are those who would like to have the control to force all in that direction.

Maybe we are regressing or progressing to the aristocratic green of the Chinese or the square or village green of the Europeans. How we maintain them may not be that much different as well. I don’t, however, see us going back to the scythe as the mowing tool.