UC WEED SCIENCE
Weed control, management, ecology, and minutia

Natural Herbicides: Are they effective?

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The public's increasing demand for safe "green" products has resulted in many new environmentally-friendly products becoming available for controlling weeds in the garden and landscape. Even though information for home gardeners on the efficacy of these new products is limited, their use is still heavily promoted by environmental awareness groups and public agencies in an effort to reduce the use of other herbicides that have a greater potential to contaminate surface waters. Retailers are beginning to dedicate shelf space to pesticides that are considered least-toxic alternatives; most of them containing essential oils or other natural plant extracts targeting weeds.

The majority of these "green" weed-control products are botanically based oils (e.g., clove oil, eugenol, and *d*-limonene), soaps (e.g., pelargonic acid), or acetic acid that control weeds by destroying the leaf cuticle or causing cell leakage that rapidly leads to death. Unfortunately, because these herbicides kill only green parts of the plant they contact, they don't provide long-term control of weeds with extensive root systems or underground storage structures such as rhizomes, tubers, or bulbs. Thus many treated plants are able to recover. In contrast, some conventional herbicides such as glyphosate or 2,4-D are translocated to roots or underground storage structures to kill larger plants and perennial weeds.

These types of herbicides are applied after the weeds have emerged (postemergent) and have little or no soil residual activity. They don't control weed seedlings that germinate after application. They kill the plants by breaking down plant membranes and are considered contact or burndown herbicides. These herbicides are very fast acting (Figure 1), but to be most effective they must contact all or most of the aboveground plant tissue. It is especially important to spray the growing points, or else the plant will regrow. Grasses and perennial weeds are difficult to control for an extended period of time, because they have some or all of their growing points below ground.

Figure 1. Effect of Bioganic herbicide on grass growth 1, 2, 14, 24, and 72 hours after application. However, the grass recovered in about 2 weeks. (photo credit: C. A. Wilen, UC)

However, in some cases, especially where annual weeds are small, these products may be appropriate. These herbicides are best used on small weeds and annual weeds or for controlling weeds in cracks and, in some cases, edging. They can be used for spot spraying, but care must be taken that the spray or drift doesn't contact desirable plants or else leaf spotting or death will occur.

Increasing the Odds

Ways to improve efficacy when using these types of herbicides include:

- Good spray coverage;
- Application in warm weather (75° to 80°F);
- If using concentrates, addition of surfactants that improve weed control;
- Treatment when weeds are small; and
- Repeat applications for larger weeds, in most instances.

Corn Gluten Meal

Another common natural herbicide is corn gluten meal (CGM). While the previously listed herbicides are postemergent types, CGM is sold as preemergent herbicide. Although being widely touted as an effective herbicide that will control seedlings as they geminate, we have conducted numerous tests with this product and haven't been able to get results that justify its use as an effective preemergent herbicide. For example, there were no differences in the time needed to remove weeds from plots treated with CGM than from plants that were handweeded or from plots that were not subjected to any other treatment (Figure 2).

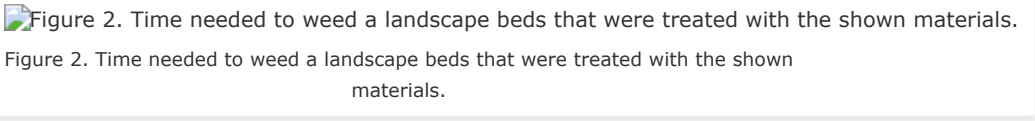

Figure 2. Time needed to weed a landscape beds that were treated with the shown materials.

So the question is: Are natural herbicides safe and effective? If used as part of an integrated pest management program, the contact herbicides fit very well. Users should know that they won't get the same kind of long-term weed control as products containing glyphosate (e.g., Roundup). The user should also be aware that many of the plant based or "natural" products can cause skin irritation or eye or lung problems. Eye protection and gloves as well as any other label requirements should be worn when using these natural herbicides, even if they are listed as exempt products. Note that some of the acetic acid products can be quite hazardous to handle.

Trade Names

Examples of **plant essential oil-based herbicides** include WeedZap, Bioganic Broadleaf Killer, and EcoSmart Weed and Grass Killer.

Examples of **orange oil (*d*-limonene) based herbicides** include Avenger and Worry Free Weed and Grass Killer.

Examples of **acetic acid-based herbicides** include WeedPharm (Signal word: Danger), AllDown, and Grotek Elimaweed Weed and Grass Killer. **Note:** The acetic acid concentration for herbicidal use should be about 10 to 20%. Household (food-use) vinegar is about 5% acetic acid and isn't effective for controlling most weeds.

Examples of **fatty acid-based herbicides** include Scythe, Safer Moss and Algae Killer, Safer Fast Acting Weed and Grass Killer, Monterey Herbicidal Soap, and Natria Weed and Grass Killer.

Combination products include Burn-out II (clove oil plus citric acid) and Earthtone 4n1 Weed Control RTU (soap of fatty acids plus maleic hydrazide, a growth regulator).

To view the actual article, visit

- Retail Nursery and Garden Center IPM News (http://www.ipm.ucdavis.edu/RETAIL/retail-newsletter.html)
- Green Bulletin (http://www.ipm.ucdavis.edu/greenbulletin/index.html)

Comments: 25

Comments:

by J Bern Hunt
on September 29, 2014 at 1:24 PM
This article needs to be updated. The information about glyphosate having little or no residual activity in the soil is proving incorrect. Now, soil scientists are seeing reduced micronutrient levels because the glyphosate is acting as a chelate, bad bacteria is on the rise, and the list goes on. There is new info out there... check out some of the studies that have done by the USDA.
Thanks, J

by Brad Hanson
on September 29, 2014 at 2:13 PM
Hi J,
I appreciate your comments but I think you may have misunderstood this post as there was no reference to glyphosate having residual activity in the soil although it did make a comparison to that herbicide compared to some "natural" products. Regarding the issues you raise about residual activity, micronutrient chelation, and bacteria on the rise, I have seen very little compelling scientific evidence to support those claims. What I have seen is generally not backed by peer-reviewed science, has not been reliably repeatable in subsequent research, or occurs in such specific conditions as to be an anomaly rather than representative of the whole.

by Al Hoove
on June 4, 2015 at 12:52 PM
J Bern Hunt: residual activity in the soil vis a vis herbicides refers to pre-emergence herbicidal activity. Glyphosate has no pre-emergence herbicidal activity.

by Denise Lawungkurr Goodfellow
on May 10, 2016 at 11:30 PM
For some years I've been using household vinegar (5%) on a range of transformer weeds and it's killed each and every one.

by Bob Randall, Ph.D.
on May 25, 2016 at 3:01 PM
Glyphosate, the active ingredient of the herbicide RoundUp is patented as an antiparasitic agent and non selective antibiotic www.google.com/patents/US7771736 Glyphosate kills bacteria at 1 ppm. It was patented by Stauffer Chemical in 1964 as a metal chelator for pipe cleaning (U.S. Patent 3,160,632 Stauffer Chemicals 1964). It kills plants and bacteria by chelating metal . Although apparently non-toxic to mammals, it is a potent intestinal micro-biome disrupter so could if consumed even in small amounts have grave health implications to the extent the microbiome is important. See the review about the microbiome & health in Scientific American http://www.scientificamerican.com/report/innovations-in-the-microbiome/

Given that, it shouldn't be used where it might get onto the edible portion of a food plant.

by David Kucher
on October 19, 2016 at 5:50 AM
Given that Vinegar is an antibiotic, a metal chelator and also a very effective pipe cleaning agent, should we not view it with the same irrational fear as glyphosate?

by Christine McIntyre
on April 12, 2017 at 7:39 PM
Some here would do well to familiarize themselves with the work on glyphosate of Dr. Stephanie Seneff, Senior Research Scientist at MIT.

-edited to remove hyperlink
-Editors note: Dr. Seneff's training includes a BS in Biophysics, an MS and EE in Electrical Engineering, and a PhD in Electrical Engineering and Computer Science. In recent years, she has coauthored a number of papers exploring links between glyphosate and human health problems.

by mike ashlock
on February 9, 2018 at 8:06 AM
A description of the "Total Time to Weed" treatment chart would be helpful for comparison of time to treat and what it means. For instance "3 times" refers to what? , How is mulched/mulching compared to other treatment in timing? , How does "untreated" take any time at all?

Reply by Brad Hanson
on February 9, 2018 at 8:12 AM
Hi Mike,
I believe those data are "amount of time it takes for three handweeding operations (minutes per plot)". So, untreated plots with no weed suppression would be the weediest and would take the longest to go through and remove all the weeds by hand.

Looks like mulch was similarly suppressive compared to the glyphosate treatment (~2 minutes hand weeding per plot) while the others were poor (15-20 minutes hand weeding per plot).

Hope that helps.
Brad

by Paul Reeve
on June 20, 2018 at 11:51 AM
I noted above that Earthtone 4n1 herbicide is a possible choice. I would point out the very poor quality studies about the safety of maleic hydrazide, the grown and sprouting inhibitor, that qualify that substance through our negligent USDA approval for that material on potatoes and other crops as a shelf life extender, the studies on mammals that should indicate extreme caution in the use of maleic hydrazide (Come on, now, do you think that everybody who uses that product would use a proper respirator? Note that it is the vapor or spray and lung path that makes maleic hydrazide the most dangerous.) BTW, I use that chemical to control invasive bamboo from a negligent neighbor's planting along one-1/2 property lines.

by Nancy
on September 25, 2018 at 7:06 AM
Scythe what is this product and is it truly safe and natural. I've been in search of a product that is safe fir a condo unit. Thank you

by Berkeley sewer replacement
on October 25, 2018 at 7:29 AM
What a cool blog and great article. Cheers to the author for your awesome idea and valuable information. Truly looking forward to reading your next post.
--Berkeley sewer replacement

by Mitali
on February 6, 2019 at 12:27 AM
There are various benefits of bioherbicides, the major one being, they can last across crop cycles until all unwanted crops are weeded out. The bioherbicides market has been growing consistently over the past few years. It is witnessing growth due to the strong initiatives with regard to developments in the organic food products industry.

by Jane
on April 15, 2019 at 7:17 AM
Thanks for publishing this awesome article. I'm a long time reader but I've never been compelled to leave a comment.
I subscribed to your blog and shared this on my Twitter. Thanks again for a great post!

Jane

by AnneElena Foster
on May 27, 2019 at 3:01 AM
Now that we have had three separate courts of law come to the conclusion that glyphosate caused those horrible diseases and Monsanto did those horrible things, folks no longer have to say it was "allegedly" the most evil organization in history, after the Third Reich. It's all been established as a matter of law.
But what about science? I still have an unopened jug of the stuff, which I have declined to use the last couple years, feeling increasingly queasy but still withholding judgment, until someone less overwrought than my organic grocery girl could tell my why I should take it to hazardous waste disposal. I always used as directed in a small area and infrequently. Should I not resume this practice? Should I put it in my massive safe deposit box until after the climate apocalypse? In the meantime, I hear I can just use boiling water and salt on the invasive grasses. Broadleaf too?
Thats my mother, the environmental toxicologist, groaning in the background, like these were stupid questions. Not a lot of sympathy in that one. Its too soon to "check the literature" and I still need to know. Any advice for going forward?

by Zeena
on June 24, 2019 at 2:55 AM
One bacterium, many bacteria; so: bacteria ARE ... The project of dumbing down the general populace is proving to be very effective.

by PJSH
on July 3, 2019 at 1:35 PM
Three separate courts of law have come to the conclusion - that means jury (and sometimes the judge) have voted in favor of the person accusing the herbicide. That does NOT mean that the herbicide caused the cancer. Juries and judges don't always listen to cold hard credible science. There are emotional elements to every court case. I'm truly sorry that these people have cancer. I'm also sorry that ruling in favor of the person is being interpreted as the herbicide causing the cancer.

by Sheri A.
on July 23, 2019 at 11:08 AM
Thank you for this article. Has there been much research regarding environmental impacts of large scale use of organic herbicides in wildlands in the context of habitat restoration? Since high concentration rates and more frequent application are required to be effective (even marginally, at that), I have concerns about impacts to insects, mammals, and beneficial soil bacteria and fungi resulting from exposure to these organic acids and oils. Since many cities are requiring use of organic herbicides, ecologists are encountering situations of inability to control invasive perennial species, while pouring copious amounts of organic oils and acids into the environment. Any information you can provide would be greatly appreciated.

by Biopesticide Analyst
on September 19, 2019 at 11:26 AM
Thank you for the great article. I think it should be updated to include Opportune Herbicide. This in an organic certified herbicide and is EPA registered. It was developed by Marrone Bio Innovations in Davis so you should be familiar with it. The company announced that it was available commercially several years ago, I believe, but I haven't heard anything about it recently. If anyone has been able to find the product for sale somewhere, I'd love to get my hands on some. So would lots of organic growers.

by Tyler Johnson
on October 1, 2019 at 12:17 PM
That's good information that good coverage could increase the effectiveness of natural weed control. I would think that would be good to leave to a professional. I would assume that they could cover the yard much more effectively with their equipment.

by William bambat
on January 9, 2020 at 9:32 AM
Great to read

by Tori Raddison
on February 4, 2020 at 12:40 PM
It's interesting that some herbicides kill the weeds by breaking down plant membranes because I didn't know there were different ways to kill plants. Thanks for explaining the different ways that herbicides can work! I'm going to choose the kind that I like best for my yard.

by Abraham
on April 15, 2020 at 9:55 AM
I really like the tips, and use or have tried most of them. But I am wondering how to control the other areas- the driveway, around the dugout (pond) and around the barn? There are so many areas on a homestead that the weeds just love. Do I just give in and use chemicals?

by MOHAMMAD SIDDIQUI
on May 2, 2020 at 8:48 AM

I am surprised to note that no one mentioned IRON HEDTA OR FEHEDTA
IN PULVERIZE , they also claim that it is very effective and takes care of the weed at their roots level without having adverse effect on the grass.
Please give youe experiences and thoughts about it.
Thanks

by Maria Coler
on June 28, 2021 at 7:24 PM
Here's an idea: pull out the weeds by hand. We cannot spray our way to an Eden inhabited only by the plants that we like. Everyone must go back and read Rachel Carson's "Silent Spring." As a society, have we truly leaned nothing since 1963?

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