Organic Citrus Production

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Organic Citrus Production

- Brief Overview of Organic
- Organic Nutrient Management
- Organic Pest Management

Organic agriculture

- Organic is a legally defined term
- Regulated by USDA under NOP, the National Organic program
- Federal regulatory program that sets uniform national standards for organic agricultural products http://www.ams.usda.gov/nop/indexIE.htm

Organic Crop Production

- Organic crops are raised without using most conventional pesticides or petroleum-based fertilizers.
- NOP prohibits the use of genetic engineering, irradiation, and sewage sludge
- Generally, natural (non-synthetic) substances are allowed in organic production and synthetic substances are prohibited.

Organic Crop Production

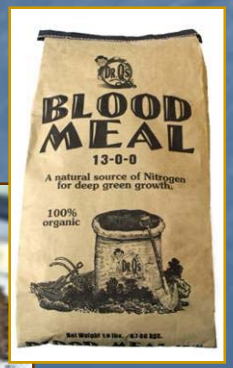
- Viewed from a systems perspective, e.g. an Organic System Plan is required for certification
- Not just substituting an organic material for a conventional one
- Fewer tools in the organic tool box than conventional – specified by NOP regulations
- Uses multiple strategies to manage nutrients and pests in order to build a healthy farm ecosystem

Nutrient Management

- Multiple strategies focused on building a healthy soil
  - Increasing and/or maintaining soil organic matter through residue management, composting, etc.
  - Providing plant nutrients in non-leachable forms
- Primary nutrients of concern: N, P in some soils, K later in season, Zn, B, Mn, and Fe
- Tissue and soil testing to determine plant needs
- Nutrient cost per lb. and labor to apply are important factors to consider

Organic Nutrient Options

1. Cover crops
2. Compost or composted manures
3. Meals: blood, fish, feather, etc.
4. Minerals
5. Blended organic fertilizers: granular, foliar, or fertigation



Cover crops

- Cover crops or "native cover" increase soil organic matter, which improves water- and nutrient-holding capacity, prevents erosion
- Grasses provide humus/organic matter, legumes provide N to soil
- Legume cover crops provide 100 -150 lb N per acre in solid stand

Potential disadvantages for citrus:

- Frost risk:
  - May increase with tall cover crops
  - Grasses may harbor ice nucleating bacteria
- Increased water use, esp. with overhead irrigation
- Clovers may exacerbate gopher problems
- Increased management/mowing

Cover crops

- Most growers use a grass-legume mixture, often with several species and cultivars of each.
- Overseed legumes into "native cover"
- Winter annuals
  - Legumes: sub-, rose, & crimson clover, bur medic
  - Grasses: Zorro fescue, Blando brome, annual rye
- Perennials:
  - Legumes: clovers, trefoil
  - Grasses: fescues, perennial rye, also natives such as *Bromus carinatus*

Nutrient Management: Compost

- Amendment: provides organic matter, improves soil structure, water- and nutrient-holding capacity, etc.
- Compost feedstock determines nutrient content, but
- On average, 1-3% N, <1%P, 1-2.5% K, plus micronutrients, generally neutral pH
- Advantages:
  - Finished product
  - N is in stable form
  - Most pathogens & weed seeds killed in composting process
- Disadvantages:
  - If you make it yourself, process is regulated, otherwise:
  - Cost
  - Municipal sources may have heavy metals, even in OMRI approved

Composted manures

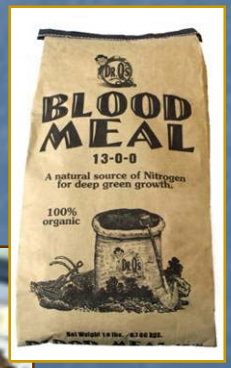
- Amendment
- Manure type determines nutrient content:
  - Poultry manure: up to 4.5% N, 6%P, 2.5%K
  - Horse manure: up to 3%N, 2%P, 3%K
  - Steer manure: up to 2.5%N, 1.6%P, , 3.6%K
- Uncomposted: must be incorporated into soil 90 days before harvest, 120 days recommended
- Advantages:
  - Readily available
  - Price is right: cost of hauling
- Disadvantages:
  - Compost before applying
  - If mixed w/bedding, may have high C content, slow decomposition
  - If not hot composted, weed seeds & pathogens may survive
  - Salt & medications content

Compost & Composted manures

- Application rates: 5-20 T/acre to start, 5-10 T/acre/year subsequently
- Apply 2-4" layer along either side of tree row or around tree base to dripline
- Keep any compost or mulch 2" away from trunk to prevent disease and rodent damage

Nutrient Management: Meals

- Most meals provide fairly high nutrient content in a relatively soluble form
- Blood meal 13-14% N, $7-8/lbN
- Feather meal 12-13% N, 1% P, $4-5/lb N, slower release
- Fish meal 8-10% N, 3% P, $10-11/lb N
- Shrimp shell meal 5% N, 8% P
- Bone meal 5% N, 10% P
- Fish bone meal 3% N, 16% P



Nutrient Management: Minerals

- Most slow release, unless finely ground
- Phosphate rock (20-35% P_20_5) very slow release, 6-24 months
- Gypsum (18-25% Ca, 15-23% S)
- Various types of lime - Ca
- Glauconite or greensand 3-4% K, micronutrients
- Rock dust: very low nutrient levels:
  - e.g. Azomite: K_2O 0.2%, calcium 1.8%, magnesium 0.5% plus micronutrients

Blended fertilizers

- Organically approved granular, pelleted, or liquid fertilizers
- Advantages:
  - Ease of application
  - Complete fertilizers
  - Soluble, quick release, guaranteed analysis
- Generally higher cost unless purchased in large quantities, e.g. 500 gal fish emulsion $6-8/lb N
- Pelleted and granular fertilizers tend to be less costly than liquids

Micronutrients

- Use of most micronutrient materials is restricted; i.e. you must have a soil analysis to demonstrate the need for the nutrient
- Boron: borax formulations: e.g. Solubor, Fertibor, Biomin boron 3-15% boron
- Iron & manganese: almost exclusively for foliar application
- Zinc: mostly zinc sulfate, foliar & soil applied

Organic Pest Management in Citrus

- Based on ecosystem management and monitoring
- Cultural practices:
  - Pruning
  - Mowing timing
  - N nutrient management: 0.5-1 lb actual N per year, depending on tree size
  - Irrigation to reduce stress and dust
- Biological control:
  - provide habitat and food for natural enemies in cover crops or hedgerows
  - Release natural enemies, e.g *Aphytis* wasps
- Use of NOP-approved pesticides – mined materials (e.g. sulfur), or of biological (spinosad) or botanical origin (neem) when pest is present

Insectary Hedgerows

- Permanent plantings: may include trees, shrubs, perennials, annuals, and/or grasses
- Usually on the perimeter of fields
- Provide habitat for natural enemies which prey on pests
- Provide nectar & pollen that many natural enemies need at certain life stages
- Bloom time critical for providing alternate food and habitat
- Need a variety of species that bloom throughout the season when citrus are not

Hedgerow, Yolo County
Wild Rose, Toyon, Redbud

Cultural practices to reduce scale

- Pruning
  - Maintain light & air movement in the interior canopy
  - Look for dappled sunlight under tree at midday
- Control ants with Tanglefoot® or baits
- Encourage natural enemies by providing nectar & pollen
- Avoid over-fertilizing, esp. nitrogen
- Reduce dust to allow natural enemies access to pests

Soft Scale: Citricola Scale

Citricola scale: crawlers & adults

Honeydew on fruit

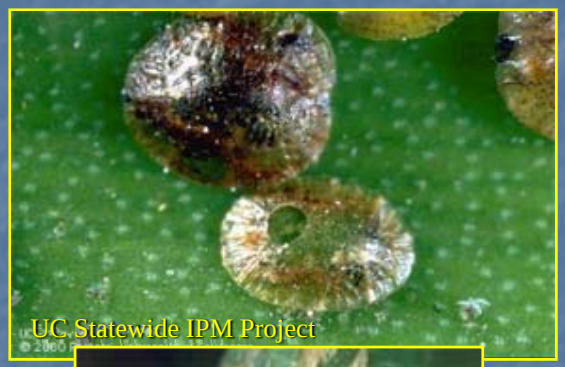
- Most common scale pest
- Produces a lot of honeydew
- Sooty mold grows on honeydew and stains fruit
- Mottled tan/brown scale
- Start on underside of leaves, then move to twigs & upper leaf surface

Citricola Scale Management

Citricola scale nymphs

- Pruning reduces *Citricola* dramatically
- Parasitic wasps (*Metaphycus* spp.) help control
- Preserve natural enemies and control ants
- Monitor twigs and backs of leaves
- Monitor for crawlers with double sided sticky tape around infested branches - starting in April
- Thresholds for treatment http://ipm.ucdavis.edu/
- Treat with Narrow range oil (e.g. PureSpray Green 440) in summer

Brown Soft Scale



Brown soft scale

- On leaves & twigs
- Yellow-brown rounded shells
- Also produce honeydew
- Many parasitic wasps help control as do several lady beetles
- Control ants because they protect from parasitism
- Monitor from May/June thru October and look for parasitism
- If needed, use oil on crawlers in summer

Cottony Cushion Scale

- Cottony cushion scale infests all citrus and many ornamentals
- Has become common landscape pest, moves on nursery stock
- Prune interior canopy, especially in old trees
- In young trees, prune lower scaffold branches

Cottony Cushion Scale

Cottony cushion scale adult, with Vedalia beetle adult

- Vedalia beetle **best** control for cottony cushion scale
- Vedalias can clean up a bad infestation in 4-6 weeks.
- Collect vedalia beetles in citrus orchard in spring (Feb-April)
- Release in infested trees, spread on their own
- One spring release of 25-100 vedalias per 10 acres should be sufficient

California Red Scale

- Armored scale, lift shell to reveal insect beneath
- Concentric rings, "nipple"
- Do not usually excrete honeydew
- Infests leaves, branches **and fruit**
- May be moved on nursery stock and fruit

California red scale

California Red Scale Management

CA red scale: adults & crawlers

- Limited infestations: *Aphytis melinus* wasp releases starting in late February/March
- 100,000 wasps per acre per year
- Every two weeks: 5-10,000 wasps/acre
- Half in spring, 25% in summer & fall

California Red Scale Management

Comperiella bifasciata, CA red scale parasite

Adult Australian lady beetle, *Rhyzobius lophanthae*

- Control ants with baits or Tanglefoot™
- Reduce dust: reduces predation of scales by natural enemies
- Carefully timed oil sprays:
  - Monitor for crawlers in early summer and fall with double-sided sticky tape
  - Apply oil when are active
  - May need to apply oil again in early fall
- OMRI approved oils include PureSpray, Sunspray, Stylet oil

Citrus Thrips

A Citrus Thrips

Citrus Thrips larvae

- Larvae feed on tender leaves and fruit, under sepals of young fruit
- Fruit damage: scabby silver or brown ring around stem end
- Most susceptible to scarring from just after petal fall to about 1 inch diameter.
- Damage is greater on outside fruit

Citrus Thrips Management

Minute pirate bug

Predatory mite

- Many natural enemies:
  - predatory mites, lacewings, spiders, minute pirate bugs
  - provide nectar & pollen in hedgerows or cover crops
- Mow cover crops early or late in season: before trees bloom or after cover dries down
- Use Entrust formulation of spinosad with an organically approved oil

Fork tailed bush katydid

- Pest of navels, occasionally mandarins
- Populations cyclical
- Chew on young fruit: scar tissue builds up, distorts fruit
- Take one bite from a fruit & then move on: can damage a lot of fruit quickly
- Some wasps are egg parasites, but control is inadequate
- Treat nymphs early in season with Entrust formulation of spinosad

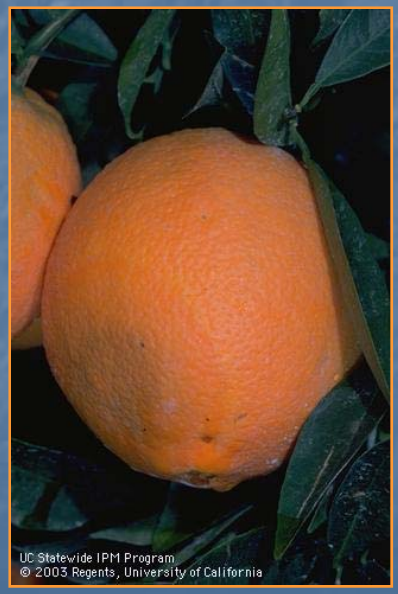
Bacterial Blast & Brown Rot

Bacterial blast

- Prune out diseased twigs
- Windbreaks
- Avoid excessive fall growth - susceptible to blast infection

Brown Rot

- Skirt pruning: 2 feet up
- Restricted use of Bordeaux mix or copper - must show need
- Spray the ground underneath trees as well as trees
- Issues with Cu build-up in soil



For more pest management information:

University of California • Agriculture and Natural Resources

UC IPM Online

STATEWIDE INTEGRATED PEST MANAGEMENT PROGRAM

UC IPM

How to manage pests

Manage and identify insects, mites, diseases, nematodes, weeds, and vertebrates

- Homes, gardens, landscapes, and turf *(including Pest Notes)*
- Agriculture and floriculture *(Pest Management Guidelines)*

Use tools to help make decisions

- Weather data and products
- Degree-days
- Interactive tools and models

http://ipm.ucdavis.edu/