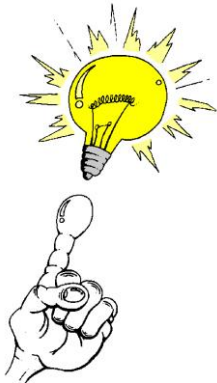


CMG GardenNotes #145

Plant Growth Factors: Plant Hormones

Outline: Plant hormones and plant growth regulators, page 1
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Thought questions

Explain the science behind the following gardening questions:

- o A couple of times a year, I shear my shrubs into rounded shapes. Now the shrubs have large woody stems with a lot of dead branches. How do I correct this?
 - o I put a stake next to a small tree trunk to keep it straight. When I took it off a year later the trunk had a worse bend than before. Why?
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Plant Hormones and Plant Growth Regulators

Another factor in plant growth is the influence of plant hormones. **Hormones** are chemicals produced by plants that regulate the growth processes.

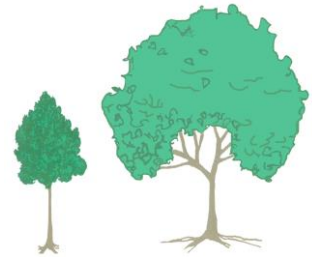
Plant growth regulators are chemicals applied to regulate plant growth. In plant propagation, cuttings are dipped in a rooting hormone to stimulate root development. In greenhouse production, many potted flowering plants (like poinsettias and Easter lilies) may be treated with plant growth regulators to keep them short. Seedless grapes are treated with plant growth regulators to increase the size of the fruit. In certain situations, turf may be treated to slow growth and mitigate the need for mowing. Because plant growth regulators are effective in parts per million or parts per billion, they have little application in home gardening.

Plant Hormones

Different hormones affect different plant processes. Understanding how hormones work allows horticulturists to manipulate plants for specific purposes.

Auxins produced in the terminal buds suppress the growth of side buds. This focuses the growth of the plant upward rather than outward. If the terminal bud is removed during pruning (or natural events) the lateral buds will develop and the stem becomes bushy. Auxins also stimulate root growth and affect cell elongation (tropism), apical dominance, fruit drop or retention.

Figure 1. Auxins produced in the rapidly growing terminal buds suppress growth of side buds, giving a young tree a more upright form. As growth rates slow with age, reduction in apical dominance gives the maturing tree a more rounded crown.



Gibberellins affect:

- The rate of cell division
- Flowering
- Increase in size of leaves and fruits
- Seed and bud dormancy
- Induction of growth at lower temperatures (used to green up lawns 2 to 3 weeks earlier)

Cytokinins promote cell division, and influence cell differentiation and aging of leaves.

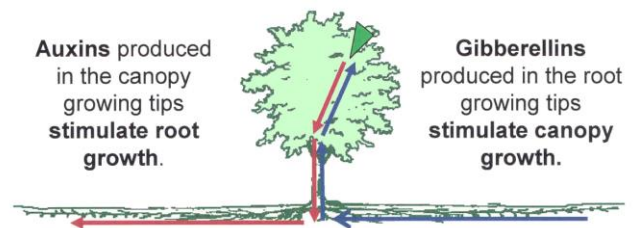
Abscisic acid is considered the “stress” hormone. It inhibits the effects of other hormones to reduce growth during times of plant stress.

Hormone Influence On Pruning

Understanding hormones is key to proper pruning. **Auxin** produced in the terminal buds suppresses growth of side buds and stimulates root growth.

Gibberellins produced in the root growing tips stimulate shoot growth. Pruning a newly planted tree removes the auxin, slowing root regeneration.

Figure 2. Trees balance canopy growth with root growth by concentrations of auxin and gibberellins.



Heading cuts (removal of a branch tip) releases the apical dominance caused by auxins from the terminal bud. This allows side shoots to develop and the branch becomes bushier. On the other hand, *thinning cuts* remove a branch back to the

branch union (crotch). This type of cut opens the plant to more light. Most pruning should be limited to thinning cuts. For details on pruning, refer to CMG Pruning fact sheets.



Figure 3. Left: A **heading cut** releases apical dominance and the branch becomes denser as the lateral buds begin to grow. Right: A **thinning cut** removes a branch back at a branch union (crotch), opening the plant for better light penetration. Thinning cuts promote an open growth habit by redirecting sugars to the terminal shoots.

Tropisms

Auxins also play a key role in *tropism* (controlling the direction of plant growth).

Figure 4. **Geotropism** – Under the influence of gravity, auxins accumulate in the lower side of a horizontal stem, causing cells to enlarge faster, turning the stem upright.

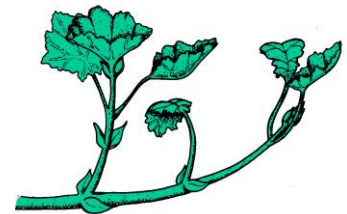
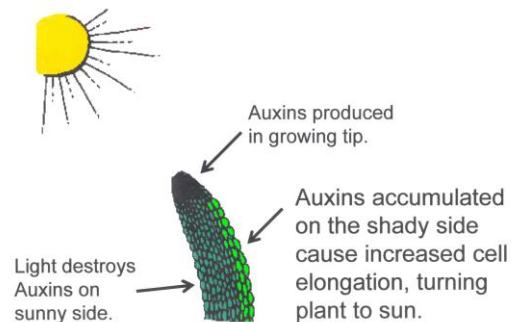


Figure 5. **Phototropism** – Auxin concentrations on the shaded side stimulates cell elongation, turning the stem to the sun.



Additional Information – CMG GardenNotes on Botany:

#121	Horticulture Classification Terms	#136	Plant Structures: Fruit
#122	Taxonomic Classification	#137	Plant Structures: Seeds
#131	Plant Structures: Cells, Tissues, and Structures	#141	Plant Growth Factors: Photosynthesis, Respiration and Transpiration
#132	Plant Structures: Roots	#142	Plant Growth Factors: Light
#133	Plant Structures: Stems	#143	Plant Growth Factors: Temperature
#134	Plant Structures: Leaves	#144	Plant Growth Factors: Water
#135	Plant Structures: Flowers	#145	Plant Growth Factors: Hormones

Authors: David Whiting, Consumer Horticulture Specialist (retired), Colorado State University Extension; with Michael Roll and Larry Vickerman (former CSU Extension employees). Line drawings by Scott Johnson and David Whiting. Revised by Patti O’Neal, Roberta Tolan and Mary Small, CSU Extension.

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