Plant Hormones in Plant Propagation

Dr. Fred Davies
Department of Horticultural Sciences
Texas A&M University
College Station, Texas

Plant Hormones = Phytohormones

- Organically produced.
- Synthesized and Translocated to site of action
- Active in small concentrations (µmol, ppm)
- Signal transduction — a molecule that acts as a signal to regulate plant growth & development

Hormone (i.e. auxin)

Hormone Receptor
Signal Transduction
Gene Expression

Plant Growth & Development Response (i.e. rooting)
Plant Growth Regulators

- Synthetically produced
- Organically produced (phytohormones)

Five Classes of Plant Growth Regulators

1. Auxins
2. Cytokinins
3. Gibberellins (GA)
4. Ethylene
5. Abscisic Acid (ABA)
- Ancillary Compounds
- New Potential Phytohormones

Auxins

- Compounds: 2,4-D, NAA, IBA, IAA,
- Enhance Adventitious Root Formation
- Most cuttings 1000-3000 ppm;
- Maximum 10,000 ppm
**Cytokinins**

- Compounds: TDZ (thidiazuron), PBA, BA, Kinetin, Zeatin, 2iP
- Enhance Adventitious Bud and Shoot Formation in leaf and root cuttings
- Used in tissue culture systems in Stage II - Shoot Proliferation
- High Cytokinin : Low Auxin ratio stimulates adventitious bud formation & overcomes apical dominance

---

**Cytokinins & Leaf Cuttings**

---

**Cytokinins & Leaf Cuttings (con.)**

---
<table>
<thead>
<tr>
<th><strong>Gibberellins</strong></th>
<th><strong>Ethylene</strong></th>
<th><strong>Abscisic Acid (ABA)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>⇔ GA&lt;sub&gt;3&lt;/sub&gt;, GA&lt;sub&gt;4/7&lt;/sub&gt;, + 90-plus GA compounds</td>
<td>⇔ Gas H&lt;sub&gt;2&lt;/sub&gt;C=H&lt;sub&gt;2&lt;/sub&gt;C</td>
<td>⇔ Compound: ABA</td>
</tr>
<tr>
<td>⇔ Foolish seedling disease with rice seedlings</td>
<td>⇔ Compounds: Ethylene gas, Ethrel, Florel</td>
<td>⇔ Acts antagonistically with gibberellic acid (GA); both share the same chemical pathway (Mevalonic Acid pathway)</td>
</tr>
<tr>
<td>⇔ Generally inhibit bud, shoot and root formation, so not used in vegetative propagation</td>
<td>⇔ Can stimulate adventitious root formation; may be an indirect effect; rooting generally occurs with intact plants, not cuttings.</td>
<td>⇔ Inhibitor; occurs during drought stress.</td>
</tr>
<tr>
<td>⇔ Sometimes used in tissue culture systems</td>
<td>⇔ Wounding and auxin can trigger ethylene production</td>
<td>⇔ Generally not used in propagation; can increase adventitious bud formation in leaf cuttings</td>
</tr>
<tr>
<td>⇔ Important in breaking seed dormancy</td>
<td></td>
<td>⇔ Inhibitors used in Hare’s Rooting powder — “cocktail” with auxin &amp; other compounds.</td>
</tr>
</tbody>
</table>
Ancillary Compounds

- Compounds: Some are Growth Retardants/Inhibitors
  - Alar (B-9), CCC, Arrest, Sumagic -- antagonistic with GA
- Polyamines
- Phenolics -- “Rooting Cofactors”
  - di-phenolics--inhibit IAA oxidase

New Potential Phytohormones

- Spermidine (polyamine)

IPPS