

Meeting the Challenge of the Asian Citrus Psyllid in California Nurseries

A two-day workshop in Riverside, California

June 11-12, 2009

Organizing Committee:

- T. Delfino**-California Citrus Nursery Society
A. Eskalen-Dept. of Plant Pathology & Microbiology, University of California Riverside
R. Lee-USDA- ARS, National Clonal Germplasm Repository for Citrus and Dates
G. Vidalakis-Citrus Clonal Protection Program, Dept. of Plant Pathology & Microbiology, University of California Riverside



Florida-Foundation Block



Brazil-Citrus Nursery



M. Rogers



Invited Speakers:

- J. Ayres**-Fundecitrus, Brazil
J. Bethke-UC, CA
G. Baze-Golden Pacific Structures, CA
T. Delfino-CCNS, CA
F. Dixon-Wells Fargo, CA
D. Elder-American Ag Credit, CA
T. Gast-Southern Gardens Citrus, FL
P. Gomes-CHRP, USDA -APHIS, NC
E. Grafton-Cardwell-UCR, CA
D. Howard-AgraTech, CA
N. Jameson-Brite Leaf Nursery, FL
R. Keijzer-KUBO, The Netherlands
P. Llatser-AVASA, Spain
S. McCarthy-CDFA, CA
G. Vidalakis-UCR-CCPP, CA

Registration: <http://ccpp.ucr.edu> & <http://eskalenlab.ucr.edu>

Location:

Sunkist Center
Citrus State Historical Park
9400 Dufferin Avenue
(Corner of Van Buren Blvd)
Riverside, California

Sponsored by:



CALIFORNIA CITRUS NURSERY BOARD



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Information on line at: <http://eskalenlab.ucr.edu>

GREENHOUSE DESIGN CONSIDERATIONS



Greenhouse structures are typically provided in one of two forms:

- **Stand Alone Design**
vs
- **Gutter Connected Design**



Advantages of a stand alone structures include:



- Lower cost
- Easier installation
- Less likely to fail due to snow & ice
- Localized environmental control
- More efficient cross ventilation
- Ideal for first time builders / growers

Disadvantages of stand alone structures include:

- Lower side walls = less area to maneuver
- Reduced height = less efficient growing conditions
- Limits material handling
- Less efficient in terms of energy
- Limits equipment use



Advantages of gutter connected structures

- **Taller side walls offer greater maneuverability**
- **Increased volumes of air in the structure promote improved growing conditions**
- **Improves material handling**
- **More flexibility to employ growing tools**
- **Reduced energy consumption**



Gutter connected greenhouses are available in any number of designs



PERMISSION REQUIRED FOR USE

Structural components



- Most greenhouses servicing the agriculture industry are constructed out of galvanized steel members.
- Greenhouse manufactures utilize a variety of different types of steel to make up their greenhouse design.
- Determining which design is best for your application will take some work. Points to consider:
 - a) Quality of the steel
 - b) Galvanizing finish
 - c) Time to construct
 - d) Structural engineering

Certified Engineering

- Most counties in California require building permits prior to erecting a greenhouse
- Typically, each County adopts certain environmental criteria which the greenhouse must meet
- The minimum standard required by much of California requires a 10 lb. live load and 85 MPH wind (3 second gust)
- In most cases, it is your responsibility to determine what the governing codes are and to communicate this information to the greenhouse builder
- Prior to placing an order for a structure verify that the manufacture can meet the stated codes and further is certified in the State you wish to build in.

Various options to consider when designing a greenhouse range

- Covering
- Fresh air ventilation
- Doors
- Shade control
- Cooling systems
- Heating systems
- Bench systems
- Irrigation systems
- Material handling systems
- Environmental controllers



Coverings



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Advantages of Polyethylene

- Price competitive
- Double poly offers ideal insulation value
- Relatively easy to install
- New designs offer light diffusion and some products are capable of blocking harmful spectrums of light



Advantages of Polycarbonate



- While initially more expensive, due to longevity of product it represents the best value
- Twin wall materials offer excellent insulation value
- Virtually impervious to weather
- Most manufactures offer limited warranties against discoloration and hail damage

Screen

- In more temperate climates, growers concerned with insect infiltration are covering their entire roofs with insect screen
- During inclement periods of weather grower installs a single layer of poly over the screen
- Advantages - incorporating this option increases the growers ability to ventilate naturally
- Disadvantages –
 - a) offers little to no protection against sudden temperature swings and or rain bursts
 - b) Labor intensive to pull on and off the single layer poly
 - c) little or no insulation value if heaters are employed
 - d) increased surface area of screen increases opportunities for tears



Fresh air ventilation – Passive or natural

Advantages:

- It's free
- Uniform

Disadvantage

- Dependent on outside conditions



Natural ventilation and insect screen



Temperature expectations



Evaporative cooling opportunities

Extreme forms of roof ventilation:



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Fresh air ventilation – Mechanically introduced



- Negative pressure systems vs. positive pressure systems
- Insect screen in mechanically ventilated designs

Advantages:

- Available on demand

Disadvantages:

- Ongoing cost
- Temp gradient

Shade solutions

- Shading solutions can be as simple as applying a shade fabric, or shade compound (paint), to the exterior covering
- Alternatively, internal retractable shade systems are controlled automatically and can double as heat retention systems



Internal retractable shade systems, while more expensive, offer substantially greater flexibility in controlling light levels within the environment

Evaporative cooling systems

- Traditional greenhouse cooling systems employ evaporation to cool the environment



Heating systems



Benching systems



Irrigation solutions



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Material Handling



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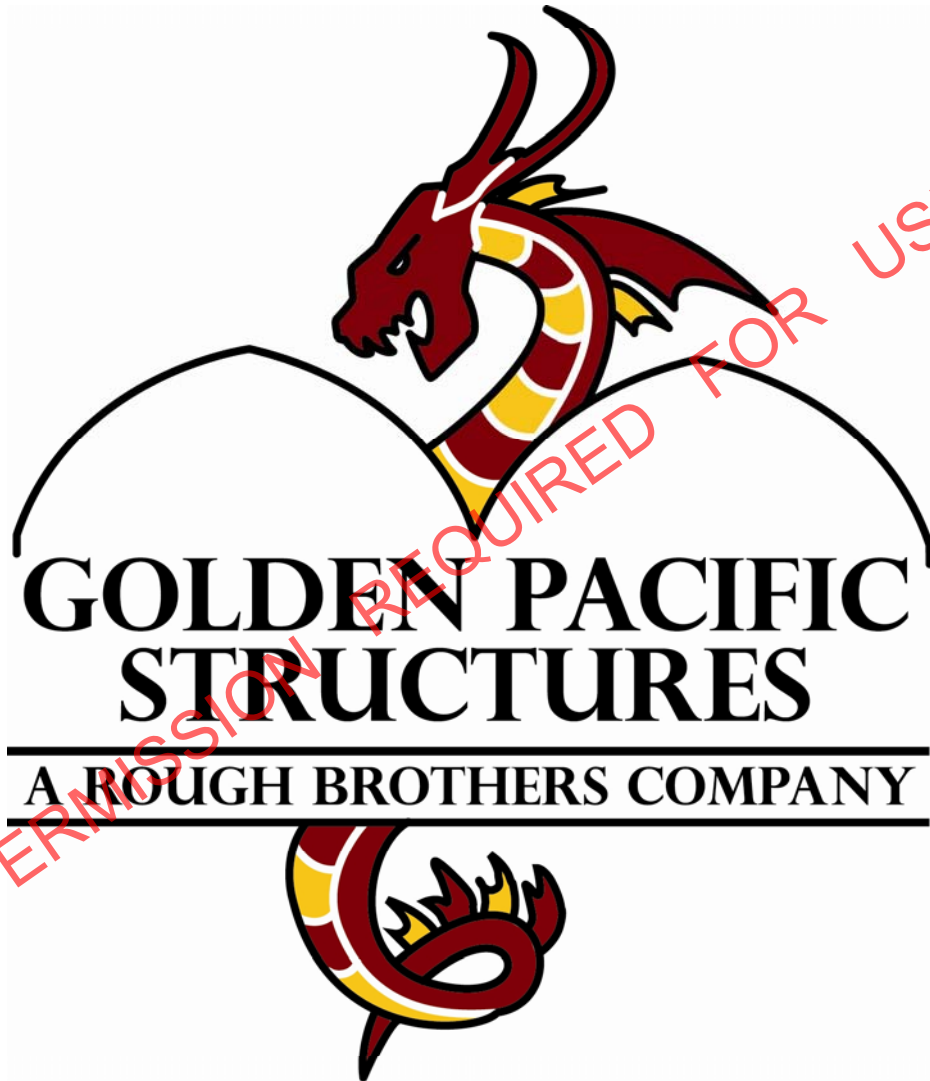
Environmental controls



- Controls are available from simple thermostat controls all the way up to sophisticated computer systems

- Two key rules:
Keep it simple and easy to understand in the key to any successful system

Incorporating a control which can monitor and operate all equipment



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