Cooperative Extension University of California Ventura County

Landscape Notes

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Palm Research Symposia

Last December (15th) Don Hodel and I presented the first Palm Research Symposium at the Huntington Library and Botanical Gardens. Many people have contacted me to let me know they received the flyer after the meeting date!!! Of course, from my perspective, this is the last thing I want to happen. I just want to let you know we mailed that flyer 30 days prior to the meeting, but bulk mail gets no respect in December. More importantly, we plan on doing this meeting again, many times around California. Plans are underway to run the seminar in Northern California, the central valley and in Southern California. Our next scheduled date is in San Louis Obispo in June. We may run the meeting elsewhere before then but when we do, we will use USPS first class mail to send out the flyer so that everyone that wants to come can come. Sorry for the inconvenience. If you are interested, we have extra copies of our handout that we can make available for a small fee.

Snake Oil, Horticultural Myths, Horticultural Urban Legends, and Persuaders in our Industry

Jim Downer

Horticulture is the cultivation of plants as ornamentals or for the production of food. When things go wrong (plants grow poorly or not at all), horticulturists sometimes turn to products that can "cure", revitalize, invigorate, stimulate or enhance the growth of their plant or crop. A colleague of mine (a horticultural consultant), has often told me, "There are no miracles!". Unfortunately, when nothing else has worked, many people will turn to these products hoping for a miracle. Products that purport to give you that miracle are termed snake oil. Snake oil products claim many things, but usually without referenced research reports from Universities. Snake oil products almost always offer numerous testimonials to support their use. Those who provide testimonials are usually not researchers.

Science Based

The most creative and effectively marketed snake oil products often cite sound biological facts or knowledge and then attempt to link their product to this knowledge, but references to the published research about their product are always missing. Very often, snake oil products will attempt to use jargon relating to the chemistry, biology or microbiology of the products in an attempt to impress the potential user with terms that sound informative but are used in a meaningless context. In some cases, these products are "ambulance chasers" and follow the most recent pest outbreak or natural disaster in an attempt to make money from desperate clients.

Works on a new principle

A prime indicator of snake oil products are that they rely on a new principle that gives them their efficacy. This "new" principle may be entirely fabricated by the manufacturer or have a shred of truth based in current science, but the science is so distorted that there is no truth in the claim. A clear explanation of the scientific principle, its discoverer, where it was published and how it relates to the product at hand is rarely or never available.

Research Based

Some products make claims of efficacy based on extensive research. But who did the research? Upon inspection, we find that independent, third party research, published in a journal is lacking. In-house research or research conducted by contract with other companies may not have the same degree of objectivity as University-based research projects. Some products allude to University research but never tell the user that the research found that their product was not effective. Sometimes product literature tells outright lies about the efficacy of the product discussed in the research. Sometimes a retired researcher will start selling a product based on the good research they have done in the past, but with little bearing on the efficacy of the current product or material. Past affiliations with Universities are no guarantee that products developed after the researcher has left the institution are efficacious. Only current published reports of efficacy in peer reviewed journals are acceptable references.

It's too good to be true

Some problems like *Armillaria* (which causes root rot and basal cankers of many ornamental plants) are essentially incurable. All the traditional sources of information suggest ways to limit the disease but no "cure" is offered. Along comes a product that kills the pathogen and reinvigorates the sick host. Sounds too good to be true? Then the product is probably snake oil. Rarely do efficacious pest management practices or products come to market without some kind of University based research. Again, there are no miracles.

Soil Microbiology Products and Services

Since plants spend all their lives with a significant amount of themselves in the ground, and since we do not see their roots very well, there is a lot of snake oil that concerns soils and soil treatments. Polymers, growth activators, hormones, vitamins, fertilizers, worm castings, composts and their teas, are but a few products that can fall into this category. Since none of these products claim to be a pesticide, the careful efficacy testing required for state registrations is not required. Efficacy claims can run to the extreme.

--Mycorrhizae

Some of the most convincing products are those that have solid scientific basis for efficacy but no direct evidence that they work. A classical example is mycorrhizal inoculants for landscape trees. Although elegant research has shown the necessity of mycorrhizae for proper growth and development for many plants and tree species, it does not indicate that those organisms are necessarily lacking from most soils, or that the products used to add them to soil are ***viable***. In a study of ten commercial mycorrhizae products, Corkidi et al.(2004), found that four of the ten failed to infect the bioassay plants and in a second trial, three of the ten products failed to infect. In a subsequent study, Corkidi et al (2005) found varying growth response in *Liquidambar* to four commercially available products and that one product failed to infect the trees, indicating that not all products perform the same on a given tree species

Recent research by several groups showed no effect on inoculated landscape trees from commercially available mycorrhizal products. Enhanced survival of newly planted landscape plants and accelerated growth **are claimed** by many product manufacturers when Arbuscular Mycorrhizal fungi (AMF) are included in planting specifications. However, Carpio et al., 2003, found that high native AMF inoculum levels colonized all non-inoculated plants. Thus, comparative field studies of inoculated and uninoculated plants are difficult. Mature trees are also subjects for mycorrhizal inoculation. The purported benefits of revitalization, increased vigor and growth have not been substantiated in replicated third party research trials. Mature landscape trees (pin oak, *Q. palustris*) were not benefited by AMF inoculants unless fertilizer was contained in the mix.(Appleton, et al., 2003) .

Indeed many manufacturers of mycorrhizal inoculants add other ingredients to increase product efficacy. Various studies have found that effective growth promoting inoculants do not necessarily cause infection of the roots (Corkidi, et al., 2004, 2005,). Also, when infection does occur, growth is initially retarded in young plants. Sometimes a product claims great things because of the interactions of its ingredients. A combination of ingredients including mycorrhizal inoculants or cocktail will be the ticket to success. Unfortunately, we

cannot separate out the effects of the wetting agents the fertilizer or the biological component as the efficacious ingredient, if any of them are effective. One component of the cocktail could have stimulated growth, especially if there were nutrient deficiencies to start with. A simple all-purpose fertilizer could have achieved the same result at 1/10 the cost.

There is a growing understanding that AMF populations are diverse and that different fungi inhabit different geographies. Stabler (2001) suggests that urbanization changes the composition of AMF populations in landscapes and that landscape irrigation may impede infection. Allen et al., (2005) have shown that various successional stages of forests have their own unique AMF populations that may be more or less stimulatory to replanted trees depending on their origin. Poor or non-existent urban soils are often used as the poster child for mycorrhizae applications. The supposition is that since the soils were removed (grading) or degraded by other home building activities, that mycorrhizae need to be replaced before plants will grow--but which mycorrhizae? Allen et al. (2005), indicate that mycorrhizae not native to a site may not function at that site because they are not adapted to grow there. This calls into question the use of "any old" mycorrhizal inoculant to stimulate tree growth.

-Biological control

A considerable amount of time is spent each year by companies producing biological control microorganisms. Although these often show good efficacy in laboratory or greenhouse trials and this research is grandly displayed, there are only a few products that show such efficacy in field-based trials. Many of the *Trichoderma* based products simply do not work outside the lab or greenhouse. Biological control is an elusive thing that we seek to understand constantly, catch glimpses of in the field, study intensively and consistently fail to recreate when and where we want it to happen.

-Soil Food Webs

Manipulation of Soil Food Webs is said to balance all the complexities of soil so that plants will grow well. The concept here is to balance the various microorganisms so that the soil will benefit the crop at hand. Lab services are used to diagnose the organism content of a given soil sample. Horticulturists then use this information to make the recommended changes to modify the soil ecology and enhance plant performance. The entire concept is couched in soil microbiology and soil ecology concepts. Because the ideas are new to many people and the speaker is enthusiastic and charismatic, a new crop of "followers" are created that spread the mythos that this is the way to manage soils, fight disease and produce healthy plants. As the story goes, in poorly managed soils, all the "good" fungi are killed and only the plant pathogens remain.

I will agree on one thing, Soil food webs are complex. For a review on this subject, see the paper by Ferris and Matute, (2003). Ferris and others have found that nematodes are good indicators of the status of the soil food web. Since nematodes feed on fungi and bacteria, the two most important manipulators of organic carbon, nematodes guilds can be monitored to determine the various successional stages of decomposers in a food web. Maintenance of labile sources of soil organic carbon ensures adequate levels of enrichment for opportunist bacterivore nematodes and thus adequate fertility necessary for crop growth. Labile organic carbon can be supplied by organic amendments or by the roots left behind after a crop is harvested. Organisms come and go in the soil, dependant on carbon available for their growth. If one group (guild) of bacteria or fungi use up the available food, another will take over on what is left. Ferris and others refer to the changes in food web function as functional succession. Analysis of nematode fauna has emerged as a bioindicator of soil condition and of functional and structural makeup of the soil food web (Bongers and Ferris, 1999). Nematodes are used to assess the food web because evaluation of the food web structure is in itself very difficult; you would have to inventory and assess all of the participants. Functional analysis of the web is difficult because it may not indicate how the various functions are being accomplished or whether they are sustainable (Ferris, 2005). Merely counting bacteria and fungi gives nothing but a snapshot view of what was happening the day the samples were obtained. Since Nematodes are the most abundant animal in soils, they can be used as a useful tool in assessing the structure, function and probably resilience of the soil food web (Ferris, 2005). Ferris and

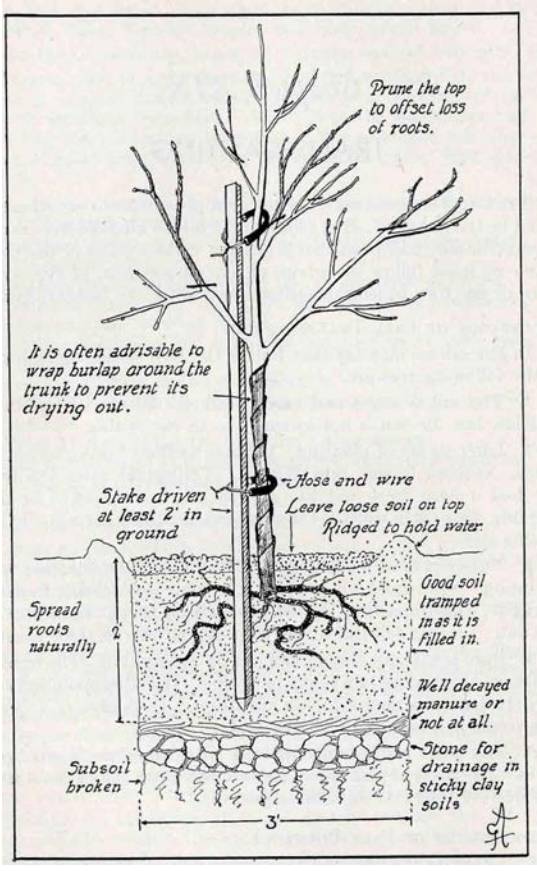
others are still researching what perturbations in the soil food web mean for crop production. This understanding of the biology of soils is new and not yet practicably applicable on a wide basis.

-Compost Teas

A natural extension of food web science is the use of compost teas to strengthen the food web. Compost teas are "brewed" from compost usually in an aerobic fermenter. Because the feedstock (compost) is highly variable, the resultant teas can also be quite different. This variability makes them difficult to conduct research on—or at least research that can be published in peer reviewed journals. Compost teas contain many different substances plus nutrients that plants can use for growth. The problem comes with rates. How much do you apply and how often? There is a lot of experimentation going on by the users of the teas but not much in the academic community due to the variability of these systems.

Horticultural Urban Legends

These are practices and products that many people working in our industry may hold to be useful but have no scientific basis for method of action. They are formed from misinformation passed on over the generations or from common observations that are misinterpreted. A good example is that of placing gravel or rocks in the bottom of a planting hole to increase drainage for the rootball. This is borne out by the fact that these drawings exist in old books (see fig. 1. taken from the book of trees, 1952). Even though the mistakes are corrected in modern texts (Harris et al., 2003) the myth that rocks in the bottom of a planting hole creates drainage, lives on today, and actually shows up in some modern architectural plans.



Another example is the notion that pruning woody plants stimulates their growth. The more severe the pruning, the more the plant is shocked into good growth. Although the growth of latent buds from major limbs that have been headed back leads to copious regrowth, if you compare the overall growth of this tree to a similar unpruned tree, the pruned tree will have grown lesson the main trunk over the same amount of time.

Transplanted trees do not need to be pruned to compensate for their root loss. Sometimes when trees are moved, compensatory pruning is done to "balance" the roots with the shoots. Research has consistently shown that as mentioned above, pruning is a growth retarding process, and thus slows the establishment of transplanted trees (Dagit and Downer, 2002)

There are many funny ideas about mulches. Almost Any mulch can be applied to the soil surface with few bad affects. There are some exceptions where the mulch contains toxic acids or contains weed seeds. However, the belief that high C:N ratio mulches (contain a lot of wood) will extract nitrogen from under the soils to which they are applied has little or no scientific evidence to support it. Just the opposite is true. Over time, woody mulches decay and release nitrogen to underlying root systems (Downer et al, 2002).

A product that has attained Horticultural Urban Legend status is Vitamin B-1. The historical account of Vitamin B-1 and the public craze it caused was well told by Rasmussen (1999) and is briefly summarized here. In the 1930's Caltech's James Bonner discovered, that Thiamin (vitamin b-1) was able to restore growth to pea root tips that had languished in tissue culture. It was concluded to be essential in plant growth media. Bonner later found that B-1 had little growth promoting effects on most whole plants in hydroponic culture, but that some plants such as camellia, and cosmos showed dramatic growth increased to added B-1 vitamins. Bonner

latter discovered that thiamin production was associated with the foliage of growing plants. The hoax was on in 1939 when Better Homes and Gardens magazine ran an article that claimed thiamin would produce five inch rose buds, daffodils bigger than a salad plate and snapdragons six feet tall!. In 1940, Bonner entered into collaborative research with Merck pharmaceutical company to master the growth-promoting effects of B-1, account for the wide variability in his experimental results and develop a product that gave consistent good results. Bonner proved during this period that B-1 was phloem mobile was made in leaves and transported downward in stems. Bonner's experiments with Cosmos continued, but with varying results, so he sought cooperative research with University experiment stations around the country. Results were mixed, some showed growth promotion, most not. By 1940, other physiologists widely reported negative results. By 1942 Bonner was debunking his own discoveries, stating that the effect only ever occurred in very few plants and that since thiamin was found in soil itself, field applications were unlikely to benefit plants. Bonner ultimately fully retracted his claims of efficacy by saying "It is now certain, however, that additions of vitamin B1 to intact growing plants have no significant or useful place in horticultural or agricultural practice.".. The public craze and fanatical headlines about thiamin continued but Merck withdrew all interest and funding in the concept so as to distance itself from a product that does not work.

Conclusion

New products come and go. Snake oil products unlike horticultural urban legends tend to disappear rapidly, when their efficacy fails to materialize after application. The products that confound their purported results with fertilizers or growth stimulators can persist, but eventually they too fail to live up to expectations at some point and will fade from popularity. Try to obtain some kind of consensus with university-based research or other peer reviewed research reports, field efficacy trials that you run for yourself, and the testimonials of others. After awhile, you will be able to ascertain the nature of the oil before you purchase it.

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