

Alternative Methods of Weed Control

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Alternative methods of weed control presents various means of weed control in addition to the common use of herbicides. Chemicals are not and should not be relied upon as the sole weed control option. An integrated approach should take into consideration economic, environmental, and human health concerns.

Weed Control Methods

- Biological
- Cultural
- Chemical



Chocolate Pudding: A New “Natural” Herbicide?

Tim Miller¹ and Bill Cosby²

¹Washington State University, Mount Vernon
²Hollywood, CA



Three strategic methods for weed control are biological, cultural, and chemical. Biological control takes advantage of natural enemies of weeds such as animals, insects, or diseases.

Cultural control methods and techniques are practices that can be implemented to prevent weeds from appearing in a location, manipulate the environment that gives the desired plants in a landscape more of an advantage to flourish over a weed, or physically remove the undesirable weed.

Chemical weed control utilizes herbicides to eliminate undesirable weeds selectively or in a broadspectrum fashion.

Examples of each will be described.

Alternative Weed Control Methods

Chocolate Pudding: A New “Natural” Herbicide?

Tim Miller¹ and Bill Cosby²

¹Washington State University, Mount Vernon
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Concern about the potential harmful effects to human and animal health resulting from use of herbicides has increased steadily over the last 10 to 15 years. Such concern has led some cities (such as Seattle, WA) to ban all herbicide use on municipal lands and has fueled a concurrent rise in demand for organic produce. To that end, “natural” products (corn gluten meal, wheat gluten, vinegar, clove oil, etc.) have been and are being tested for weed control potential in organically-produced crops and for use in public ornamental plantings and gardens. The research reported here involved testing of several new natural products, including chocolate pudding.

The primary difficulty with CHOCPUD technology centers on the rapid gain in product viscosity in the tank after mixing. For this reason, high agitation is necessary to avoid premature “setting up” of the product. In addition, quick applications (within 10 minutes, in our studies) will be required if major tank and spray line clogging is to be avoided. A second difficulty is in the large number of packages of CHOCPUD that must be used for even small pocking applications. For example, a standard 380-L tank will require approximately 800 packages of Jell-O® brand CHOCPUD. Because of the labor involved in opening and emptying that many packages into the spray tank and the strong potential for paper cuts, Jell-O® is developing a Solupak that will aid in the mixing of dry product with the milk in the tank.

Weed species showing the greatest susceptibility to the four-way mixture + flame in 2002 were dogfennel (*Aureothema cotula*), dogtailgrass (*Cynosurus* spp.), dogbane (hemp, *Apocynum cannabinum* and spreading, *A. androsaemifolium*), catnip (*Nepeta cataria*) and common catscar (*Hypochaeris radicata*). We speculate that the methylxanthines theobromine and caffeine found in cocoa probably account for the observed toxicity to these species.

Concerns about human and animal health and safety have increased efforts to seek and achieve weed management in crops and landscapes in an integrated way. Without having to depend solely on a single tactic, an integrated weed management system is desirable by taking advantage of knowledge and proven techniques that are safe, simple, and affordable.



Weed Control Methods

• Biological

- Animals
 - goats, sheep, geese
- Microbial diseases
 - Fungi, bacteria, viruses, nematodes
 - Require right conditions (environment, host, pathogen)
- Insects
 - Root, shoot, flower, seed

Biological control takes advantage of natural enemies of weeds such as animals, insects, or diseases.

In many cases, animals such as goats or sheep can be herded and introduced to a weedy site to graze and remove the weeds. Geese can be similarly introduced to an area to remove undesirable vegetation.

Microbial diseases including fungi, bacteria, viruses, or nematodes may be naturally occurring or may be artificially introduced in a site to infect susceptible weeds.

Diseases require the “disease triangle” of the host weed being present at the susceptible stage and condition, the pathogen being introduced artificially or already naturally occurring to be able to infect the weed, and the environmental conditions having the right weather conditions for temperature, moisture, etc.

Biocontrol agents can be insects or mites that invade and feed on a weed’s roots, shoots, flower, or seed. The immature or adult stages of the insects may have preferences for certain parts of the weed as it grows.



Powdery mildew on sowthistle

Weed Control Methods

- Biological

- Microbial diseases
 - Fungi, bacteria, viruses, nematodes
 - Require right conditions (environment, host, pathogen)

An example of a disease occurring on a weed is powdery mildew on sowthistle. The disease weakens the weed; however, it occurred when the weed was maturing as it already flowered and began to set seeds. A more timely and effective occurrence on a seedling weed would possibly prevent unsightliness in a landscape or not allow the weed to be competitive in a crop.

Puncturevine
seed weevil



Eric Coombs
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Bugwood.org



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Bugwood.org

Weed Control Methods

- Biological

- Insects

- Root, shoot,
flower, seed



There are a seed weevil and a stem weevil for puncturevine. One feeds on the seed to reduce the ability of the weed to reproduce and one invades the stem of the plant. The weevils require introduction to sites where the weed exists. One or the other is available commercially.

FINE TEXTURED GRASSES	ORIGIN	GERMINATION
③ 30% 'Challenger'	Oregon	⑤ 85%
④ Kentucky bluegrass		
37.20% 'Unique'	Oregon	87%
Kentucky bluegrass		
31.75% 'Brittany'	Oregon	95%
creeping red fescue		

OTHER INGREDIENTS:

- ⑦ 0.00% Crop Seed
- ⑧ 0.05% Weed Seed
- ⑨ No Noxious Weeds
- ⑩ 1.00% Inert Matter

⑥ Tested: 7-19-98

Weed Control Methods

- Cultural
 - Preventive
 - Restrict movement, quarantine
 - Feed
 - Plant selection, placement
 - Animals
 - Clean seed, propagules, nursery stock
 - Humans
 - Regulatory (noxious weed list)
 - Vehicles
 - Management practices
 - Monitoring / scouting, record-keeping
 - Timing - Seasonal, climate
 - Mechanical
 - Physical manipulation
 - Mowing, hoeing, cultivating

Cultural methods are all practices other than biological or chemical. Preventive practices restrict the movement of weed seed or propagules. Humans and animals ship or transport seeds, stolons, rhizomes, sprigs, or other vegetative plant parts from location to location where highly adaptive weeds can get established rapidly. State and federal laws and regulations restrict movement within and between states. Seed laws restrict movement of weed seeds in commercial crop seed sales. Preventing weeds can be achieved by manipulating planting time and techniques to give an advantage to crops and landscapes so weeds emerge earlier or later to not become competitive.

Monitoring or scouting the site to observe and identify weed species and recording them as to the location and time of emergence and growth stages will provide a record of occurrence(s) and help to develop a weed management program.

Mechanical practices include hand-pulling, hoeing, mowing and tiling or cultivating to remove weeds. Such practices should be done to prevent the weed from flowering and then setting seed before they can be disseminated.



Weed Control Methods

- Cultural
 - Management practices
 - Monitoring / scouting, record-keeping
 - Timing - Seasonal, climate

Use weed identification guides such as the 2-volume “Weeds of California and Other Western States” or if you can be lucky, find a copy of the out-of-print “Weeds of the West”.

After identifying whether the weed is an annual or perennial, grass or broadleaved weed, winter or summer, keep accurate records of the infestation for where it occurs, time of the year, it emerges, flowers, or dies,



Weed Control Methods

- Cultural
 - Mechanical
 - Physical manipulation
 - Mowing, hoeing, cultivating

Use these mechanical practices when weeds are small and easy to physically remove. Mow low and frequently if weeds become too large and too late for spraying.



- Cultural
 - Mechanical
 - Physical manipulation
 - Mowing, hoeing, cultivating

Weed Control Methods

In turf, mowing height of cut and frequency can encourage or discourage weeds. Weak turf mowed too short can create voids for weeds to invade and emerge. Tall turfgrasses can create a canopy and shade out weeds as they try to become established. Frequent mowing can weaken weeds against the competitive turf that develops a dense canopy. Less frequent mowing can allow weeds to grow above the turf and mature to set seeds.



Weed Control Methods

- Cultural
 - Mechanical
 - Physical manipulation
 - Mowing
 - » Frequency, height
 - Hoeing
 - Cultivating
 - » Aerify, verticut, slice
 - Mulching
 - Plastics, natural products

Cultivation practices that slice, verticut (vertical mowing), or punch holes or remove cores to aerify improve the health and vigor of the turfgrass by providing air and water for the roots.

Physical barriers with plastic sheets or other natural products (wood chips, paper sheets, organic mulch materials) can cover surfaces to prevent weed emergence and establishment

Weed Control Methods

- Cultural
 - Mechanical
 - Physical manipulation
 - Barriers
 - Mulches



Walls and physical barriers or layers of rocks or gravel or organic mulches can prevent weed encroachment.

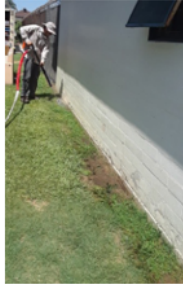
Preventing or eliminating excessive moisture (i.e. leaky irrigation systems) will prevent weed seed germination and weed invasions.

Weed Control Methods

- Cultural
 - Mechanical
 - Physical manipulation



Physically removing weeds and reproductive parts – seeds, vegetative stolons, etc. by vacuums, brushing, weed whacking, or using heavy equipment can help remove weeds and their sources,



Weed Control Methods

- Cultural
 - Mechanical
 - Physical manipulation
 - Steaming

A mechanical weed control practice is to use steam. High heat can be used to "cook" small weeds.

Weed Control Methods

Chemical applications



Selective or broadspectrum chemical applications can be done safely to control weeds in turf or in areas where total vegetation control is desired. Applicators should always read and follow product label instructions and use and wear required personal protective equipment – long-sleeved shirts, long pants, socks and shoes, eye protection, and rubber gloves at a minimum. If budgets allow, an air-conditioned cab for a sprayer would be ideal. Spot-sprays can selectively control small populations of scattered weeds while a boom sprayer can cover larger acreages more efficiently, A very selective application technique can be to “wipe” a differentially taller weed growing above the turf (upper right photo)



Weed Control Methods

Chemical applications

Very selective herbicide applications can include tree trunk injections or pouring salt (sodium chloride) to control susceptible bermudagrass in salt-tolerant seashore paspalum.

Granular herbicides can be spread across a site to provide control preemergence or "weed and feed" with a postemergence herbicide-coated fertilizer.

Weed Control Methods



Chemical applications



When herbicide sprays are applied, preemergence herbicides that are derived from yellow dyes can indicate where treatments were made. Other sprays can include an adjuvant added to the spray tank to indicate where the sprayer has been with a blue or green dye,

Weed Control Methods

- Chemical

- Conventional herbicides



- Selective ~~vs. Non-selective~~
 - Grasses ~~vs. Broadleaved~~
 - Preemergence



- ~~Postemergence~~



- Pounds vs. Ounces



- ~~Organic vs. Synthetic~~

- Yellow herbicide (DNA)

The next several slides describe commonly available and used herbicides for varied weed conditions and infestations.

Selective herbicides control specific weeds within a desirable crop or landscape without causing injury or damage to desirable turfgrass or trees and ornamentals.

They “select” the weeds to control. Some herbicides can select a broadleaved weed out of the turfgrass or control weedy bermudagrass in an ornamental shrub.

A preemergence herbicide is applied to the soil or turf before the weed seed germinates. It is absorbed by the tiny root or shoot that first emerges from the seed and doesn’t allow it to grow.

Newer chemistries are now applied at low doses weighed out in ounces compared to many older products that required several pounds per acre or per 1000 sq ft per label instructions.

Examples of commonly used preemergence herbicides are the “yellow” dinitroaniline (DNA) chemistry family. Prodiamine (Barricade), pendimethalin (Pendulum), and oryzalin (Surflan) prevent emergence and establishment of most grass weeds and some very small-seeded broadleaved weeds. They require overhead irrigation or rainfall or mechanical mixing into the soil zone to be activated where most weed seeds germinate.

Weed Control Methods

- Chemical
 - Conventional herbicides
 - ~~Selective~~ vs. Non-selective
 - Grasses vs. Broadleaved
 - Preemergence
 - ~~Postemergence~~
 - Pounds vs. ~~Ounces~~
 - Organic vs. ~~Synthetic~~
 - Corn gluten meal
 - 20 lb/1000 sq ft



A naturally-derived, organic, non-selective preemergence herbicide may control a broadspectrum of weeds. Corn gluten meal requires an application rate of 20 lb per 1000 sq ft to achieve acceptable weed control. Some difficult to control weeds may escape treatment. The cost of corn gluten meal will be very expensive to treat weeds in a large area at a high rate of application.

Weed Control Methods

- Chemical



- Conventional herbicides
 - Selective ~~vs. Non-selective~~
 - ~~Grasses vs. Broadleaved~~
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
 - ~~Organic vs. Synthetic~~
 - Phenoxies (synthetic auxin)
 - 2,4-D
 - Dicamba
 - MCP
 - MCPA



For turfgrasses, many winter and summer annual broadleaved weeds can be effectively controlled postemergence with the synthetic auxin family of herbicides. These herbicides applied to the foliage enter the plant and mimic the naturally occurring plant hormones within the weeds and the overdose causes the leaves and stems to grow uncontrollably exhibiting twisting, strapping, and becoming misshaped before dying.

Caution should be used and the labels read and followed to avoid spray drift to non-target desirable and sensitive crops and ornamentals.

Weed Control Methods

- Chemical



- Conventional herbicides
 - Selective ~~vs. Non-selective~~
 - Grasses ~~vs. Broadleaved~~
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
- ~~Organic vs. Synthetic~~
 - “fops and dims”



Fusilade
Segment
Envoy

These selective “fops and dims” effectively control only grassy weeds when applied to the foliage. Fluazifop (Fusilade), sethoxydim (Segment), and clethodim (Envoy) are very effective against weedy bermudagrass in landscapes.

Weed Control Methods

- Chemical
 - Conventional herbicides
 - ~~Selective vs. Non-selective~~
 - Grasses vs. Broadleaved
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
 - ~~Organic vs. Synthetic~~
 - glyphosate



Roundup and its imitators



Glyphosate (Roundup and many other branded products) is one of the most popular, safest, and effective general herbicides available in the marketplace. It is not selective as it is effective against a broad spectrum of annual, perennial, grassy, and broadleaved weeds. It must be applied to the foliage of the weeds as it is not active in the soil to be a preemergence herbicide.

As mentioned, there are many products with different brand names that contain glyphosate. However, the efficacy of the different products may vary when they may be manufactured or reformulated by different manufacturers.

Very confusing marketing of the Roundup name is occurring as homeowner products are labeled as “Roundup” for lawns that do not contain glyphosate but other active ingredient herbicides that do selectively control turf weeds.

There are other glyphosate formulated products that include active ingredients to enhance and improve the rapidity of herbicide symptoms on weeds. Adding diquat herbicide to glyphosate in the pre-mix product exhibits faster leaf burning symptoms compared to slower yellowing by glyphosate alone on foliage.

Further confusion for the end-user is the addition of herbicides that offer extended residual weed control for months compared to glyphosate alone that does not last at all. Potent herbicide active ingredients such as imazapyr or imazapic last long for bare ground weed control and can severely damage nearby trees and ornamentals

when sprayed near roots.

Otherwise, glyphosate products are safe and effective tools for economical weed control.

Weed Control Methods

- Chemical
 - Conventional herbicides
 - ~~Selective vs. Non-selective~~
 - Grasses vs. Broadleaved
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
 - ~~Organic vs. Synthetic~~
 - glufosinate



Glufosinate (Finale) is similar to glyphosate in that it is non-selective against most grass and broadleaved weeds as a postemergence spray. The formulated product doesn't contain a high concentration of active ingredient so more product is required to be mixed in the spray tank. Compared to most highly safe glyphosate products, Finale has a 'Warning' signal word to protect eyes from potential harm and damage.

Weed Control Methods

- Chemical



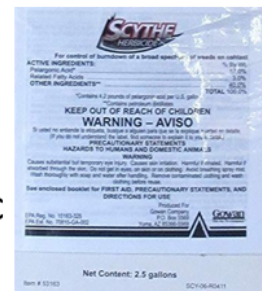
- Conventional herbicides
 - ~~Selective vs. Non-selective~~
 - Grasses vs. Broadleaved
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
- ~~Organic vs. Synthetic~~
 - Burndown, contact



Immediate results can be observed when diquat herbicide burns foliage of treated weeds. It is most effective against small grasses and broadleaved weeds. Diquat is relatively safer to use than its related paraquat herbicide.

Weed Control Methods

- Chemical
 - Conventional herbicides
 - ~~Selective vs. Non-selective~~
 - Grasses vs. Broadleaved
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
 - ~~Organic vs. Synthetic~~
 - Burndown, contact



Very similar to diquat, immediate results can be observed when Scythe herbicide burns foliage of treated weeds. It is most effective against small grasses and broadleaved weeds.

It is a long-chain fatty acid – pelargonic acid.

The signal word is “Warning” because it is a hazard to eyes.

Weed Control Methods

- Chemical
 - Conventional herbicides
 - ~~Selective vs. Non-selective~~
 - Grasses vs. Broadleaved
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
 - Organic vs. Synthetic
 - Burndown, contact



Active Ingredients:	
Ammonium Nonanoate	40.0 wt.%
Other Ingredients	60.0 wt.%
TOTAL	100.0 wt.%
Contains 3.3 lbs. of Ammonium Nonanoate per US Gallon.	



Very similar to diquat, immediate results can be observed when Prizefighter herbicide burns foliage of treated weeds. It is most effective against small grasses and broadleaved weeds.

Similar to Scythe – pelargonic acid, it is another long-chain fatty acid – nonanoic acid. It also has a "Warning" signal word and additionally is listed as an organic pesticide.

Weed Control Methods

- Chemical
 - Conventional herbicides
 - ~~Selective vs. Non-selective~~
 - Grasses vs. Broadleaved
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
 - ~~Organic vs. Synthetic~~
 - Vinegar, salt, soap



A “home brewed” herbicide consisting of vinegar, salt, and soap offers some control of small weeds similar to diquat, pelargonic acid, or nonanoic acid herbicides. The acetic acid content in cooking vinegar is much less concentrated than industrial strength material that is 20%. Mixing and spraying a “home brewed” herbicide is hazardous so at a minimum, eye protection must be worn when using an acid, soap, and salt spray. The commercial use of such a “home brewed” herbicide is not legal.

Weed Control Methods

- Chemical
 - Conventional herbicides
 - ~~Selective vs. Non-selective~~
 - Grasses vs. Broadleaved
 - ~~Preemergence~~
 - Postemergence
 - Pounds vs. Ounces
 - Organic ~~vs. Synthetic~~
 - Citric acid, Clove oil

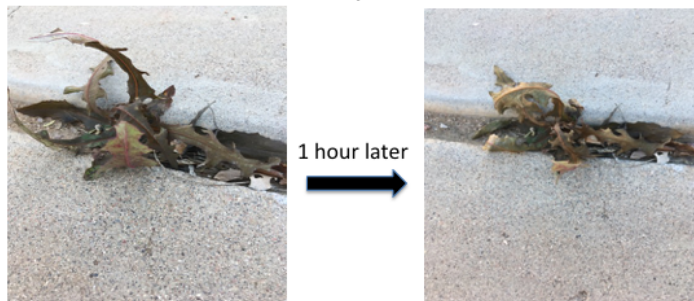


Very similar to diquat, pelargonic acid, and nonanoic acid herbicides, immediate results can be observed when citric acid or clove oil derived herbicides burn foliage of treated weeds. They are most effective against small grasses and broadleaved weeds.

Weed Slayer is a relatively safe product with a “Caution” signal word. BurnOut can cause eye irritation and harmful if swallowed so it has a “Danger” signal word.

Weed Control Symptoms

- Chemical
 - Conventional herbicides
 - Postemergence
 - Burndown, contact



The contact herbicides perform similarly when applied to the foliage of small-sized weeds that have not matured and hardened to tolerate environmental conditions. Under sunny warm conditions, these burndown herbicide can exhibit immediate activity within minutes of spraying. Under cool and cloudy conditions, they may take several days to show leaf burning symptoms. (next slide)

Weed Control Symptoms

- Chemical
 - Conventional herbicides
 - Postemergence
 - Burndown, contact



Larger-sized weeds generally will take longer to control or may recover with incomplete kill as new growing points grow new shoots.

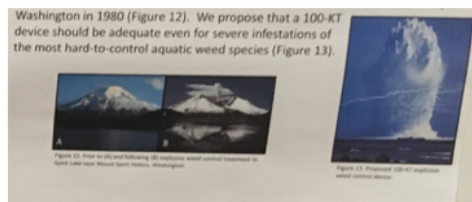
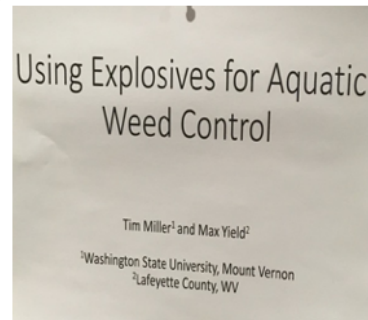
A Consideration for Herbicide Selection

- **Signal words** indicate the relative acute toxicity to humans and animals
- For very low toxicity products, signal words not required
 - **“Keep Out of Reach of Children”** – all labels
 - **Danger-Poison** – skull & crossbones
Acute dermal, oral, inhalation
 - **Danger** – Cat. I
 - **Warning** – Cat. II
 - **Caution** – Cat. III
 - None – Cat. IV

Selecting appropriate herbicides for identified weeds in a specific turfgrass or landscape situation should take into consideration safety. Any selected herbicide whether low or higher toxicity should be treated with care so that unnecessary exposure does not occur. If multiple applications present multiple opportunities for exposures, diligence must be exercised to constantly observe label instructions to use proper PPE and implement safe procedures each time. If using a “Danger” or “Warning” labeled herbicide for a single application, extreme care should be exercised to prevent any exposures – eye or skin contact, vapors, or swallowed. For any and all herbicides, **Keep Out of Reach of Children!**

A Consideration for Herbicide Selection

- “Keep Out of Reach of Children”
 - all labels
- **Danger** – Cat. I



For any herbicide, **Keep Out of Reach of Children!**



For desert turf when bermudagrasses are dormant during the winter season, non-selective herbicides can be applied to control most winter annual weeds. The contact herbicides can be used safely during most of the winter and multiple applications may be required if weeds are too big and not completely controlled during the cold weather. Systemic glyphosate should be applied only when no green tissue can be seen on the bermudagrass. Especially as warmer spring approaches, bermudagrass begins to greenup and any glyphosate may delay spring transition. When the bermudagrass is dormant and “blonde”, turf colorants can be used to enhance the color to mimic winter ryegrass overseeding.

Alternative for sports field and landscapes



If a last resort to maintain green surfaces is to install synthetic turf, it will still require water for cooling and cleaning as well as regular maintenance activities to groom it and maintain its upright quality and the proper in-fill depth and uniformity. Weeds can still penetrate the backing material and emerge as nutsedge does or annual weed seeds can germinate and grow in the in-fill material.



Turfgrass information can be found in the publications section of the displayed website.