

Evaluating gardening products and practices: What works, what doesn't, and why

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- 🌿 Gray - not peer reviewed, professional audience
- 🌿 Popular - not peer reviewed, general audience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 |
| 🌿 Compost tea | 🌿 Biodynamics |
| 🌿 Conditioners | 🌿 Companion planting |
| 🌿 Kelp products | 🌿 Fertilizer injections |
| 🌿 Vitamin B-1 transplant fertilizer | 🌿 Hügelkultur |
| 🌿 Wound dressings | 🌿 Lasagna mulching |
| | 🌿 Leaving rootballs intact |

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

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: 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: 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: fertilizer injection is more effective than soil application

- About injections
 - Most fine roots are close to the soil surface
 - Trunk injection can hurt trees
 - Soil injection is ineffective and a waste of money and resources

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

2. 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

3. 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

Look at the body of research. If a paper is at odds with the majority of other papers, it must withstand increased scrutiny.

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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:

Hügelkultur - <http://cru.cahe.wsu.edu/CEPublications/FS283E/FS283E.pdf>

Mycorrhizae - <http://cru.cahe.wsu.edu/CEPublications/FS269E/FS269E.pdf>

Scientific literacy - <http://cru.cahe.wsu.edu/CEPublications/EM100E/EM100E.pdf>

Wood chip mulches - <http://cru.cahe.wsu.edu/CEPublications/FS160E/FS160E.pdf>