

In August, the Southern California Horticultural Society invited Ernesto Sandoval, Director of the UC Davis Botanical Conservatory, to speak about plant hormones and how to manage them for better growing results. The program was educational and easy to understand, as Sandoval is accustomed to interpreting the world of plants for audiences ranging from K-12 students to life-long gardeners and horticulture professionals.

Sandoval began his presentation by reviewing some simple botany that is helpful for all gardeners to understand in terms of basic plant growth. He identified the meristems of plants (found at the top of the plant, the tips of the roots, and in the nodes) as groupings of undifferentiated plant cells

that will eventually grow into new parts during the life of the plant. Meristematic tissue found within the dormant axillary buds in nodes can be influenced to become new shoots or roots through the application of growth hormones, either naturally occurring or artificially-introduced. The two major types of hormones affecting plant growth are auxins and cytokinins.

Auxins are produced at actively growing shoot meristems and young leaves, and travel through the phloem of the plant's vascular system towards the roots, inhibiting axillary bud growth along the way. Since the roots are unable to photosynthesize, they receive sugars and hormones this way, stimulating their growth. Synthetic examples of auxins include several acids (IBA, NAA, IAA) which trigger the same response in the root system that natural auxins do, and these are commercially available for purchase, like the powder forms found in products such as Rootone or Snip 'n' Dip.

Cytokinins are produced at actively growing root tips, and travel upwards towards shoots and leaves via xylem, the water transport system of plants. In contrast to the auxins, the cytokinins promote axillary bud growth as they move towards the top of the plant. These hormones are available in the form of keiki paste, and can be ordered online.

Sandoval next spoke about the responses plants have to various types of pruning cuts in regard to hormonal activity. When tips of shoots are removed, the production of auxins is interrupted, resulting in higher levels of cytokinins, which then allow the plant to generate new growth at the site of axillary buds. Cuts should be made just above the axillary buds located in the nodes.

Conversely, if root-pruning occurs, the plants will build up a surplus of auxins where the cut was made, which will result in the formation of new roots at that site.

It is the combined knowledge of where to cut and which hormones to apply that allows for successful vegetative propagation to occur. He gave as an example the practice of planting tomatoes "deep" by removing the lowest leaves and burying the stripped stem several inches below the soil level, allowing the plant to form adventitious roots along the stem wherever meristematic tissue exists. This method creates an imbalance of hormones resulting in the production of more cytokinins that will speed up the vegetative growth of soft-stemmed plants like tomatoes, mints, geraniums, etc. If the goal is to "stunt", or slow the growth rate of plants, both shoots and roots need to be pruned in order to remove multiple hormonal control points simultaneously. By comparison, when transplanting, it is best to have active hormone production occurring. Cuttings for propagation should also be taken when the plant is actively growing. The softer the stem cutting, the fewer hormones are needed, which is why succulent cuttings can easily be "over-dosed" with synthetic hormones, and only products with low-level concentrations should be applied, if at all. Further, Sandoval explained that treated cuttings should always be kept vertical to allow gravity to bring auxins down to the bottom of the cutting, otherwise adventitious roots will form along the stem.

Slides showing varying degrees of success in stimulating vegetative growth of fresh stem and root growth provided visual evidence to illustrate the cutting techniques Sandoval described. He also presented a short video clip of how to strip the young leaves off a 4"-5" stem, make a fresh horizontal cut with sterile pruners (just below a node) before dipping it into rooting powder and then "planting" it in a mixture of damp vermiculite/perlite. He suggested creating a bit of humidity, or a greenhouse effect, by placing the container with the cutting(s) into a plastic bag. Conversely, succulent cuttings should be rooted in pumice or gravel and be allowed to grow in the open air. Additionally, he shared slides on the techniques of "air layering" to clonally propagate difficult-to-root woody plants along their stems; "layering" wherein stems are laid horizontally to allow auxins to build up at a specific point; splitting the apical meristem of an aloe (as well as other succulents) with a sterile blade to stimulate branching, and even touched on grafting slow-growing cacti onto other cacti with more vigorous roots to stimulate growth.

To wrap up his presentation, Sandoval briefly described gibberellins and ethylene, which are other hormones produced

throughout plants, not just in meristematic tissue. Gibberellins promote the elongation, or stretching of cells, and are broken down by sunlight. This is why shade plants have greater amounts of gibberellins, resulting in larger (stretched out) leaves. Commercially they are often sprayed on table grapes to plump them up, whereas poinsettias and many house plants are treated with gibberellin-inhibitors to keep them compact. Ethylene is responsible for promoting ripening, cell maturation, leaf senescence and the eventual death of plants.

After the presentation, webinar hostess Erin Castillo awarded a copy of the book *Plant Propagation, 8th Edition* by Hartmann and Kester as a raffle prize to a winner from the audience, followed by a Q & A session with Sandoval to conclude the program.

✉ Sabine Steinmetz

Photo and text courtesy of speaker.



To learn more about the functions of all plant hormones, please visit:

www.phytohormones.info

To watch this entire presentation on SCHS's YouTube channel, click on the following link:

https://www.youtube.com/watch?v=SF_vsedAYR4

SCHS MONTHLY GARDEN SHARE

Protect your plants from the effects of the excessive heat (exacerbated by the wildfires).

- Provide supplemental water
 - Shade them to protect against sun-scald on foliage
- Hold off on removing "burned" leaves - they will shield others

And please protect yourselves during these heat waves too!

- Stay well-hydrated
- Remain indoors or in the shade as much as possible
- Limit physical activity - like gardening!

PLEASE STAY SAFE!

✉ Sabine Steinmetz