Reasons for Layering success

- Attachment to the mother plant.
- Increased photosynthate and hormones in the rooting area.
  - A function of excluding light
- Invigoration and or rejuvenation
- Taking advantage of seasonal effects on rooting.

Procedures in Layering

- Simple
- Compound
- Serpentine
- Air
- Mound layering or stooling
- Trench
- Drop
Simple Layering

- Bending an intact shoot to the ground and covering with soil.

Compound Layering

- Bending an intact shoot to the ground and covering with soil and numerous shoots form from the nodes.

Serpentine Layering

- Bending an intact shoot to the ground and alternately covering or not covered with soil.

Air Layering

- Wrapping an aerial stem with rooting medium and causing adventitious roots to form.
Mound Layering or Stooling

- Shoots are cut back to the ground.
- As new shoots emerge, rooting medium is mounded at the base of the new shoots.
- New roots form at the base of covered shoots.

MANAGEMENT OF PLANTS DURING LAYERING

Figure 14–1 Apple rootstock production. (a) Apple stoolbeds of 8- to 10-year-old M9 EMLA rootstock, (b) stoolbeds of MM 111 planted at a 45 degree angle prior to layering, (c) layering with temporary electric cable clips to tie-down and train the layers flat in the planting trench, (d) sawdust applied on new growth in late May in England to.elimate the base of rootstock, (e) harvesting stoolbeds with a tractor-mounted rotary saw, (f) nursery-designed saw with replaceable teeth, (g) one-year-old, rooted apple layers with soil removed, and (h) brushing-off the winter covering of sawdust and soil in late March to begin the next stool crop cycle. Courtesy

Drop layering

- Mound layering of containerized plants.
PROCEDURES IN LAYERING

Table 14-1
Comparison of Different Layering Techniques

<table>
<thead>
<tr>
<th>Layering technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slips</td>
<td>A shoot that is taken from the ground and a single portion of the root is inserted and left in contact with soil. Examples include: rose, lilac, rhododendron, parrotia.</td>
</tr>
<tr>
<td>Compound</td>
<td>Shoots from various rooted cuttings that are inserted into soil. Examples include: grape, melon, pistachio, pomegranate.</td>
</tr>
<tr>
<td>Serpentine</td>
<td>Similar to compound layering except that each alternating shoots is inserted into soil and held in place with wire or plastic. Examples include: grape, melon, pistachio, pomegranate.</td>
</tr>
<tr>
<td>Air-plug</td>
<td>A portion of the above ground stem is produced on a rooted cutting. The shoot is then inserted into soil and held in place with wire or plastic. Examples include: grape, melon, pistachio, pomegranate.</td>
</tr>
<tr>
<td>Mossed</td>
<td>A shoot is taken from a shoot that has been rooted in moss or sphagnum. This technique is often used for orchids. Examples include: orchids.</td>
</tr>
<tr>
<td>Trench</td>
<td>The method is to bury the plant in a trench, allowing the plant to develop its own roots. The trench is then filled with soil. Examples include: caladium, banana, ginger, azalea.</td>
</tr>
<tr>
<td>Prop</td>
<td>A method similar to mound layering. The shoots are growing in soil. Examples include: hibiscus, heather, and huckleberry.</td>
</tr>
</tbody>
</table>

Plants Propagated by These Methods
- Rose
- Lilac
- Rhododendron
- Parrotia
- Grape
- Melon
- Pistachio
- Pomegranate
- Orchids
- Caladium
- Banana
- Ginger
- Azalea
- Hibiscus
- Heather
- Huckleberry

PLANT MODIFICATIONS RESULTING IN NATURAL LAYERING

Table 14-2
Comparisons Among Structures Used in Natural Layering

<table>
<thead>
<tr>
<th>Type of modified stem structure</th>
<th>Growth habit</th>
<th>Plants propagated by these structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stolons</td>
<td>A trailing or arched stem that grows horizontally above or below the soil to form new plants at the nodes.</td>
<td>Dogwood (Cornus sericea), bugleweed (Ajuga reptans), strawberry (Fragaria), spider plant (Climbing fig), strawberry geranium (Excarpeae)</td>
</tr>
<tr>
<td>Runners</td>
<td>A specialized type of stolon usually without leaves that arises from the axil of a leaf at the crown and grows horizontally above ground. New plants arise at the tip as daughter plants.</td>
<td>Iris, Solomon’s seal (Polygynium)</td>
</tr>
<tr>
<td>Crowns</td>
<td>The greening point of a plant at the soil surface where new shoots are formed.</td>
<td>Many herbaceous perennials and ornamental grasses.</td>
</tr>
<tr>
<td>Offsets</td>
<td>Short horizontal shoot at the base of the main stem that forms an independent crown.</td>
<td>Many bulbs, clivias, Hosta, palms.</td>
</tr>
<tr>
<td>Suckers</td>
<td>Shoots that develop from underground roots or shoots. In most cases, these arise from roots.</td>
<td>Raspberry (Rubus), pawpaw (Asimina)</td>
</tr>
</tbody>
</table>

Figure 14–18 Runners (arrow) arising from the crown of a strawberry (Fragaria) plant. New plants are produced at every second node. The daughter plants, in turn, produce additional runners and runner plants.
Runners –
• horizontal stem developing from the axil of a leaf which forms a new plant at one of the nodes.

Rhizomes –
• horizontal stem – typically the primary stem of the plant.

Crows –
root-stem juncture of the plant.

PLANT MODIFICATIONS RESULTING IN NATURAL LAYERING

Figure 14–26 (a) Stock beds of field-grown Liriope. (b) Removing crowns, and (c and d) dividing into rooted liners or “bibas.”
Offsets – (offshoot)

- a specialized leafy plant stem that develops from the base of some monocots.

Chapter 15

Propagation by specialized stems and roots

Bulbs

Morphology
- Basal plates
- Scales
- Contractile roots

Types
- Tunicate (Laminate)
- Scaly
BULBS

• Definition and Structure
  – A bulb is a specialized underground organ consisting of a short, fleshy, stem axis (basal plate), bearing at its apex a growing point or a flower primordium enclosed by thick, fleshy scales.

Figure 15–1 The structure of a tulip bulb—an example of a tunicate laminate bulb. Longitudinal section representing stage of development shortly after the bulb is planted in the fall.

Figure 15–2 (a) Bulb with tunicate covering and adventitious roots (arrow). (b) Cross-section of bulb showing basal plate, bulb scales, and flower axis.

Figure 15–7 Left: Outer appearance of a scaly bulb of lily (Lilium hollandicum). Right: Longitudinal section of a bulb of L. longiflorum ‘Ace,’ after flowering stage, showing old mother bulb scales and new daughter bulb scales. Bulb obtained in fall near digging time (18).
Propagation

- **Bulblets** – underground miniature bulbs
- **Offsets** – bulblets grown to mature size
- **Bulbils** – aerial bulblets

Bulbils

- Aerial bulblets
  - *Allium* (onion)
  - *Lilium* (lily)

**BULBS**

- Propagation
  - Offsets
  - Tulip
  - Daffodil
  - Lilies
- Bulblet Formation on Stems
  - Stem Cuttings
- Bulblet Formation on Scales (Scaling)
- Basal Cuttage
- Leaf Cuttings
- Bulb Cuttings

Propagation

- Scaling and secondary meristems
  - Bulbs dug
  - Outer scales removed
    - Fungicide dip
    - NAA (1 ppm)
  - Planting or storage in vermiculite at 60 to 80 F
**Cuttings**

- Stem-tip
- Leaf node
- Leaf
- Tissue culture

**Bulb Cuttings**

- Amaryllis, Nerene
- Bulb sectioning
- Twin scaling

**Basal Cuttage**

- Hyacinths
- Offsets - too slow
- **Scooping** – removal of basal plate
- **Scoring** – destruction of apical meristem

**BULBS**

Figure 15–18 Propagation of bulbs by (a) splitting Eucomis bulb in half. (b) Scooping of Eucomis basal plate (arrow) and (c) later formation of multiple bulblets (arrow). (d) Scoring through the basal plate of hyacinth led to bulblet formation (arrow), and (e) and (f) multiple bulblets forming.
Corm
• Structure-
  – solid stem structure with distinct nodes and internodes
  – dry leaf bases form a tunic
  – fibrous and contractile roots
• Propagation
  – Corm division
  – Cormels

CORMS
• Definition and Structure
  – A corm is a unique geophytic structure characteristic of certain important ornamentals, such as Gladiolus and Crocus.

TUBERS
• Definition and Structure
  – A tuber is a special kind of swollen, modified stem structure that functions as an underground storage organ
TUBERS

- Growth Pattern
- Propagation
  - Division
  - Tubercles

Figure 15-23 Stolon (black arrow) and tuber (red arrow) production in Curcuma (ginger, Thai tulip) and Phlomis (Jerusalem sage).

Amorphophallus (voodoo lily)

- Tubercle

Tubers

- Swollen, modified stem with nodes and internodes.
TUBEROUS ROOTS AND STEMS

- Definition and Structure
  - The tuberous root and stem class includes several types of structures with thickened tuberous growth that function as storage organs.
  - Botanically, these differ from true tubers, although common horticultural usage sometimes utilizes the term *tuber* for all of them.

- Fleshy and Tuberous Roots
  - Tuberous Stems
  - Growth Pattern
  - Propagation
    - Division
    - Adventitious Shoots
    - Stem Cuttings

Figure 15–25 Types of fleshy and tuberous roots and shoots. (a) Sweet potato fleshy root showing adventitious shoots. (b) Dahlia during early stages of growth. The old tuberous root piece will disintegrate in the production of the new plant; the new roots can be used for propagation. (c) A tuberous begonia stem, showing its vertical orientation. This type continues to enlarge each year.

Figure 15–26 (a) Fleshy root of sweet potato with adventitious shoots or "slips" (arrow). (b) Tuberous roots of dahlia attached to crown (arrow). (c) Each separate tuberous dahlia root must have a section of the crown (arrow) bearing a bud that elongates into a shoot.
Tuberous roots and stems

- Tuberous roots – (Dahlia)
  Swollen root system attached to the crown.
- Tuberous stem – (Tuberous begonia)
  Swollen stem produced by enlargement of the hypocotyl.

Tuberous roots

- Propagation
- Dahlia
  - Division of tuberous roots with an intact shoot bud.
- Sweet Potato
  - Adventitious shoots ("Slips") develop on the fleshy roots.

Rhizomes

- Specialized stem – the main structure of the plant grows horizontally.

RHIZOMES

- Definition and Structure
  - A rhizome is a specialized stem structure in which the main axis of the plant grows horizontally at, or just below, the ground surface.
**Rhizomes**

- **Pachymorph** – short, thick, fleshy, determinate rhizomes (Iris, Ginger)

- **Leptomorph** – elongated, indeterminate rhizomes (Spreading bamboo)

**Propagation**

- Division of clumps and rhizomes
  - Culm cuttings
PSEUDOBULBS

• Definition and Structure
  – A pseudobulb (literally “false bulb”) is a specialized storage structure, produced by many orchid species, consisting of an enlarged, fleshy section of the stem made up of one to several nodes.

Figure 15–34 Commercial propagation of cymbidium orchids from pseudobulbs. (a) and (b) Back and (c) green pseudobulbs.