UNIVERSITY OF MARYLAND EXTENSION

Greenhouse TPM/IPM Report

Central Maryland Research and Education Center
Ellicott City, Maryland

February 2, 2022

From: Stanton Gill, Extension Specialist – IPM for Greenhouse and Nurseries, Central Maryland Research and Education Center, University of Maryland Extension
Karen Rane, Plant Pathologist, Director of the Plant Diagnostic Clinic, University of Maryland Extension
Andrew Ristvey, Extension Specialist, Wye Research and Education Center, University of Maryland Extension
Suzanne Klick, Technician, CMREC, University of Maryland Extension

Heating This Winter for Greenhouses

By: Stanton Gill

December was not too bad, temperature wise. January and February are turning out to be rather brutal with temperatures dipping to 8 °F in Carroll County and as low as 4 °F in Washington County. The temperature warmed up to 30 – 40 °F on several days in January then plunged to the single digit temperatures overnight. To add to this dilemma, fuel costs have rocketed up in 2022. The price of oil shot up from the mid $40/barrel range to over $80/barrel. It might go higher if the situation in Ukraine explodes in February.

If you have a clever method to reduce heating cost in a greenhouse and are willing to share, please send them to Sgill@umd.edu, and we will publish it in the next IPM Alert.

Bring in Plugs

By: Stanton Gill

Plugs that arrive from your suppliers should be closely inspected for insects, mites, and diseases. One of the best methods to reduce the chance of bringing in insects and mites is to make up a stock tank of SuffOil-X mixture with BotaniGard (*Beauveria bassiana*). Dip the plug trays in this mixture for 2 – 5 minutes. Let it drain off. The oil and *Beauveria bassiana* will work well on thrips, tarsonemid mites, aphids, and spider mite life stages that might be on the plugs. SuffOil-X® is slightly different from other horticultural oils and is a concentrate of pre-emulsified, highly refined, high paraffinic, low aromatic oil. It is a good choice for effective insect, mite, and disease control in a broad range of greenhouse, nursery, and vegetable crops.

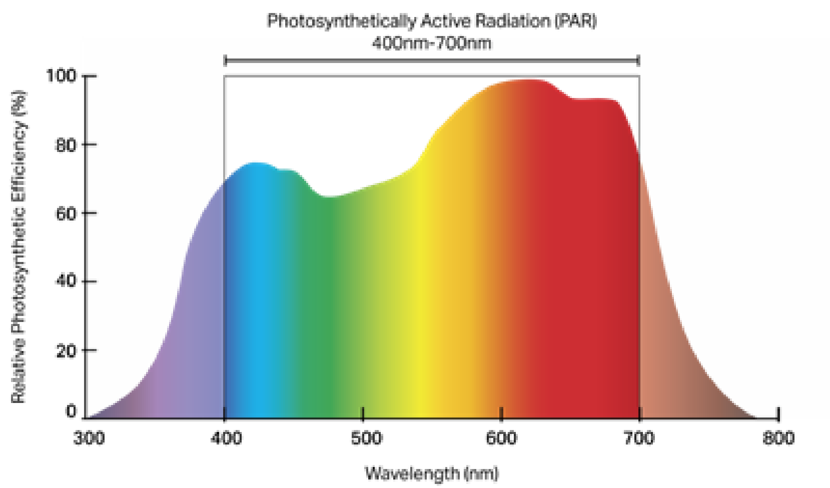
When you receive plugs, check them closely for insects, mites, and diseases.

Measuring Light for Plant Production

By: Andrew Ristvey

I had a great basic plant biology professor when I started graduate school for my doctorate. You may ask why was I taking a basic plant biology class at this stage in my career, but the truth is my pre-doctorate education was not in horticulture. Dr. Gerry Deitzer's specialty was light and how plants use it. Dr. Deitzer's class explained a lot of things about light that I had not learned in my undergraduate courses beforehand, and I was grateful for what he taught me.

Of course, anybody who knows plant biology, knows that plants use only a certain portion of the visible light spectrum for photosynthesis. We may also know that plants use blue, ultra violet, infra and far-red for some important metabolic functions and morphological adaptations apart from photosynthesis, like germination, elongation, shade responses and phytochemical production. We learned that for photosynthesis, plants use wavelengths between 400 and 700 nanometers (from blue to red visible light) and some wavelengths are more efficient than others in driving photosynthesis. This range of light is called Photosynthetically Active Radiation (PAR). PAR is an old term that was used to measure the amount of light plants use for photosynthesis. This was originally measured as energy (Watts per square meter), but in the 1970's, Dr. Keith McCree of Texas A&M suggested that it was not energy but the quantity of photons a plant received in a certain amount of time, that drove photosynthesis. Photons are particles of light. This new way of thinking about light and photosynthesis was rapidly accepted and the measurement was changed to Photosynthetic Photon Flux (PPF). Recently it was better defined as Photosynthetic Photon Flux Density (PPFD) to more accurately account, without confusing terms, the area the photons hit over time. The term is measured in units of micromoles (µmol) which is the quantity of photons, per unit area (a square meter) per unit time (seconds).



A graphic that depicts the relative photosynthetic efficiency of different color wavelengths of light for plants. New research is showing that wavelengths outside the 400 to 700 nm range are also photosynthetic.

Plants need a certain amount (a minimum) of photons to maintain their metabolic activity. The Light Compensation Point (LCP) is the lower limit of plant's light requirements to maintain basic respiration needs. At light levels lower than this LCP, the plant will not be able to meet its energy requirements and will eventually die. For argument's sake, the PPFD at the compensation point is around 200 $\mu mol/m^2 \cdot s$, but this is species specific. For comparison, the PPFD is around 2000 $\mu mol/m^2 \cdot s$ in full sunlight.

Earlier, I mentioned the term PPF. That term relates to the amount of PAR photons a light source will emit (we can still use the PAR term generically). The unit PPF is µmol/s. Notice we have removed the area term (m^2). With High Intensity Discharge (HID), light sources like High Pressure Sodium and Metal Halide, the PPF are between 1000 and 2000 µmol/s. LEDs can provide the same amount of light or more, using less energy than HIDs, but higher output LED lights are more expensive. However, LED lights are much more efficient (more photons per unit energy expended) and longer lived. If the light source emits a certain amount of photons (PPF in µmol/s), the area that the photons hit needs to be considered, and that's where the area (square meter) comes in. It's how many photons a plant may capture. The greater the distance from the light, the less photons hit per unit leaf area. Plants need a certain amount of light per day to grow. The more light they have, the higher the potential yield to a certain point of diminishing returns. Of course, like von Liebeg's law of the minimum for nutrients, plants need water, CO_2, nutrients, temperature, etc. Give a plant more of one factor, it needs more of another to maintain growth, so it's a balancing act to maintain efficiency. Let's stick to light, given that all other growth factors are satisfied.

Over time, the plants you grow need a total amount of light or photons for a target yield. This is extremely important in winter. This is what we call Daily Light Integral or the accumulation of photons in a day. A great example of this is rainfall, and I heard this from Dr. Bruce Bugbee, a well published and very well respected authority of plant light-physiology at Utah State University. PPFD is similar to the rate in which rain falls, and DLI is similar to the amount of rain that falls. We're just talking about photons instead of water droplets.
If we take a PPFD value from a light source, we can estimate the DLI that particular light source will provide. Simply multiply the PPFD value by 3600 (the amount of seconds in an hour) and then multiply by the hours the light is on.

If a light source output is 750 $\mu mol/m^2 \cdot s$, in one hour, that light will give 2.7 $mol/m^2 \cdot hour$ and 32.4 $mol/\ m^2 \cdot day$ in a 12 hour day.

$(750\ \mu mol/m^2 \cdot s \times 3600 s/hour)/1{,}000{,}000 = 2.7\ mol/m^2 \cdot hour \times 12\ hours = 32.4\ mol/\ m^2 \cdot day$

The DLI requirements for plants vary. Phalaenopsis orchids only need between 6 to 10 $mol/\ m^2 \cdot day$. Alstroemeria (cut flower) need a minimum of 14 $mol/\ m^2 \cdot day$, but 22-30 $mol/\ m^2 \cdot day$ dramatically increases quality. Pansy are the same, but they need cool temperatures (remember von Liebegs Law of the Minimum). *See the Purdue fact sheet reference below*.

As a special treat, we will have Dr. Jim Faust of Clemson University coming to Chesapeake Green to speak with us about DLI. I'm sure he will give a much better face to face explanation of all this but I wanted to give you a primer. Don't miss him!

As an epilogue…
One of Dr. Gerry Deitzer's colleagues is the preeminent plant light physiologist, Dr. Bruce Bugbee. If you do not know of him, he has been a very important person in the area of greenhouse plant production and measuring light. He is also the owner of Apogee Instruments.

Recently, scientists, including Dr. Bugbee, have determined that the photosynthetic wavelengths, originally thought to be only between 400 and 700 nanometers where PPFD is measured, should be expanded to include wavelengths at least 50 nm on either side of that range. The new term may possibly be Photon Flux Density.

I want to thank Dr. Bruce Bugbee for creating videos and making this subject material easy to understand. I have links below. Please watch them and many others that he has created to explain plant light physiology and light measurement. I also want to thank my colleague Dr. John Lea-Cox for his critical input into this article.

Some can't miss references:

Videos
PAR, PPF, PPFD, and PFD Explained
Cannabis Grow Lighting Myths and FAQs with Dr. Bruce Bugbee

Literature
https://www.extension.purdue.edu/extmedia/ho/ho-238-w.pdf

Conferences

February 17 and 18, 2022
Chesapeake Green Horticulture Symposium
Location: Maritime Institute, Linthicum Heights, MD

February 25, 2022
Manor View Farm and Perennial Farm Education Seminar is being held virtually
Contact: Vicki@manorview.com or www.manorview.com for registration information.

March 15, 16, and 17, 2022
Cut Flower Course
Locations: Howard County and Montgomery County sites
For the schedule and registration information

April 5 – 8, 2022
IPM Scouts' Session
Details will be posted when available

Cut Flower Short Course Topics for March 15, 16, and 17, 2022

This program will be held at various locations for lectures and there will be site visits to different cut flower operations.

Day 1: High tunnel production: lectures and visiting locations with high tunnels.
Day 2: Crops to produce in high tunnels, Managing soil in high tunnels, Big bucks in spring cut flowers, Marketing cut flowers via local markets, Raised bed demonstration, Soil fertility, Using and calibrating fertilizer injectors
Day 3: Marketing - tricks of the trade, unusual woody cut stems, Walk-in coolers, Setting up a trickle irrigation system, Small equipment to make cut flower production easier

See the schedule for details.