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Topics in Subtropics Newsletter

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News from the Subtropical Tree Crop Farm Advisors in California

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Editor's Note

Please also let us know if there are specific topics that you would like addressed in subtropical crop production. Phone or email the advisor in your county.

Visit your County Cooperative Extension website and the Calendar of Events to register for upcoming workshops or seminars.

In our effort to conserve resources, please help us save paper by signing up to receive your newsletter on line. Just visit the Cooperative Extension website, go to newsletters, click on Tropics in Subtropics and enter your email address.

Mary Bianchi
Editor of this Tropics in Subtropics issue

Organic Herbicides – Do they work?

W. Thomas Lanini, Cooperative Extension Weed Ecologist, Department of Plant Sciences,University of California, Davis

In recent years, several organic herbicide products have appeared on the market. These include Weed Pharm (20% acetic acid), C-Cide (5% citric acid), GreenMatch (55% d-limonene), Matratec (50% clove oil), WeedZap (45% clove oil + 45% cinnamon oil), and GreenMatch EX (50% lemongrass oil), among others. These products are all contact-type herbicides and will damage any green vegetation they contact, though they are safe as directed sprays against woody stems and trunks. These herbicides kill weeds that have emerged, but have no residual activity on those emerging subsequently. Additionally, these herbicides can burn back the tops of perennial weeds, but perennial weeds recover quickly.

These products are effective in controlling weeds when the weeds are small and the environmental conditions are optimum. In a recent study, we found that weeds in the cotyledon or first true leaf stage were much easier to control than older weeds (Tables 1 and 2). Broadleaf weeds were also found to be easier to control than grasses, possibly due to the location of the growing point (at or below the soil surface for grasses), or the orientation of the leaves (horizontal for most broadleaf weeds) (Tables 1 and 2).

Organic herbicides only kill contacted tissue; thus, good coverage is essential. In test comparing various spray volumes and product concentrations, we found that high concentrations at low spray volumes (20% concentration in 35 gallons per acre) were less effective than lower concentrations at high spray volumes (10% concentration in 70 gallons per acre). Applying these materials through a green sprayer (only living plants are treated), can reduce the amount of material and the overall cost (http://www.ntechindustries.com/weedseeker-home.html). Adding an organically acceptable adjuvant has resulted in improved control. Among the organic adjuvants tested thus far, Natural wet, Nu Film P, Nu Film 17, and Silwet ECO spreader have performed the best. The Silwet ECO spreader is an organic silicone adjuvant which works very well on most broadleaf weeds, but tends to roll off of grass weeds. The Natural wet, Nu Film 17 and Nu Film P work well for both broadleaf and grass weeds. Although the recommended rates of these adjuvants is 0.25 % v/v, we have found that increasing the adjuvant concentration up to 1% v/v often leads to improved weed control, possibly due to better coverage. Work continues in this area, as manufacturers continue to develop more organic adjuvants. Because organic herbicides lack residual activity, repeat applications will be needed to control new flushes of weeds.

Temperature and sunlight have both been suggested as factors affecting organic herbicide efficacy. In several field studies, we have observed that organic herbicides work better when temperatures are above 75F. Weed Pharm (acetic acid) is the exception, working well at temperatures as low as 55F. Sunlight has also been suggested as an important factor for effective weed control. Anecdotal reports indicate that control is better in full sunlight. However, in a greenhouse test using shade cloth to block 70% of the light, it was found that weed control with WeedZap improved in shaded conditions (Table 3). The greenhouse temperature was around 80F. It may be that under warm temperatures, sunlight is less of a factor.

Organic herbicides are expensive at this time and may not be affordable for commercial crop production. Because these materials lack residual activity, repeat applications will be needed to control perennial weeds or new flushes of weed seedlings. Finally, approval by one's organic certifier should also be checked in advance as use of such alternative herbicides is not cleared by all agencies.

Review tables on following page...

(**Table 1.** Broadleaf (pigweed and black nightshade) weed control (% control at 15 days after treatment), when treated 12, 19, or 26 days after emergence.

	Weed age		
	12 Days old	**19 days old**	**26 days old**
GreenMatch Ex 15%	**89**	**11**	**0**
GreenMatch 15%	**83**	**96**	**17**
Matran 15%	**88**	**28**	**0**
Acetic acid 20%	**61**	**11**	**17**
WeedZap 10%	**100**	**33**	**38**
Untreated	**0**	**0**	**0**

Table 2. Grass (Barnyardgrass and crabgrass) weed control (% control at 15 days after treatment), when treated 12, 19, or 26 days after emergence.

	Weed age		
	12 Days old	**19 days old**	**26 days old**
GreenMatch Ex 15%	**25**	**19**	**8**
GreenMatch 15%	**42**	**42**	**0**
Matran 15%	**25**	**17**	**0**
Acetic acid 20%	**25**	**0**	**0**
WeedZap 10%	**0**	**11**	**0**
Untreated	**0**	**0**	**0**

Table 3. Weed control with WeedZap (10% v/v) in relation to adjuvant, spray volume and light levels. Plants grown in the greenhouse in either open conditions or under shade cloth, which reduced light by 70%.

	Pigweed control (%)		**Mustard control (%)**	
	Sun	**Shade**	**Sun**	**Shade**
WeedZap + 0.1%v/v Eco Silwet (10 gpa)	**31.7**	**93.3**	**26.7**	**35.0**
WeedZap + 0.5%v/v Eco Silwet (10 gpa)	**31.7**	**48.3**	**43.3**	**71.7**
WeedZap + 0.5%v/v Natural Wet (70 gpa)	**26.7**	**94.7**	**26.7**	**30.0**
Untreated	**0.0**	**0.0**	**0.0**	**0.0**
LSD.05*	**5.7**		**11.5**	

* Values for comparing any two means. Pigweed and mustard were each analyzed separately.

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

Jim Downer Ph.D. Cooperative Extension, Ventura County

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 horticultural consultant colleague of mine, has often told me, "There are no miracles!" Unfortunately, when nothing else has worked, many people will turn to so called miracle products in hopes of a cure. 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. Professional horticulturists, farmers and gardeners should be able to recognize snake oil products and avoid their use—we should base our horticultural decisions on sound research-based information, not on marketing claims and testimonial based admonitions.

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 use jargon relating to the chemistry, biology or microbiology of their products in an attempt to impress potential users 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. Very often the active ingredient is not listed on the label and is a "secret" or proprietary substance. 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 peer-reviewed 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.

Snake oil products can sometimes be lawbreakers!

Products that purport to control a pest such as a disease organism or an insect or weed, but are not registered with the State or Federal EPA and do not have pesticide registration numbers, are not pesticides and can not be used for that purpose. It is a violation of state and federal laws to apply products as pesticides when they are not labeled for that use. Sometimes a product claims to boost plant health and thus avoid diseases, also avoiding the pesticide registration process. Health boosters, activators, and stimulators are not considered pesticides by regulatory agencies; however, they are often not efficacious or supported by University research findings.

It is too good to be true

Some problems like *Armillaria* (which causes root rot and basal cankers of many ornamental and orchard trees) 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

All plants have root systems and almost all are rooting in soil, 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 **may** fall into this category. Since none of these products claim to be a pesticide, the careful efficacy testing required for state or federal registrations is not required. Efficacy claims can run to the extreme.

Mycorrhizal Fungi

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 fungal mycorrhizae forming inoculants for landscape trees. Mycorrhizae are not snake oil. However, some products that purport all the things that mycorrhizae can and do achieve for plants may be. Many of the numerous scientific papers written on mycorrhizal fungi do not indicate that mycorrhizae 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. Another researcher found that of eight tested products, none had living spores of mycorrhizae forming fungi and many of the products were contaminated with bacteria and antagonistic fungi (Appleton, unpublished data). In a subsequent study, Corkidi et al. (2005) found varying growth response in *Liquidambar* to four commercially available products; while some products significantly stimulated growth, others 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 various 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 pits. 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 purported subjects for mycorrhizal inoculation. The purported benefits of revitalization, increased vigor and growth have not been substantiated in published scientific journal articles. In one such study, mature landscape trees (pin oak, *Q. palustris*) were not benefited by AMF inoculants unless fertilizer was contained in the product (Appleton, et al., 2003).

Indeed many manufacturers of mycorrhizal inoculants add other ingredients to increase product efficacy. Various studies found that effective growth promoting inoculants do not necessarily cause mycorrhizal infection of roots (Corkidi, et al., 2004, 2005,). Also, when infection does occur, growth can be 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 will be the ticket to success. Unfortunately, we cannot separate out the effects of the wetting agents from 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. If nutrients are limiting, at the planting site a fertilizer application may achieve similar results at a fraction of the cost. Other standard planting practices such as mulching may have greater benefits toward the establishment and growth of newly planted woody ornamentals than application of mycorrhizal inoculants (Abbey and Rathier, 2005)

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 AMF origins. Poor or non-existent urban soils are often used as the poster child for mycorrhizae applications. The supposition is that since the soils that were removed (grading) or degraded by other home building activities, need mycorrhizae 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. Although this calls into question the use of generic mycorrhizal inoculants as tree growth stimulants, many mycorrhizae are cosmopolitan, having a worldwide distribution, and if applied in active form may assist establishment of landscape trees in difficult soils. There is a need for research that examines the existing mycorrhizal content of landscape soils. Also, anecdotal statements of success with mycorrhizal fungi products do not take the place of testing to see if actual infections occurred and identification of the fungi causing the infection.

There is no question that mycorrhizal fungi are essential components of tree ecosystems. Whether or not we add them to new or established plantings requires an intimate knowledge of the site, the trees growing there, the mycorrhizal products that are available for our use, and mycorrhizal fungi that inhabit the site in question.

Biological control

A considerable amount of time is spent each year by companies producing biological control microorganisms. Although these often show good efficacy in university-based laboratory or greenhouse trials, and this research is published, there are few products that show efficacy in field-based trials. Many of the *Trichoderma* based products simply do not work when applied as products outside the lab or greenhouse. Biological control of soil-borne diseases 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. Rarely has a single organism been applied with disease control effect in field settings. Soil ecosystem level changes (like massive mulch applications) can promote biological control of root rot diseases (Downer et al., 2001) but these effects are caused by many kinds of fungi that are naturally occurring in the environment.

Soil Food Webs

Manipulation of Soil Food Webs is purported to balance all the complexities of soil so that plants will grow well. The concept 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. A "healthy soil" will grow healthy plants; a "sick soil" is unproductive. The theory predicts that in poorly managed soils, all the "good" fungi are killed and only the plant pathogens remain. The data relating good fungi to bad and how their populations interact is rarely given and published references with this information are lacking. Detailed information on the interactions of soil food webs with specific plant pathogenic fungi are distinctly lacking in the literature.

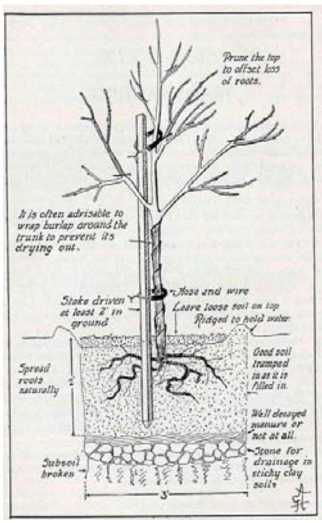
Soil food webs are complex. For a review on this subject, see the paper by Ferris and Matute, (2003). Ferris and others have found that nematodes are good indicators of the status of the soil food web. Since nematodes feed on fungi and bacteria, the two most important manipulators of organic carbon, nematode 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 tool in assessing the structure, function and 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. They may be aerated or non-aearated. Because the feedstock (compost) is highly variable, the resultant teas can also be quite different. Due to the tremendous number of variables in "brewing" compost teas (ph, fermentation time, water source and content, temperature, added nutrients, feedstocks and aerated vs. not) the results are hard to replicate and quite variable; this makes studies hard to publish. Compost teas contain many different substances plus nutrients that plants can use for growth or that can act as plant growth stimulators. 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 validation in the academic community (especially research on trees) due to the variability of these systems. For a review of the literature on compost teas see the work by Scheurell and Mahaffee, 2002.

Horticultural Myths

These are practices and or products that many people working in our industry may hold to be useful but have no scientific basis for their 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 landscape architectural specifications.



Another myth 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 less on the main trunk over the same amount of time.

Transplanted trees do not need to be pruned to compensate for their root loss (Shoup et al., 1981). 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 (Ranney et al., 1989; Dagit and Downer, 2002). As Whitcomb's group found, moisture stress from leaving the entire tops of trees intact after transplanting is offset by more rapid and thorough development of a supporting root system.

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.

Conclusions

New products come and go. Snake oil products often disappear rapidly, when their efficacy fails to materialize after application. 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 not on the testimonials of others. If you decide to conduct your own trials, they must be replicated and statistically analyzable, otherwise they are little more than anecdotal observations that have little value in quantifying the effects of the above mentioned products and practices. For more help with trials, seek out University Extension agents and specialists. This is their job, and they are willing partners in field research. After awhile, you will be able to ascertain the nature of the "oil" before you purchase it.

References

Abbey, T. and T. Rathier. 2005. Effects of Mycorrhizal fungi, biostimulants and water absorbing polymers on the growth and survival of four landscape plant species. J. Environ. Hort. 23:108-111.

Appleton, B., J. Koci, S. French, M. Lestyan and R. Harris. 2003. Mycorrhizal fungal inoculation of established street trees. J. Arboriculture 29:107-110

Allen, M.F. and E.B Allen, and A. Gomez-Pompa. 2005. Effects of mycorrhizae and non-target organisms on restoration of a seasonal tropical forest in Qunitana Roo, Mexico: Factors limiting tree establishment. Restoration Ecology 13:325-333.

Bongers, T. and H. Ferris. 1999. Nematode community structure as a bioindicator in environmental monitoring. Trends Evol. Ecol. 14:224-228.

Carpio, L.A., Davies, F.T. and M.A. Arnold. 2003. Effect of commercial mycorrhiza on growth, survivability, and subsequent landscape performance of selected container grown ornamental nursery crops. Procs. of the SNA research conference 48:45-48.

Corkidi, L., E.B. Allen, D. Merhaut, M.F. Allen, J. Downer, J. Bohn and M. Evans. 2004. Assessing the infectivity of commercial mycorrhizal inoculants in plant nursery conditions. J. Environ. Hort. 22:149-154.

Corkidi, L., E.B. Allen, D. Merhaut, M.F. Allen, J. Downer, J. Bohn and M. Evans. 2005. Effectiveness of commercial mycorrhizal inoculants on the growth of *Liquidambar Styraciflua* in plant nursery conditions. J. Environ. Hort. 23:72-76.

Dagit. R. and J. Downer. 2002. To prune or not to prune: recovery of Coast Live Oak after transplanting. Proceedings of the 5th Oak Symposium, San Diego, CA USDA Forest Service G. Tech. Rep. PSW-GTR-184: 269-380.

Downer, A.J., J.A. Menge, and E Pond,. 2001. Association of cellulytic enzyme activities in eucalyptus mulches with biological control of *Phytophthora cinnamomi* Rands. Phytopathology: 91 847-855

Downer, J., B. Faber. and J. Menge. 2002. Factors affecting root rot control in mulched avocado orchards. HortTechnology 12:601-605.

Ferris, H. 2005. The structure and functions of the soil food web. Proceedings of the Landscape Disease Symposium, November 29, 2005, Santa Paula, CA. pp 28-36.

Ferris, H. and M.M Matute. 2003. Structural and functional succession in the nematode fauna of a soil food web. Applied Soil Ecology 23:93-110.

Harris, R.W., Clark, J.R. and N. P. Matheny. 2003. Arboriculture: Integrated Management of Landscape Trees, Shrubs, and Vines Fourth Ed. Prentice Hall, Upper Saddle River, NJ.

Ranney, T.G., N.L. Bassuk and T.H. Whitlow. 1989. Effect of transplanting practices on growth and water relations of "Colt" cherry trees during reestablishment. J. Environ. Hort. 7:41-45.

Rasmussen, N. 1999. The forgotten promise of thiamin: Merck, Caltech biologists and plant hormones in a 1930's biotechnology project. J. of the History of Biology 32:245-261

Scheuerell, S. and W. Mahaffee. 2002. Compost Tea: Principles and Prospects for Plant Disease Control. Compost Sci. and Utilization 10:313-338

Stabler, L.B., C.A. Martin, and J.C. Stutz. 2001. Effect of urban expansion on arbuscular mycorrhizal fungal mediation of landscape tree growth. J. Arboriculture 27:193-202.

Success Story Before There is a Problem

Ben Faber Ph.D. Cooperative Extension, Ventura County

Tropinota hirta Poda (Coleoptera, Scarabaeidae, Cetoniinae) is the most common pest scarab beetle in Turkey, causing damage by feeding on the flowers of many perennial plants. Damage can occur to both agricultural as well as ornamental plants, such as stone fruits, citrus and roses. The larval stage normally takes one to two years in the ground, feeding on the roots of herbaceous plants. Their numbers can increase significantly in orchards where no weed control is maintained. On emergence, adults will feed on flowers and their reproductive parts, resulting in no fruit formation. Early flowering plants, such as cherry and almond are especially susceptible. Damage can be dramatic with significant yield reductions, however no statistical data was developed for exact losses in Turkey. In Europe, it is considered to cause significant economic damage to pear and apple. Late flowering citrus is less of a problem, but coastal lemons with their extended flowering period could have a problem.

In Turkey, these beetles were not a problem until about 1980, when increasing winter soil temperatures reduced the larval development time and caused earlier soil emergence, shortening their larval period from two to one year. Damage was notable in certain areas of Turkey, until farmers started leaving weed strips on the perimeters of orchards for the beetles to go to and by placing cups under the drip emitters in the orchards. The beetles would find the water and drown themselves. These cultural management practices have reduced the problem now, to the point that growers do not worry about the insect.

This pest is not yet found in the United States. However, this is an example of a pest that could be very destructive to many different California crops. In this case, though, we already have a potential method for control.

Good flowers on left, damaged flowers on right.

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