

Horticultural Zombies - How to recognize and dispatch

Seminar roadmap

- 🌱 Sources of information
- 🌱 Evaluating information
- 🌱 Assessment examples
 - 🌱 Products
 - 🌱 Practices
- 🌱 Good and not-so-good science

Sources of information

- 🌱 Scientific - peer reviewed, academic audience
- 🌱 Gray - not peer reviewed, professional audience
- 🌱 Popular - not peer reviewed, general audience

Evaluating information using the CRAP test

- 🌱 Credibility of the source
 - 🌱 Author's credentials and qualifications?
 - 🌱 Publisher?
 - 🌱 Website urls?
- 🌱 Relevance to managed landscapes
 - 🌱 Crop production or urban landscapes?
 - 🌱 Geographic or other constraints on usability?
- 🌱 Accuracy
 - 🌱 Science-based?
 - 🌱 Objective?
 - 🌱 Current?
 - 🌱 Well-written?
- 🌱 Purpose
 - 🌱 Educational or commercial?
 - 🌱 Political, ideological, cultural, religious, or personal biases?
 - 🌱 When in doubt, consult with relevant discipline experts

Assessment of products and practices

- 🌱 No supporting science (no research; inconsistent or negative results; poor quality research or reporting)
- 🌱 Misapplied science (agricultural products and practices applied to nonagricultural settings)
- 🌱 Overextrapolated science (products and practices with limited efficacy applied to settings outside the efficacy window)

No consistent, reliable supporting science

- | | |
|-------------------------------------|---------------------------------|
| 🌱 Products | 🌱 Practices |
| 🌱 Balanced fertilizers | 🌱 Avoiding hot weather watering |
| 🌱 Compost tea | 🌱 Biodynamics |
| 🌱 Conditioners | 🌱 Companion planting |
| 🌱 Kelp products | 🌱 Hügelkultur |
| 🌱 Organic product superiority | 🌱 Lasagna mulching |
| 🌱 Vitamin B-1 transplant fertilizer | 🌱 Leaving rootballs intact |
| 🌱 Wound dressings | 🌱 Native plant superiority |
| | 🌱 Permaculture |

Because none of these products or practices are supported with sufficient scientific evidence, they should not be used or recommended.

Claim: Use balanced fertilizers to support garden and landscape plants

Fact: Fertilizers are frequently overused and misused in home gardens and landscapes

- Imbalances and toxicities disrupt uptake of other nutrients
- Beneficial microbes are negatively impacted
- Heavy metals build up rapidly
- Only a soil test can tell you what your soils needs

Claim: Compost tea fights plant diseases and improves soils

- Science behind compost tea and disease
 - In general, mixed results in the lab and the field in controlling disease
 - ACT less effective than NCT in controlling pathogens
 - ACT not only ineffective, but in some cases make problems worse
- Science behind ACT and soils
 - Few studies published
 - Virtually no differences between soil treated with water and ACT
 - Compost has much greater nutrient content and many more microbes than ACT
- Scientific summary
 - ACTs have no value in disease control or as a fertilizer
 - ACTs are not legal pesticides
 - ACTs can contain pathogens
 - ACTs are expensive and energy-wasteful compared to compost

Claim: Conditioners will “reduce soil compaction, help clay conditions, improve drainage and aeration, and bioactivate soils”

- About conditioners
 - Active ingredient is often ammonium laureth sulfate: a surfactant or soap
 - Anything with a waxy protective covering will be injured or killed by conditioners

Claim: Kelps and seaweeds stimulate root growth and plant establishment

- About kelp
 - The “trees” of marine ecosystems
 - Clearcut to make garden products
 - Kelp harvesting affects fish and coastal seabird populations
- Scientific summary
 - Weak fertilizer
 - Kelp hormones can stimulate rooting
 - Generally no different than controls in greenhouse and field experiments
 - When compared to well-watered, fertilized plants, there are no differences

Claim: Organic products are superior to “chemicals”

Fact: Everything, natural or otherwise, is composed of chemicals

- Scientific summary
 - Organic: In chemistry, this is any chemical compound composed of C, H, and O
 - Organic farming: partially defined as using only naturally occurring chemicals
- Recommendations
 - Start with a soil test
 - Avoid using any chemical unless a soil test indicates a deficiency

Claim: Vitamin B-1 will help transplants establish

- About Vitamin B-1
 - Plants make their own
 - Rooting hormones are more effective
 - Additional minerals in products unnecessary

Claim: Wound dressing will protect wounds and enhance their healing

- About wound dressing
 - Components include petrochemicals
 - Application interferes with natural sealing
 - Restricts oxygen
 - Prevents wound wood formation
 - Inhibits compartmentalization
 - Increases disease
 - Seals in decay
 - Does not keep pathogens out
 - Does not stop rot

Claim: Watering during the hottest part of the day will scorch leaves

- Water drops on the leaf surfaces act as tiny magnifying glasses
- Wet leaf surfaces are more likely to burn than dry ones

Fact: Other factors can cause scorch, but not water

- Symptoms of water deficit:
 - tip and marginal leaf scorch, early leaf abscission
 - shoot dieback and stunted growth
- Causes of water deficits - all linked to decreased leaf water:
 - Soil issues: lack of water, presence of salts, compaction, flooding
 - Weather issues: lack of rainfall, high temperature, high light, wind
 - Plant issues: poor root health (improperly prepared roots)
- Recommendations
 - Maintain adequate soil moisture, oxygen, temperature, and nutrients
 - Watch foliage for signs of wilt and water immediately
 - Do not overuse fertilizers and pesticides
 - Run recycled or grey water through a filtering system before applying it to plants

Claim: biodynamics stimulate vitalizing and harmonizing processes in the soil

- About biodynamics
 - Philosophy based in alchemy, astrology, and homeopathy
 - Scientific inquiry rejected by inventor
 - No differences on plants or soil between organic methods and biodynamics
- Vine nutrition and winegrape analyses - results
 - “Based on the fruit composition data, there is little evidence the biodynamic preparations contribute to grape quality.”
 - “The differences observed were small and of doubtful practical significance.”
- Vine nutrition and winegrape analyses - abstract
 - “...the biodynamic treatment had ideal vine balance for producing high-quality winegrapes...”
 - “Biodynamically treated winegrapes had significantly higher ($p < 0.05$) Brix and notably higher ($p < 0.1$) total phenols and total anthocyanins in 2003.”

Claim: Companion plants “use tables to select compatible species”

- About plant associations
 - Three Sisters
 - Polyculture and intercropping
 - Phytoremediators
 - Nitrogen fixers
 - Nurse plants
- NOT: astrological charts for gardeners

Claim: Hügelkultur is an ancient way to grow vegetables sustainably

- About Hügelkultur
 - Invented by a German gardeners and published in a booklet in the 1960's
 - Promotes a method that doesn't occur in natural systems
 - Is inherently unstable and therefore not sustainable

Claim: Lasagna mulching creates a healthy, nutrient rich soil

- About lasagna mulching
 - "a no-till method of layering brown and green materials to increase organic matter"
 - Emotional appeal
- Scientific summary
 - Sheet mulches reduce water and air availability to roots
 - Overuse of any nutrient can create soil, plant and water problems

Claim: Root balls must be left intact during transplanting

- About B&B and container root balls
 - Surrounded by clay or soilless media
 - Often too deeply buried
 - Often have fatal root flaws
- Scientific summary on bare rooting
 - Eliminates multiple barriers to root establishment (burlap, clay, etc.)
 - Allows detection and correction of root flaws
 - Guarantees planting at grade

Claim: Native species are the best choices to support landscape biodiversity

Facts:

- Definitions of "native" and "alien" are value judgments, not scientific terms
- Not all introduced species are invasive
- Urban areas do not have natural environmental conditions
- Native species are often not adapted to urban conditions
- Introduced species provide ecological benefits
- Vegetation diversity, structure and function more important to biodiversity than nativeness

Claim: Permaculture is an ecology-based approach to gardening

Facts:

- Permaculture is a philosophy-based approach to gardening
- Includes scientific-sounding terms that are meaningless or incorrect (i.e., pseudoscience)
 - Dynamic nutrient accumulators, narcissistic plant species
 - Buffer plants, guilds
- Practices are not science-based and are damaging to plant and soil health
 - Sheet mulching
 - Recommended use of noxious weeds and other invasive species

Misapplied science

Products

- Antitranspirants
- Epsom salts
- Gypsum
- Hydrogels (“water crystals”)
- Phosphate fertilizer

Practices

- Amending soil before planting
- Foliar fertilizers

Claim: Antitranspirants “block out insects and disease, and lock in moisture during stress”

- About antitranspirants
 - Cover leaf surfaces, including stomates
 - Reduce water and gas movement between the leaf and atmosphere
- Scientific summary
 - May reduce insect attack but not disease
 - May work in weed control

Claim: Epsom salts are a “safe, natural way to increase plant growth”

- About Epsom salts
 - Magnesium sulfate
 - Originally from Epsom, England
 - Makes water feel silkier
- Scientific summary
 - Generally used to treat magnesium deficiency in production agriculture
 - Adding magnesium to soils with adequate magnesium can cause nutritional imbalances

Claim: “Adding gypsum to your yard or garden will improve soil tilth”

- Gypsum can:
 - Replace sodium in salty soils with calcium
 - Improve heavy clay soils
 - Improve agricultural soils
- Gypsum will not:
 - Change acidic or sandy soils
 - Improve water holding capacity
 - Improve most urban soils
 - Help plants establish

Claim: Water crystals protect plants in heat-stressed, drought-prone situations, by absorbing water, then releasing it gradually as plants need it”

- About hydrogels
 - Acrylamide polymers
 - Absorb large amounts of water
 - Used in cosmetics, disposable diapers, tissue enhancement
- However, water crystals
 - ...are broken down quickly by microbes, sunlight and fertilizers, so...
 - ...are only a temporary fix to droughty soil conditions
- Scientific summary
 - Variable effectiveness in field studies; no long term benefit
 - As crystals dry out, they absorb water from the soil
 - Studies have found mulches to be more cost-effective

Claim: phosphate fertilizer enhances root growth of new transplants

- About phosphorus
 - Most urban soils have enough phosphorus
- Scientific summary
 - Phosphorus competes with iron and manganese uptake
 - Excess phosphorus Inhibits mycorrhizal fungi, so roots work overtime
 - Excess phosphorus pollutes aquatic systems

Claim: before planting trees and shrubs, work in organic material to improve soil

- Based on an agricultural model for intensive crop production
- Scientific summary
 - Hydrology disruption
 - Soil subsidence
 - Nutrient overload

Claim: foliar feeding puts fertilizer directly onto leaves rather than wasting it on the soil

- Scientific summary
 - Foliar fertilizers only treat foliar symptoms; they don't solve soil deficiencies
 - Repeatedly applying foliar fertilizers is expensive and can injure plants

Overextrapolated science

- Corn gluten meal (CGM)
- Harpin
- Mycorrhizal and probiotic inoculants

Claim: corn gluten meal controls weeds

- About corn gluten meal
 - Natural, pre-emergent herbicide registered for turf use
 - High (10%) nitrogen by-product of corn milling
 - CGM inhibits seedling development, by drying the soil and reducing water availability
 - Soil must remain dry during seedling development
 - Effectiveness is species specific
- Scientific summary
 - Greenhouse trials demonstrate effectiveness
 - Field trials less successful
 - Little effect on container weeds
 - No control of turf grass weeds
 - No control of crop field weeds
 - Soil must be dry in late spring
 - Spring is the wettest season in the coastal western US
 - CGM is not successful in this and similar climates
 - High nitrogen content of CGM acts like a fertilizer

Claim: harpin is like a vaccination that turns on a plant's defenses

- About harpin
 - A protein isolated from the bacterium that causes fire blight
 - Triggers plant systemic immune response
 - Must be taken up into the intercellular spaces
- Scientific summary
 - Laboratory work

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URL: <http://www.theinformedgardener.com> (white papers on many of these myths)

Blog: <http://www.gardenprofessors.com>

Books: <http://www.sustainablelandscapesandgardens.com>

Facebook page: <http://www.facebook.com/TheGardenProfessors>

Facebook group: <https://www.facebook.com/groups/GardenProfessors/>

Washington State University Extension publications: <http://gardening.wsu.edu/> (peer-reviewed fact sheets on many topics of interest)

Fact sheets referred to in this presentation:

Corn meal and corn gluten meal - <https://pubs.extension.wsu.edu/cornmeal-and-corn-gluten-meal-applications-in-gardens-and-landscapes-home-garden-series>

Epsom salt - <https://pubs.extension.wsu.edu/epsom-salt-use-in-home-gardens-and-landscapes>

Gypsum - <https://pubs.extension.wsu.edu/gypsum-use-in-home-gardens-and-landscapes>

Hügelkultur - <https://pubs.extension.wsu.edu/hugelkultur-what-is-it-and-should-it-be-used-in-home-gardens>

Kelp products - <https://pubs.extension.wsu.edu/the-efficacy-and-environmental-consequences-of-kelp-based-garden-products>

Mycorrhizae - <https://pubs.extension.wsu.edu/a-gardeners-primer-to-mycorrhizae-understanding-how-they-work-and-learning-how-to-protect-them-home-garden-series>

Native vs. nonnative trees and shrubs - <https://pubs.extension.wsu.edu/are-native-trees-and-shrubs-better-choices-for-wildlife-in-home-landscapes>

Scientific literacy - <https://pubs.extension.wsu.edu/scientific-literacy-for-the-citizen-scientist>

Wood chip mulches - <https://pubs.extension.wsu.edu/using-arborist-wood-chips-as-a-landscape-mulch-home-garden-series>