



CMG GardenNotes #145

Plant Growth Factors: Plant Hormones

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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 their growth processes.

Plant growth regulators are chemicals applied to regulate plant growth; they are synthetic plant hormones. 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. Some plant growth regulators are expensive, labor-intensive, and have little application in home gardening. Others are commonly used, including many herbicides.

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, and fruit drop or retention. **[Figure 1]**



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 two to three weeks earlier).

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

Abscisic acid inhibits the effects of other hormones to reduce growth during times of plant stress and plays a role in the development of stress tolerance and seed maturation. Despite its name, it plays a limited role in leaf abscission.

Ethylene is another hormone associated with maturation and/or stress. It plays an important role in promoting fruit ripening and leaf drop.

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-generating tissues, slowing root regeneration. [Figure 2]

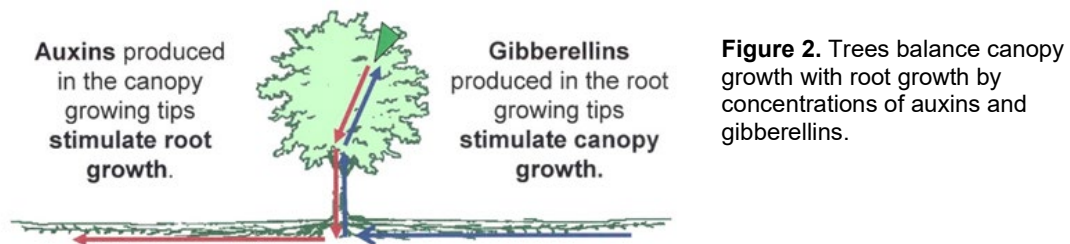


Figure 2. Trees balance canopy growth with root growth by concentrations of auxins and gibberellins.

Heading cuts remove a branch tip to eliminate the apical dominance maintained 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 side branch back to the branch union (crotch). This type of cut opens the plant to more light and does not have the same structural effect as removing growing tips from leaders; for this reason, most pruning should be limited to thinning cuts. [Figure 3]



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.

For details on pruning, refer to Fact Sheet 7.003, Training and Pruning Fruit Trees as well as CMG GardenNotes #610-617 on The Science of Pruning.

Tropisms

Auxins also play a key role in some **tropisms** (controlling the direction of plant growth). [Figures 4 and 5]

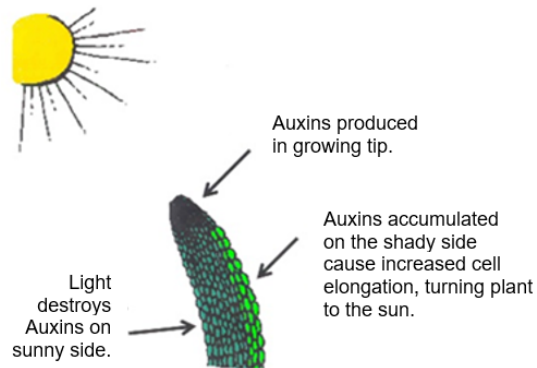


Figure 4. Geotropism

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.



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