Propagation Of Woody Plants
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Where Landscape Trees and Shrubs Come From

- Wholesale Nurseries
- Retail Nurseries
- Home Propagation
- Transplanting from native plantings
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Origination of Landscape Trees and Shrubs

• Several years go into growing landscape trees and shrubs
Origination of Landscape Trees and Shrubs

• Propagation Include Seeds, Cuttings, Layering, or Grafting
Wholesale Nursery
Some grow hundreds of different plants- (Trees and Shrubs)
Wholesale Nursery
Some focus on a few types-Roses, Fruit Trees, etc
Wholesale Nursery

- Propagation Area –
  Start seeds, cuttings, grafting, tissue culture,
Wholesale Nursery

• Move rooted plants to field area
  – Train, prune, root, prune, control pests
Wholesale Nursery

• Canned stock – grown in containers
Wholesale Nursery

- Grading and packing area (cold storage)
Propagation from Seed

- Seedlings are similar but not the same as parents
Propagation from Seed

- Collect seeds from mature plants
Propagation from Seed

• Collect seeds near where plants are going to grow elevation or latitude
Propagation from Seed

• Collect seeds from typical, problem free specimen plants
Collecting, Storage and Planting

- Collect Spring produced seeds (red maple, silver maple, poplar, elm) when they mature and sow immediately
Collecting, Storage and Planting

- Collect Pulpy fruits (apple, walnut, rose, viburnum), remove the pulp and stratify in a cool moist environment for 1 – 4 months
Stratification of Seeds

- Stored in a cool (35 to 39 degrees) moist environment (moist peat moss, shredded leaf litter, potting soil) for 1 – 4 months
Stratification of Seeds

- Hormone (Dormin) in the seed has to break down before seeds will sprout
Stratification of Seeds

- Collect acorns in fall, store in refrigerator with moist material... after 3 months the radical will begin to emerge
Stratification of Seeds

- Natural seeding in soil, chilling, moist
Collecting, Storage and Planting

• Seeds with hard coats (honey-locust, Kentucky Coffee Tree, basswood) need seed coat abrasion or scarification
Scarification of Seeds

- Seeds with hard seed coats
- Place seeds in a covered can with equal portions of sand and drive around with them for several days to scratch the seed coat
Fire

- Lodgepole pine, sequoia, and others have their seed dormancy broken by high temperature from fires.
Chemical

• Some seeds must soak in water to leach the chemical that keep them dormant
Direct Seeding in Growing Area

- Direct seeding is the most economical
Direct Seeding in Growing Area

• Prepare the seedbed as you would a garden
Direct Seeding in Growing Area

- Seedlings grown to whips
Direct Seeding in Growing Area

- Seedlings used for grafting rootstock after one year (Cherry rootstock used for flowering cultivar)
Training Field Grown Stock

- Space plants to prevent crowding
Seedlings Grown and Sold

• One year-old whips
Direct Seeding in Growing Area

• Set seeds about 1 foot apart
Seedlings Grown and Sold

- 2 and 3 year-old branched stock
Woody Plants Grown and Sold

- Some slow growing stock may take 8 – 10 years to grow before moving and sale
Seedlings Grown and Sold

- Dug bare-root, stored or sold as bare-root, or replanted into containers or retail nursery
Seedlings Grown and Sold

- Large stock moved as B/B or tree spade
Tree Production Systems

- Bare Root
- Field grown trees dug in the fall or spring and replanted
- Cannot let roots dry out
Tree Production Systems

- Ball and Burlap
- Field grown then dug and moved with root ball intact
Tree Production Systems

• Container Nursery
• Plants grown in containers for most of the production time
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Tree Production Systems

- Pot in Pot
- Advantage of below ground but contained root system
Asexual Propagation

- Vegetative, non-sexual reproduction through the regeneration of missing parts ie roots, shoots, or both
Asexual Propagation

- Involves only simple cell division or mitosis
Advantages of Vegetative Propagation

• All offspring plants are identical to the parent, ie clonal cultivars as ‘Raywood or Autumn Purple’ Ash, ‘Autumn Blaze’ Maple and ‘Miss Kim’ Lilac
Advantages of Vegetative Propagation

- Propagate dwarf varieties that do not come true from seed
Advantages of Vegetative Propagation

• Some dwarf cultivars may revert back to parent
Advantages of Vegetative Propagation

• May be easier and faster, ie no seed dormancy
Advantages of Vegetative Propagation

• Can perpetuate plants which do not have viable seeds, ie Marshall Seedless Ash, Cotton-less Cottonwood
Methods of Woody Vegetative Propagation

- Grafting or Budding - combining rootstock and scion wood
Methods of Woody Vegetative Propagation

- Inducing adventitious roots and shoots
  - Layering-rooting while attached to mother plant
Methods of Woody Vegetative Propagation

• Inducing adventitious roots and shoots
  – Cuttings-rooting stems cut from mother plant or shoots generated from mother plant root segments
Adventitious Roots and Shoots

• Roots and/or shoots produced from abnormal or unusual locations
Adventitious Roots and Shoots

- Growing points form on vegetative tissue
Layering

- The vegetative plant part remains attached to the mother plant while it is developing adventitious roots and/or shoots.
Simple Layering

- Dig hole to bury stem
- Wound stem to stimulate rooting
- Bury in late spring
- Sever from mother plant in late summer
- Transplant fall or spring
Tip Layering

- Some plants (black raspberry) rat-tail
- Rooting takes place near the tip of current season’s shoot
- Dig after rooting and transplant
Trench Layering

- Bury growing branch horizontally in a soil filled trench in spring
- Wounding between buds stimulates roots
- Roots develop at the base of new shoots
- Used for many shrubs
Mound Layering (Stooling)

- Cut plant back near the ground during the dormant season and mound soil over the base so new shoots will develop.
Mound Layering (Stooling)

- Dwarf fruit tree rootstock
Cuttings Vegetative Propagation

- Vegetative plant parts develop adventitious roots and/or shoots while detached from the mother plant.
Cuttings Vegetative Propagation

• Nurseries commonly use stem cuttings
Cuttings Vegetative Propagation

- Hardwood cuttings – stems from the previous season’s growth collected during the dormant season (chilling may be necessary to break dormancy)
Cuttings Vegetative Propagation

- Softwood cuttings – stem segments collected from current seasons growth during early summer
Cuttings Vegetative Propagation

- Root cuttings - root segments are taken in late winter or early spring before new growth starts
Plant Polarity

- Shoots are formed on the end nearest the tip
- Roots are formed on the end farthest from the tip
Plant Polarity

• Keeping the polarity straight when propagating plants
Hardwood Cutting

- Dormant stem segments from last season’s growth
Hardwood Cutting

• Cut just below a node
Hardwood Cutting

- Use rooting hormone
Hardwood Cutting

- Heat soil medium
Softwood Cutting

• Four to 6 inch segments of current season’s growth
Softwood Cutting

- Remove lower leaves or major portion of leaf
Softwood Cutting

• Basal cut below node
Softwood Cutting

• Use rooting hormone
Root Cutting

- Four to 6 inch dormant root segments are used
Root Cutting

- Adventitious buds originate from the cambial region of the root
Root Cutting

- Polarity is important for adventitious formation
Starting Cuttings

• Use a portion of the garden for fast rooting plants (grapes, poplar, willow) and water daily
Starting Cuttings

- Use a greenhouse mist bed
Starting Cuttings

• Use a miniature greenhouse
Use Natural Hormones in Willows
Use Synthetic Hormones if Needed
Grafting

- Joining of plant parts by means of tissue regeneration
Grafting

- **Rootstock** provides the root portion (dwarf, disease resistant)
Grafting

- **Scion wood** is the parent portion selected for its cultivar characteristics.
Grafting

- **Graft union** is the healing wound between the rootstock and scion
Reasons for Grafting

• Increase the number of a plant cultivar which is difficult to propagate by adventitious rooting
Reasons for Grafting

• Where cross-pollination results in a plant different from the parent (apple)
Reasons for Grafting

- Seedless cultivars
  (seedless grapes, seedless plants, male plants)
Reasons for Grafting

- Stem color (Red and yellow twig dogwood)
Reasons for Grafting

• Leaf color (Japanese Maple)
Reasons for Grafting

• Flower color (Prairie Fire Crabapple)
Reasons for Grafting

- Fruit quality
  (Delicious Apple)
Reasons for Grafting

- Mineral Nutrition
Reasons for Grafting

- Tree hardiness and dwarfing (Three way tree with rootstock, interstem and scion)
Reasons for Grafting

• Disease resistance
  (Root root)
Reasons for Grafting

- Disease resistance (Crown gall)
Reasons for Grafting

- Sexual status
  (Marshall Seedless Ash, Male Ginkgo, Thornless Honeylocust)
Reasons for Grafting

- Multiple varieties
Reasons for Grafting

- Special ornamental cultivars
Selecting Rootstock

• Young seedlings
Selecting Rootstock

• An established tree (top working, or use trunk)
Compatibility

- Graft only closely related plants (same species: maple, ash, cherry)
Compatibility

- Unrelated plant species usually fail
Selecting the Grafting Site

- Match the cambial zone on both the rootstock and scion wood
Resources

Plant Propagation by Hartmann and Kester
Tools and Materials

• Rootstock and scion wood
Tools and Materials

- Sharp knife (utility knife)
Tools and Materials

• Grafting wax, tape (rubber strips, rubber electricians tape)
Tools and Materials

- Tree wound dressing
Tools and Materials

- Practice wood (poplar, willow, apple)
Collecting Dormant Scion Wood

- Collect dormant wood in late February and store in cool, moist (36 degree) environment
Collecting Dormant Scion Wood

• Select one year-old water sprouts or shoots, one fourth to 3/8 diameter stems
Selecting Rootstock

- Root stock or segments
Selecting the Grafting Site

- Select a smooth and straight area on both the rootstock and scion wood
Selecting the Grafting Site

- Root stock grafts may have side roots trimmed
Whip and Tongue Graft
Root Graft

Bench grafting
Cleft Graft
Cleft Graft in Future Years

Fig. 1. Three stages of the evolution of a branch from a cion are shown.

Cleft Graft
(Following years)

Fig. 6. Trouble ahead in the next storm. Don’t let two leaders compete.
Modified Cleft Graft
Bud (Shield) Graft
Summer Bud Graft

from mid-July to early September.
Training Field Grown Stock

• Narrow-leafed evergreens (yews, junipers, spruce) pruned in spring before new growth
Training Field Grown Stock

• Pines (Mugo, Norway, Red, White) pruned in June when new growth is soft (candles)...1/3 of candle is removed
Training Field Grown Stock

• Shade trees are trained to a *single main trunk*
Training Field Grown Stock

• Select several main branches, spaced uniformly
Training Field Grown Stock

- Root pruning - compact roots system
Our pioneers were good examples of this. Many of the irrigation ditches were lined with poplars... simply the sticks they brought with them...
Cuttings: Asexual Propagation...

“Vegetative reproduction, i.e., multiplication that does not involve the seed cycle – clonal propagation.”
Clone...

A genetically identical assemblage of individuals produced from a plant entirely by vegetative means.

Hartmann and Kester
So, Let’s Get Started...

- Types of Cuttings
- Hygiene
- Soils & Growing Media
- Propagation Environment
- Light
- Heat
- Moisture
- Humidity
- Methods
Asexual methods:

* Hard & Soft Wood Cuttings
* Layering; air layering
* Leaf cuttings
* Rooting cuttings
* Grafting
* Specialized structures
* Tissue culture; micropropagation
Softwood cuttings are new succulent growth that has not yet turned woody.
Hardwood Cuttings are from **dormant** wood.

They are slower to root but robust and not prone to drying out.
If you take a start off a pussy willow or grape vine when they are dormant, you are taking a **hardwood** cutting.
Choose a good book on propagation like this *American Horticultural Society* edition...
It can tell you how hard the plant is to start and the best time of the year to start it.
Whether starting plants from seed or cuttings, keep the area clean to prevent diseases.

A good solution is 1 part bleach to 10 parts water
A few handy wipes around will help you keep your tools and containers free from harmful bacteria or contaminants...
This propagation unit helps provide light that is needed for photosynthesis.
These lights, secured on a small chain, can be raised, or lowered to give the intensity needed for seed or cutting propagation.
Heat...
The most critical factor seems to be heat, particularly bottom heat.
Take softwood cuttings, put them into cool soil and they will sit there and finally rot.
Raise the soil temperature to 80 degrees and you will see roots form in only a few days.
... and look like this in only a few weeks.
There are many ways to provide bottom heat...

- Heat lamps
- Heating cables
- Hot water piped
- Manure bed & straw
- Space heaters

Caution: Water and electricity are not safe companions... make sure you never mix the two! All power should come from a ground fault circuit.
Here’s how to start with softwood cuttings...

The new growth on this pussy willow has just started...

Take a few branches about the size of a pencil...

...cut them 6” - 8”...
Cut the base on a sharp angle to expose more of the cambium layer...
It helps to stimulate rooting by wounding the base of the cutting by slicing off a sliver of bark…
Use a pencil or stick to make a hole in your planting media before inserting the cuttings...
A good drink and controlled humidity will get your cuttings off to a good start...
Tucked away from direct sunlight...

...or put where bottom heat will speed the rooting process.
Bigger is possible...

Willows & poplars are easy to propagate from larger cuttings

You can take a limb off several feet long...
Put it in a moist place...

Steel bar makes a good hole
Take all the branches off
The best timing is in the spring, just as the buds start to swell.
This cottonless cottonwood, hybrid poplar, is ready to be put in a post hole...
Dig the post hole as deep as you can.

The cutting must stay moist, even saturated, until roots form...
A simple drip system can help you maintain a wet environment for root development the first few months…
5 years later...
...100 years later!
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