ALABAMA DEPARTMENT OF AGRICULTURE AND INDUSTRIES
PESTICIDE MANAGEMENT

STUDY MANUAL FOR SETTING OF LANDSCAPE PLANTS EXAMINATION

Alabama Department of Agriculture and Industries

Introduction to the Setting of Landscape Plants Study CD

The CD that you are using is a compilation of Cooperative Extension System Publications, short study guides, power points and video clips. The authors or web managers have given permission for this information to be used as long as it is *never* sold.
Parts of the CD are critical for your success on the exam and parts are important for your future study and success in the field.
We would like you to eventually read and study all the information on the CD, but believe as a *minimum* you need to watch the Quick Time videos, become familiar with "Alabama Landscape Plants" and the rest of the files 1-20.
Depending on your computer's programs, you may have to download a free Quick Time video- viewing program from the Internet to watch the video.
The Alabama Department of Agriculture and Industries wants you to succeed on the license exams and in your future business endeavors.
If you need help with the testing and certification process, you may contact the ADAI @ 1-334-240-7243 or www.agi.state.al.us for more information.
Please contact the Environmental Training Center of Alabama @ 1-205-862-2588, fkapp@bellsouth.net or www.etcala.org for training and testing opportunities to help you and your business succeed.

We would like to thank the following entities for allowing the use of their work in this CD.

- The Alabama Cooperative Extension System, www.aces.edu.
- The Georgia, Virginia, South Carolina, Minnesota, Wisconsin, Florida and North Carolina Extension Systems. You may search "E – Answers" for any national extension system publication.
- Tennessee Tech, the USDA Forest Service and the National Urban and Community Forestry Advisory Group for the use of the video vignettes.
- Oregon State University for the plant images.
  You may want to type "Oregon State Landscape Plants" into your search engine to see the entire site.

Also, we would like to thank Auburn University and Cawaco RC&D Council for helping fund the reproduction and mailing of these CDs to industry members.
The following objectives and study material relates to information in the provided CD or is included to clarify key points.
Horticulture is an art and a science, and recommendations vary due to soil types, climactic zones and plant species.
The exam committee has attempted to eliminate "trick" questions or test items that are controversial.
If there are concepts in this guide that differ slightly with the manual, please "go with the guide " for best exam results.
Some of the following information may be considered "simplistic", but the idea is to improve your practical knowledge and your results in the field.
If you need more help, the Environmental Training Center of Alabama, the Green Industry Associations and the Two and Four Year colleges offer classroom and practical training.
You may also want to visit your local Alabama Cooperative Extension System office and speak with your county agricultural agent.
There are other great websites, such as "Horticulture on the Internet" or just go to your Internet search engine, type in the plant name or term and select "enter."

The student preparing to take the state license exam must be able to:

1. List or pick out the major functions of the following plant nutrients:

    - Nitrogen – the nutrient most responsible for green, vegetative growth and protein content in a plant.
      The overuse of nitrogen may lead to excess growth, disease and insect problems.
      During cool weather, it is important to use nitrate forms of nitrogen, instead of ammonium to encourage growth in pansies and other flower displays.
      Nitrogen is usually is lost to the air or groundwater quickly, leading to pollution problems if misapplied.
      Nitrogen is considered a primary macronutrient.

- Phosphorous – responsible for root growth, flowering and maturity. Often builds up in the soil, as it is not very mobile. Excess amounts may tie up micronutrients, such as iron, which may lead to poor growth on centipede lawns, boxwoods, decorative container grown plants, etc.
  Phosphorous is considered a primary macronutrient.

- Potassium – has many uses, but is important to fight stress from cold, heat, drought, disease, etc.
  Potassium is considered a primary macronutrient.

- Calcium – is a secondary macronutrient responsible to help with proper cell division and is an important component of cell walls. Calcium is found in all limes and helps raise the pH of acid soils.

- Magnesium – is a secondary macronutrient and critical component of the chlorophyll molecule and its addition will green-up plants and improve acid soils. The liming material that contains large amounts of magnesium and calcium is dolomitic lime.

- Sulfur – is a secondary macronutrient, important to protein synthesis in plants and will help green-up leaves, but will make soils more acid if overused.
  Centipede lawns often react well to sulfur applications.

- Iron – is a micronutrient that allows rapid green-up without much vegetative growth. Iron is common in most Alabama soils, but may be unavailable due to pH and other soil issues. Chelated iron is a special formulation that allows plants to uptake iron even if the pH is very alkaline or basic.

2. Describe or identify the following horticultural terms and processes:

   - Photosynthesis – the food making process in plants, where water vapor and oxygen are released through the leaves to allow uptake of carbon dioxide and the formation of sugars.

Sunlight and the pigment, chlorophyll, are necessary to the process. All green parts of the plants photosynthesize.

- Transpiration – the process by which water moves into the roots, up the trunk and out of the leaf stomates as vapor.
  As the water moves it carries dissolved minerals and other needed materials to the leafy "solar factory."
  The ability to replace water lost from the leaf quickly is one reason certain plants can handle full sun. Shade loving plants are able to function better in the shade as the environment puts less strain on their inefficient root and leaf systems.
  Many plants, like azaleas, often suffer in poorly drained, full sun situations.
  Other plants, such as junipers, may do well in full sun because their leaves are adapted to lose smaller amounts of water.

- Respiration – is the breakdown of stored food in the plant.
  Stored sugars are broken down in an efficient, orderly way to fuel the work of the plant. Soils that are very wet due to over irrigation or rain in the summer may lead to plant death as the plants cannot respire.
  Alabama is home to many poorly drained clay soils that may lead to this situation.

- Cation Exchange Capacity – is the ability of the negative charged clay and organic particles in the soil to hold and release positive charged nutrients in the soil or added as fertilizer.
  The CEC also helps indicate the amounts of pre-emergent herbicide, lime, etc. the soil can retain.

- Soil pH, acid and alkaline – pH is a measure of the acidity or alkalinity of the soil. It is based on a numerical range, where 1 to less than 7 is acid, 7 is neutral, and more than 7 to 14 is alkaline or basic.
  The pH of a soil is determined by a soil test, and indicates how much lime is needed to raise the pH, lowering the acidity or adding sulfur, iron or aluminum amendments to lower the pH and raising the acidity.

The pH affects the uptake of nutrients, water infiltration, the decomposition of organic matter, and the growth of beneficial microbes and much more in the soil.
Some plants such as centipede, azaleas, camellias, blueberries and red oaks do their best in acid soils. Plants like these will show interveinal chlorosis or yellowing due to a pH so high that iron and other micronutrients are unavailable.

- Compartmentalization – a term used by arborists to explain that plants don't "heal" damage, they "close over" damaged tissue and wall it off from the rest of the plant. This process uses up stored foods, so it is best to avoid damaging plants by hitting with mowers, string trimmers or driving over their root systems.

- Hardpan – is a layer of hard soil that roots cannot grow through. In some cases, deep tilling or spading may alleviate the problem.

- Soil Texture – the proportion of sand, silt and clay particles in the soil. Determined by a particle separation test, texture helps indicate available oxygen, water needs, fertilization and liming programs and quantities of pre-emergent herbicide to be applied.
  Unless the budget is available to make wholesale changes, as in golf greens or sand based athletic fields, texture is difficult to change on a large scale.
  The best advice is to thoroughly till or pulverize the soils, add some organic matter, lime as needed and till again.
  The resulting soil will be of similar texture but more able to grow the desired plants.

- Soil structure – the arrangement of the ingredients in the soil. Soil structure can be improved by lime and organic matter additions and through proper tilling or spading.
  Excess tilling or preparing <u>wet</u> soils, compaction and the use of cheap, high salt fertilizers may destroy soil structure.

- Percolation test – a field test to determine if soils have adequate internal drainage. Auger or dig a posthole 12" deep, fill with water and check at 12 hours. If the hole is not free of water by 8 - 12 hours, French drains, berms or other solutions should be employed.

- Soil sampling – a procedure in which the technician obtains many sub-samples at the crop's proper root depth and creates a representative sample for the whole area.
  Many problems exist with this method as most urban landscapes have soils that vary greatly in short distances.
  Tools needed are a bucket, soil probe or trowel and a soil test information sheet and mailing box from the county extension system office.

- Root or pot bound – a condition in which plants roots take the form of the container they are in, leading to stunting and perhaps, later death.
  Making 3-4, 1" deep cuts down the root ball will sever roots and encourage plant health. See the Florida Extension System planting power point for more detail.

- Adventitious buds – hidden growth points found under the bark in some plants such as yaupon or 'Burford' holly that help predict how well they respond to renovation pruning.
  Plants like juniper, pines, boxwood and azalea are less likely than others to re-grow due to fewer adventitious buds.

- Lateral buds – growth points found between the leaf petiole and the stem on a plant. Lateral buds can be forced to grow by removing the terminal bud or the lateral just above.
  Depending on the plant, pruning cuts only affect lateral buds about 8" away from the cut.

- Apical or terminal buds – the growth point at the tip of a branch or shoot. Hormones like auxin, with the help of sunlight, keep the apical bud dominant in growth habit.

Removal of the apical bud by pinching or pruning will cause the bud below it to "break" or grow.

- Organic – compounds containing carbon, usually a word used to describe an amendment that comes from a living source like manures, composts and decomposed bark fines.
  Alabama soils are generally very low in organic matter and all types seem to benefit from some organic matter additions.
  Organic matter helps the soil hold water, nutrients and encourages the growth of beneficial microbes.
  Organic mulches like pine bark and pine straw decompose over time and add organic matter back to the soil.

- Inorganic – amendments that come from sources that are not living, such as naturally occurring minerals and the synthetics, such as petroleum based fertilizers.
  Mulches made of volcanic rock, gravel and chipped tires are inorganic and do not seem to improve the existing soil.

- Actual Nitrogen – the term used to designate the percentage of nitrogen in a fertilizer to help indicate how much carrier to use for a desired application. For example, a fertilizer with an analysis of 20-0-5 has 20% actual nitrogen. If your specifications call for 1 pound "actual" per thousand square feet, you would apply 5 pounds of that fertilizer.

- Primary macronutrients – the plant nutrients nitrogen, phosphorous and potassium, applied normally in greater pounds per acre for most crops. The percentage of each is expressed as the analysis or grade on the label in the order nitrogen (N), phosphorous (P) or potassium (K).

- Secondary macronutrients – the plant nutrients calcium, magnesium and sulfur, applied normally in lesser pounds per acre than the primary macronutrients.

- Micronutrients – nutrients applied in very small amounts to plants, some as little as ounces per acre.

The most important nutrient to plant growth is the one that is in short supply. This concept of the "limiting nutrient" is important to remember as you make applications without soil testing.

3. Identify and describe the following plant parts:

- Roots – the usually underground part of the plant responsible for anchorage, water and mineral uptake and food storage in the plant. Roots grow best in optimum levels of soil air and water, and die in soils that are too dry or wet.
  Most roots are found in the top two feet of the soil, depending on the soil type and plant.
  Cutting or filling around plants will often kill roots and perhaps the plant itself.

- Stems, branches & trunks – supportive and connective tissue found in most plants. Water and nutrients pass through these tissues so improper pruning and mechanical damage may kill the plant. All green plant parts are capable of making food, so be careful spraying any herbicides on these tissues.

- Buds, flowers and fruit – the reproductive parts of the plant, leading to seed formation and new plants.
  For most customers, these traits may be their main concern with plant selection. Try to balance these traits with overall plant growth habits, diseases resistance and needed plant maintenance levels.
  In some cases, flowers and fruit may attract pests or lead to slips and falls, so take care in their installation sites and cleanup.

- Leaves, mid-rib, blade and petiole – leaves are the solar collectors that turn light energy into simple sugars and other compounds. For that reason, they usually are green or some close variation.
  The main vein on certain leaves is called the mid-rib.
  The flat part of the leaf is the blade, and the small stem that holds the blade to the shoot is the petiole.

Leaves can be deciduous and lose all of their leaves in a short time period, as happens in the fall. Plants like dogwood, oak, maple and hydrangea are deciduous.
Leaves may also be evergreen, which means they lose their leaves a certain percentage each year, such as happens with pines, hollies and azaleas.

- Xylem, phloem & cambium – tissue systems that make up the vascular parts of plants.
  Cambium is the very active, green growth area just under the bark. Cambium is comprised of xylem, which carries water and dissolved minerals up the tree, and phloem, which transfers processed food down the tree to storage or use sites.
  The growth rings found in most trees are due to the production of new cambium layers each year.

- Root flares – roots tapering off the tree trunk that become more exposed as their diameter increases.
  Do not cut, fill or heavily mulch root flares as the tree will suffer. Fertilizer, herbicides, trenchers and mowers should not get close to flares for the same reason.

- Girdling root – roots than grow around the trunk, eventually killing the plant. Not "scoring" or cutting the roots 1" deep in several places on a container plant before installing in the landscape can lead to girdling roots. New research shows that girdling roots are also caused by over mulching landscape plants or shifting or "bumping up" nursery stock too deeply.
  Large girdling roots may be cut to allow trunk expansion, but in some cases "the cure also kills the patient."

- Water sprouts – rapidly growing, straight shoots that grow from branches, perhaps wasting energy and destroying the plant's form.

- Suckers – rapidly growing, straight shoots growing from the root system. Plants like wax myrtles, crape myrtles and crabapples tend to produce lots of suckers. The final result is a messy looking plant that creates extra pruning.

4. Select the proper time of the year and the proper method for pruning various trees and shrubs.
   Please refer to the charts in the files on pruning techniques found on this CD.

5. Describe or identify the following pruning methods or terms.

- Selective pruning – a pruning process that removes one branch at a time as opposed to shearing.
  If done properly, selective pruning improves plant openness and health and accentuates natural form.
  Selective pruning is a high skill activity, demanding the horticulturist know plants and their growth habits and forms.
  Because it is a slow process, selective pruning can be much more expensive than shearing.

- Shearing – formal, rigid pruning that turns plants into hedges, or other shapes not found in nature. Practiced to excess by the Romans and the French aristocracy, the shearing of plants should be left to fine formal landscapes, certain hedges and Disney Land. Most shearing today is carried out because the service provider or customer doesn't know better or the budget is tight. The use of power shears without safety equipment is a common cause of personal injury and a reason to keep company insurance updated.

- Thinning – the pruning method that involves reaching deep into a plant to remove or shorten a branch. Thinning is the method that most improves the health and appearance of plants.

- Heading back – removal of a branch at a location at or near the edge of the canopy. Heading back is used to fill in bare areas, but leads to rapid re-growth and a dense outer layer of shoots.

- Anvil Type Pruners – have a blade and anvil that lead to greater damage to plants stems when pruning. Their use is fine for tougher plants like holly and juniper as they are less likely to become damaged when used roughly.

- Bypass Pruners – have blades that work like scissors, leading to a cleaner cut with less tissue damage. They are usually more expensive and can be damaged by cutting limbs over ½" diameter or through rough handling.

- Pruning Saw – normally a curved saw with a folding or fixed blade having coarse, wide set teeth. Most pruning saws cut on the pull stroke and benefit from frequent oiling, cleaning and sharpening.

- Loppers – anvil or bypass pruners with a larger opening between the blades and longer handles to increase leverage for larger limbs up to 1"

- 3-Cut method for limb removal – the recommended method for removing limbs from trees that are not small enough to be easily managed when removing.
  The first cut is an "undercut" made about 1' out from the point of attachment, from the underside of the limb to about 1/3rd the way in. This cut will keep the branch from tearing trunk bark and damaging the tree if you lose control of the limb.
  The second cut is a "through cut" made about 4" outside the undercut, and is completed once the limp pops off.
  The "finish cut" is made outside the bark ridge and branch collar and completes the process.
  No wound painting or sealing is recommended, as it interferes with the natural closing of the wound.
  Please refer to the many videos, brochures and power points that illustrate the process in this CD.

- Bark ridge – bark that is between the trunk and the attached branch, one of Dr. Alex Shigo's targets to use when pruning limbs.

- Included bark – bark that has little connective strength and often a source of limb failure in narrow crotched trees.
  These trees include 'Bradford' pears and zelkovas to name a few.

- Collar – tissue found on some tree limbs that indicate the transition between branch and trunk tissue.
  Properly cut limb wounds are more round than pear shaped, as the cut is above the wider collar.

- Topping – a butchering process practiced by the uninformed to keep trees in a desired height range. The growth that results is rapid, weak and creates the need for more pruning.
  Large, decaying wounds in big limbs is a sign of tree topping.

- Pollarding – a formal type of tree pruning that results in a smaller sized tree, without the resulting decay of a topped tree.
  If done well, it is very labor intensive.

6. Identify or describe proper staking and guying methods.

- Root ball staking – the concept proposed by Dr. Ed Gilman of the University of Florida that it is better to anchor the root ball without attaching guy wires to the trunk.
  Root ball staking allows the tree to flex and develop taper naturally.
  The staking of container trees involves driving untreated wooden 1x 2's through the roots into the subsoil. The 2 to 4 stakes are never removed as they decay over time.
  With balled and burlapped plants, the stakes may need to be 2x4's driven next to the ball and flush. Large trees may need connecting 2x4's for stability. Refer to the planting power point from Florida Extension for additional information and images.

- Not staking at all - research proves it is better not to stake the plant at all if it can support itself.

- Wires, rubber hoses, strapping, etc. – any material pulled tight on the trunk will cause girdling and cambium death over time.
  Many "soft" hoses with wire have girdled and damaged trees.
  Wide cloth strapping, although better, can also cause damage.
  If you feel you can't implement trunk staking, at least allow the guying to be loose enough for the tree trunk to sway and develop taper.

Check and loosen strapping as needed over time to lessen damage.

7. Select the proper method of planting for different plant forms.

- Bare root – a plant production method where the plant is shipped without any soil and planted during the dormant season.
  Bare root trees are sold smaller and have a narrow planting window. It is better to soak the bare root plants in water for 4 hours before planting to encourage some water uptake.
  When installing, a wide hole with a pedestal of tamped earth at the bottom, is a good practice.
  Make sure the soil is pulverized and work the soil around the roots to insure stability and a well dispersed root system.
  One stake driven next to the trunk and secured with a figure 8 of cloth strapping is usually sufficient.
  Bare root plants are usually cheaper and often produce better - adapted plants.

- Container – most container plants are growing in sawdust or pine bark fines soil mix for many months and their roots tend to form to the shape of the pot. It is critical to slice or score he roots as described earlier, to allow the plant to re-grow a proper root system in the planting bed.
  Try to water the containers several hours before installing in the landscape, remove carefully from the container and score the roots. Make sure the entire planting bed is amended and tilled 8-10" deep if possible.
  Install the plants with the top of the root system slightly above grade, perhaps 1-2", to allow for better drainage.
  Pulverize the native soil, if tilling was not possible, and backfill around the roots.
  Never cover the roots with anything other than light mulch.
  Soils, especially heavy clays, piled on the roots can lead to low oxygen levels in the roots and little infiltration of water.
  Newly installed container plants often dry quickly. The proper installation includes several visits after the job is "complete" to check on plant progress.

Setting irrigation systems to take care of all the water needs of a new landscape is a recipe for failure. Property managers and homeowners do not understand the need to reset the system as plants "root in." It is very likely that a new landscape will die from excess water if systems are not monitored frequently.

- Balled and burlapped – lose up to 90% of their root system in the harvesting process and are subject to lots of initial transplant shock.
  Set the plant on a pedestal of firmed soil that keeps the ball from settling and allows the top of the ball to stay above grade.
  Backfill as described above, there is no need to remove healthy branches to compensate for root loss.
  It is most critical to cut the tie string that holds the burlap around the top of the ball as this will girdle the stem if left in place.
  Next, slice the burlap in several places, or remove if possible.
  Because of the low oxygen content of many Alabama soils, even natural burlap may take years to degrade.
  To see if burlap is real, light it with a match. Real burlap turns to ash, while synthetic burlap turns to a plastic "goo."
  All synthetic burlap must be removed or pushed down from the ball.

- Wire basket – trees above 3" caliper may lose 90% of their existing roots in the harvesting process. For this reason, it is critical to handle the plants carefully and install as son as possible.
  All the above B&B procedures apply, with the addition of removing the top tier of the wire basket.
  Research differs on the harm caused by the basket wire, but there is little doubt that roots grow over the wire, instead of pushing it out of the way.
  As trees increase in caliper, the wire will girdle the trunk.
  If nothing else, please cut the seatbelt fabric strapping that holds the basket to the trunk. Strapping left in place will girdle the trunk over time.
  Again, root ball staking and planting on a firmed pedestal will keep the tree from settling or shifting.

- 4" pots and cell packs – water before removal and score or slice the root ball to help get the roots out of their spiral.
  Be very careful not to cover annual roots with soil or piles of mulch. Less is better around the crown of the plant.

8. Identify the best techniques for planting trees and shrubs. Including:

- Call the Alabama Line Locator at 811 before digging!
  One incident with a power or gas line can be fatal and cutting one fiber optic cable could destroy your business.

- Planting pit size and depth – these need to be 2-3x the root ball diameter and more shallow than the ball to discourage settling.
  If the site is tilled, there is no need to dig a hole larger than the root ball. Proper tilling can save labor dollars, energy *and* improve your results!

- Shape – not very important if the entire bed is tilled.
  For individual plants, wider is better.

- Condition of backfill – backfill with native, pulverized soil.
  Research from UGA shows no real improvement adding organic matter to a planting *hole*. Adding several inches of organic matter to a *bed planting* is helpful. Till afterward to make a homogeneous mixture.
  If you till up a vegetable garden and add compost before planting a dollar tomato plant, shouldn't the $100 boxwood deserve the same? If you don't expend the energy to prepare the soil, the work will have to be done by the plant, if it survives long enough.
  Whenever possible, till the soil thoroughly before installing any plants!

- Height of root ball – this should always be above grade in poorly drained clay soils. Try to find the "topmost" root and set it at or above grade.
  In sandy soils, the ball can be at grade but no deeper.

Plants that settle below grade often are stunted and slowly die over time.

- Drainage and oxygen content – provide for proper drainage and oxygen content by routing downspouts out of the bed, allowing for proper slopes away from the foundation, properly designing irrigation and amending with composted pine bark fines.
  Low oxygen soils have an odor like " sewer gas" and often have root standing in water.

- Fertilization – again, there is controversy, but add fertilizer to your tilled soil using your test results.
  Nitrogen is not recommended initially for most plants, although some disagree, but never right before cold or drought conditions occur.
  Phosphorous, potassium and lime levels should be addressed before installation begins.

9. Select or identify major turf management concepts. Including:

- Overseeding – refers to the use of ryegrass planted in an existing warm season grass like bermuda or zoysia during the dormant season. Although there is a use for preventing wear on an athletic turf, overseeded lawns often suffer from the added competition. During cool springs, rye may not die out, leading to the warm season turf to weaken or fail.
  Ryegrass is also a "very wet" turf, which leads to mowing problems and certain diseases.

- Fertilization – it is best to keep turf "a little on the hungry side" and not push lawns to be too green from excess nitrogen. Over fertilization leads to pollution, wasted maintenance dollars, insect and disease problems.
  Turf fertilization programs vary, but the following rates of actual nitrogen per 1,000 square feet are a good starting point:

  1. bermuda – 4-6 lbs.
  2. zoysia, St. Augustine and fescue – 3-4 lbs.
  3. centipede – 1-2 lbs.

High quality, slow released fertilizers, low in salt will more likely give the turf manager the best results.
Granular fertilizers are often the best choice for turf, but liquid inorganics and organics are also very useful.

- Core Aerification – pulling soil cores with a machine on a pattern of 6" or so apart over the entire lawn. The cores are broken up with a mower and left to decompose the thatch in the lawn. Aerification also improves water infiltration, rooting depth and lessens the effects of compaction.
  Warm season turf should only be aerified after green up and before the transition begins to dormancy. In most years in Alabama, May to August is considered optimal timing if irrigation is available.

- Irrigation – water turf deeply and infrequently. Frequent shallow watering leads to poor root depth, wasted fertilizer and pre-emergent herbicides, and disease.

- Soil preparation – turf grows the best on amended, tilled soils that are graded to allow for proper runoff of water.
  Lime and fertilize according to your soil test.

- Mowing – turf should be mowed so no more than 1/3rd the canopy is cut off at one time. This "1/3rd –Rule" allows for turf to always be able to produce sugars for growth.
  Scalping, or cutting lawns too far back, causes turf to lose stored food and encourages weed growth.
  Always mow turf with a properly sharpened blade.
  For best results, blades should be sharpened after 4-6 hours of mowing. Several included bulletins on turf recommend mowing bermuda as low as ½". Low mowing heights are maintainable if the frequency of cut is 3-5 days and the lawn is very smooth.
  In most settings, turf maintained at 2" plus will have less weeds, more stored food and a deeper root system.

10. Select or identify proper weed management concepts with

mulches and pre-emergent herbicides.

- Pre-emergent herbicides are pesticides that limit the germination of weeds in lawns and shrub beds that reproduce by seed.
  Most should be watered in to start the weed inhibition process.

- Number of applications - most turf programs use 3-4 applications per year, while shrub beds receive 2-3 per year.

- Pre-emergent herbicide targets – any seed that is germinating in the soil can be inhibited by pre-emergent herbicides.
  Some seeds are more easily managed by certain herbicides.
  Read the pesticide label before applying any pesticide!

11. Identify basic business concepts. Such as the need for:

- State Professional Services Permits – state law requires any person installing plants for a fee to have a "Setting of Plants" license, obtained by passing an exam and being current with yearly fees.
  If you give any landscape design advice, you also need a "Landscape Design" license.
  Applying any fertilizers with pesticides on them, or applying pesticides such as Roundup, requires an "Ornamental and Turf Pest Control" license.
  Some cities are now requiring SLP and OTPS licenses before bidding on any city work.
  Fines and jail time are possible if you fail to comply with the law!

- City and county business licenses – all businesses must have licenses in every city or county they perform work.
  Because each city does require separate licenses, a small contractor may be wise to try to market in a several city area to cut license and travel costs.

- State Licensed General Contractor's license – state law requires contractors that install *jobs over $50,000* to be Licensed General

Contractors. You may contact the state at 334-272-5030 to find out more details.

- Liability Insurance – needed to protect the business from everyday problems that arise such as damage to a customer's home caused by an employee while landscaping.
  Most commercial contracts will require a policy with specific coverage limits.

- Workman's Compensation Insurance – required for companies with 4 or more full or part-time employees during a calendar year.
  Even if your company has less than 4 employees, it may be required by contract or may be a good idea to have the insurance.
  Workman's Compensation Insurance provides coverage for injuries to employees that occur at work.
  Companies without WC insurance may be subject to penalties, fines and civil liabilities.
  Contact 1-800-528-5166 for more information.

- Business Vehicle Insurance – personal vehicle insurance may not cover an accident that occurs doing business activities.
  Check with your insurance agent for the coverage needed.

- Proper payment of federal, state and FICA taxes – it is wise to have an accountant to help you with advice about submitting the proper payroll and other taxes to government agencies.
  Improper or non-payment of payroll taxes is a major problem with *penalties, interest and jail time* as possible repercussions.

- Department of Transportation compliance – the DOT regulates all commercial vehicles in the state.
  Contractors with trucks and trailers over a certain Gross Vehicle Weight will be required to comply with certain signage, safety and health regulations before traveling to job sites.
  The DOT contact number is 334-242-6358.

12. Select the proper answers to horticultural math problems.

Make sure you bring a ruler and calculator to help with the test!

Math is an essential part of your horticulture business and career. Whether you are estimating a job, reading a set of landscape plans or working on your payroll, your math skills are critical.
For this reason, expect to be asked to work 10 or more problems that involve reading scale rulers, square and cubic measure, bidding jobs based on labor and production hours and estimating fertilizer needs.

- Reading scale rulers – you will be asked to use a ruler to read dimensions on a landscape plan.
  If the scale of a drawing is 1" = 10', a plan with a tree 5" from a house corner will become an installed tree 50' from the house in the field.
  On the same plan, a shrub bed 2" x 3", will become a bed 20' x 30' installed.
  If the scale is 1" = 4', a flower bed 2" x 2" will actually be 8'x8' installed.
  If the scale of a drawing is 1" = 20', plants that are ¼" apart on the plan, will be 5'on center in the field.

- Calculating actual nitrogen content if given the fertilizer carrier analysis, and applying it to practical problems.
  Fertilizers are carriers with the primary macronutrients expressed as percentages of the total weight.
  If your fertilizer is 20 – 0 - 10, it contains 20% nitrogen, 0 % phosphorous and 10 % potassium.
  If the bag weighs 50 pounds, it contains 50 pounds x 20%, or 10 pounds of nitrogen or "actual" nitrogen.
  In most landscape situations, you will be given specifications to apply the fertilizer in pounds actual nitrogen per 1,000 square feet.
  It will take 5 pounds of 20-0-10 to give you 1 pound actual nitrogen per thousand, as 5 x 20% = 100% or 1.

  1. Your soil test results call for 2 pounds of actual nitrogen per thousand square per year to be applied to the landscape. If you have an area of shrubs 20' x 100', how much 16-4-8 fertilizer is needed in a year's time?

20' x 100' = 2,000 square feet
2 pounds per thousand square feet x 2 = 4 pounds total actual nitrogen
4 pounds actual nitrogen divided by 16% or .16 =
25 pounds 16 -4- 8 fertilizer

2. You are going to apply 1&1/2 pounds of actual nitrogen to a bermuda lawn that measures 10,000 square feet.
If you have a fertilizer that has a 32-3 -10 analysis, how much fertilizer is needed for the lawn?

1&1/2 pounds of actual N per thousand x 10
(the amount of 1,000's in 10,000) = 15 pounds actual N
15 pounds actual nitrogen divided by 32% or .32 =
46.875 or 47 pounds 32-3-10 fertilizer

3. How much 20-4-10 fertilizer with pre-emergent herbicide should you apply per acre if the desired actual nitrogen is 1 pound per thousand square feet?

Please consider that *it is illegal* to apply a fertilizer with pre-emergent herbicide if you do not have a current OTPS license.

If you are licensed, you first must know that there are 43,560 square feet per acre.
1 pound actual N per thousand x 43.5 = 43.5 pounds actual N
43.5 pounds of actual N divided by 20% or .2 =
218 pounds 20-0-10 fertilizer

- Calculating the number of plants in an area after being given the "on center" spacing.

To give you an example, let's say you have the opportunity to install 2,000 square feet of 4" summer annuals on 12" centers for a housing development.
When planted on 12" or 1' centers you need almost 2,000 plants, after subtracting for edges, curves etc.
You do a great job and win the fall contract after bidding the job

for the same price.
The problem is that your supplier tells you that pansies need to be planted on 8" centers and you will need 2.25 times as many plants and you are on your way to losing a lot of money!
To help with your future work remember the following:
For an area 25' x 40', or 1,000 sq. ft., you need about:

1. 1,000 plants on 12" or 1' centers,
2. 1,440 plants on 10" centers
3. 2,250 plants on 8" centers
4. 4,000 plants on 6" centers
5. 9,000 plants on 4" centers
6. 250 plants on 2' centers
7. 111 plants on 3' centers

It's great to memorize, but better if you can work it yourself.
To figure the amount of plants in a given area and on center spacing, multiply the distance in inches times that number and divide into 144", the amount of inches in a square foot.
This number can be multiplied by the square footage to come up with the needed plants.
For example, you are asked to plant 2" pots of mondo grass on 8" centers in a bed 10' x 20'. How many plants do you order from your supplier?

1. Multiply 8" x 8" = 64 square inches
2. 144" divided by 64" = 2.25
3. 2.25 x 10' x 20' = 450 plants

Because the customer does not think the planting is thick enough, You are asked to pull the entire bed and reinstall 6" on center.
To calculate the new total number of plants:

1. Multiply 6" x 6" = 36 square inches
2. 144" divided by 36" = 4
3. 4 x 10' x 20' = 800 plants

There are some factors that affect how many plants you need besides spacing.
Staggered or triangular patterns will require more plants than a

square or rectangular pattern.
Because plants are not placed on the bed edge, you can usually discount your number somewhat to allow for that information. Additionally, some plants will be taken out to fit beds that are curved or irregular.

For a 1,000 square foot groundcover planting your customer wants a plant quantity comparison between planting 3' and 2' on center spacing.

1. 3' x 3'= 9 sq. ft. per plant
2. 1,000 sq. ft. divided by 9 = 111 plants
3. 2' x 2' = 4 sq. ft. per plant
4. 1,000 sq. ft. divided by 4 = 250 plants
5. 250 – 111 = <u>139 more plants on 2' centers</u>

- <u>Calculating square and cubic measure.</u>

There are 3' x 3' or 9 sq. ft. in a square yard of sod.
How many sq. yds. of zoysia do you need to order for an area 25' x 40'? Assume there is no loss when cutting.

1. 25' x 40' = 1,000 sq. ft.
2. 1,000 sq. ft. divided by 9 sq. ft. = <u>111 sq. yds</u>.

There are 3' x 3' x 3' or 27 cubic feet in one cubic yard.
How many cubic yards of soil are needed to fill a planter 10' wide x 40'long x 1' deep?

1. 10' x 40' = 400 sq. ft.
2. 400 sq. ft. x 1'deep = 400 cu. ft.
3. 400 cu. ft. divided by 27 cu. ft. = <u>14.8 cubic yards</u>

Bark mulches and topdressing is applied in layers less than 1', so all depths must be given in decimal equivalents or fractions of a foot. For example:

2" of depth is 2/12 or .166 feet
3" of depth is 3/12 or .25 feet
4" of depth is 4/12 or .33 feet

How much bark mulch do you order to mulch an area
20' wide x 100' long x 3" deep?

1. 20' x 100' = 2,000 sq. ft.
2. 2,000 x .25'(3/12') = 500 cu. ft.
3. 500 cu. ft. divided by 27 cu. ft. = 18.5 cu. yds.

- Pricing jobs based on hourly labor rates and productivity charts

It is important to price your jobs with a keen eye on labor, as labor is the greatest risk to most contractors.
Bid your labor in "man hours", with each hour worked per laborer as 1 man hour.
For example 12 hours of labor could be one man working 1&1/2 days or 3 men working ½ day each.
It would not be uncommon to bid a job at $45 per hour and have confusion occur.
There probably are many companies that charge as little as $15 an hour per man because they do not understand the real cost of doing business.
There are also companies that charge $45 an hour *per man* because they understand the costs of business and have overhead due to insurance, other legitimate business costs and feel they deserve a profit.
When you present an estimate to a customer, make sure they understand your billing for labor is based on man-hours or cumulative time, not elapsed time.

You have been asked to price a small landscape job that will involve planting 300, 3 gallon plants for a developer.
From past experience, you know that your crews can plant an average of 10, 3 gallon shrubs per man per hour.
Your labor charge is $35 per man hour.
What is the amount of the labor bill you will give your customer?

1. 300, 3 gallon shrubs divided by the production rate of 10 per hour = 30 hours
2. 30 hours of labor x $35 per man hour = $1,050

If you send a five man crew, how many hours will elapse before you complete the job?

1. 300, 3 gallon shrubs divided by 10 = 30 hours
2. 30 hours divided by 5 crew members = 6 hours elapsed time

13. Select the proper answer to basic landscape safety questions.

Safety is a very important part of your work in the landscape industry. Properly managed companies know they must provide safety training and equipment as required by state and federal law.
Company managers may find applicable laws by contacting the federal Occupational Safety Health Administration or Safe State located at the University of Alabama.
If you do training, make sure all employees sign off on what they have learned.

Safety training without signed verification is of little use in court.

Major areas of concern are as follow:

- Back safety – teaching your employees to lift properly, whether that means using proper mechanics, a helper or a piece of equipment is crucial.
  Back injuries are a major source of workman's compensation claims and can be prevented with proper training.
  All employees should be taught to stretch properly before doing any heavy lifting.

- Hydration – doing heavy or hot work without proper fluid intake may create more problems with heat stress, heart irregularities and weakness.
  Your employees should avoid caffeinated drinks that act as diuretics or "fluid losers." Caffeine and high sugar drinks also put much more pressure on your heart and general metabolism, creating more stress.

Diluted sports drinks, water and some fruit juices, combined with proper eating habits make the most sense.
If you are diabetic or have other health problems, you should talk to your doctor before doing heavy, outdoor work.

- Eye safety – mowers and string trimmers can create projectiles that travel at 200 mph. Employees working with, or around others using power equipment, should wear safety goggles.

- Hearing safety – noises above 85 decibels can create permanent hearing loss in your employees. Power tools such as blowers, string trimmers, mowers, tractors, etc will all cause damage after use.
"Ringing in the ears" is a good gauge that hearing loss has occurred.
Disposable earplugs and earmuffs are recommended for employees that use power equipment.

- Mower safety – riding and push mowers are common causes of accidents in landscape management work.
Mowers turning over, cutting off toes or fingers, projectiles and burns from mufflers are common issues.
As with all equipment, you and your employees must read and follow the manufacturer's safety manual.
Always push; never pull a "push mower."
Avoid cutting up and down slopes with walk behind mowers.
When using a riding mower, avoid cutting across the slope.
Most manufacturers will ask you to ride the mower up and down the slope to avoid flipping over.
Most mowing equipment should not be used on slopes greater than 30%.
Do not ask an employee to do any activity prohibited by the manual.

- Driving safety – employees must have a valid driver's license, and not be taking medications or substances that affect their driving.
Aggressive driving with a crew and equipment on board is a recipe for disaster.

Drivers are responsible to check oil and tires before driving to a work site.
Companies that don't encourage driving safety by replacing worn tires and brakes are creating a safety culture that will lead to accidents and lawsuits.
DOT inspections will become more frequent and carry greater penalties in the future.

Conduct frequent, verifiable safety training and encourage all your employees to make safety Job #1!

LANDSCAPE MANAGEMENT/INSTALLATION EXAM
STUDY GUIDE

Introduction –

The following study guide is to help you prepare for your Landscape Managers/Installer's exam. Landscape Management and Installation is an art and science with a history that goes back many thousands of years.

Potential topics and questions, and the supporting websites, textbooks, and information sheets would be too numerous to reference and much too large a task for you to study.

Please study the enclosed handouts but try to do more, both before and after your exam.

Textbooks like Gordon Halfacres' Landscape Plants of the Southeast, Michael Dirrs' Manual of Woody Landscape Plants, and David Hensley's Professional Landscape Management are excellent places to start.

If you have access to a computer and do not know website addresses, just type in "Pruning Landscape Plants," "Planting Landscape Plants" or "Oregon State Landscape Plants" in the search engine and be amazed at the quality and quantity of the information available.

Formal education at land-grant colleges, like Auburn, two year colleges, or industry training is a great way to improve your skills and success in the field.

If these options are not available to you, realize that some of the best landscapers and gardeners in this state are mostly self-taught. If you have a real interest, and invest the time, you can become a successful professional

For more help, contact your local county extension agent, professional associations like the Alabama Nurseryman's Association and the Greater Birmingham Association of Landscape Professionals, and other experts in the field.

Skills and topics potentially on the exam include

:

1. Reading landscape plans
2. Reading scale rulers
3. Calculating square measure, cubic measure
4. Square footage in an acre and related calculations
5. Calculating actual nitrogen in fertilizer and applying it to practical problems
6. Pricing jobs based on hourly labor rates and productivity charts
7. Calculating needed plants for an area if given the on center spacing
8. Pruning techniques
    A. Tree limbs
    B. Broadleaf shrubs
    C. Summer flowering shrubs
    D. Spring flowering shrubs
    E. Conifers
    F. Specific common plants and pruning for each

9. Pruning Cuts
    A. Thinning
    B. Heading back
    C. Shearing
    D. Selective pruning as a concept

10. Function of Plant Parts
    A. Roots
    B. Stems/branches/trunks
    C. Buds, flowers, and fruit
    D. Leaves, midrib, blade, petiole
    E. Xylem, Phloem, Cambium

11. Plant Processes, soil and fertilizer terminology
    A. Photosynthesis
    B. Transpiration
    C. Respiration
    D. Soil Texture
    E. pH
    F. Soil structure
    G. Cation exchange capacity
    H. Actual nitrogen
    I. Acid/alkaline
    J. Primary macronutrients
    K. Secondary macronutrients
    L. Micronutrients
    M. Clay, silt, and sand
    N. Organic mulches and amendments
    O. Inorganic mulches and amendments
    P. Soil sampling
    Q. Adventitious buds
    R. Lateral buds
    S. Apical buds
    T. Hardpan
    U. Percolation test
    V. Particle separation test

12. Staking and Guying trees
    A. Rootball staking
    B. Traditional methods and their variations
    C. Situations where it is not needed

13. Planting Different Plant Forms
    A. Bareroot
    B. Container
    C. Balled and burlapped
    D. Wire basketed trees and shrubs
    E. 4" and cell packs

14. Planting Methods
    A. Planting pit, size, shape and depth
    B. Condition of backfill, organic matter
    C. Height of rootball
    D. Importance of drainage and oxygen content of soil

15. Pre-emergent Herbicide use in lawns, shrub beds, and annual color beds

16. Limes/Gypsum and their characteristics and uses
    A. Dolomitic
    B. Calcitic
    C. Hydrated
    D. Basic slag
    E. Calcium sulfate/gypsum

17. Business related concepts
    A. Workmen's compensation insurance
    B. Liability and vehicle insurance
    C. City, county, and state business licenses
    D. State Professional Services Licenses
    E. Federal, state, and FICA taxes

18. Turf
    A. Overseeding
    B. Fertilizing
    C. Core aerifying
    D. Sodding/seeding
    E. Soil Preparation

Landscape Design and Installation Strategies

Fred Kapp, Landscape Consultant

Overview

There are many opportunities for the landscape designer, installer, and management professional to lessen pest problems in the landscape, without sacrificing quality.

Perhaps the weakest link in the process is the designer, as he has the first chance to shape the project properly. Many times designers are constrained by the property owners, withering budgets or perhaps a lack of plant knowledge. Even so, designers must specify the proper plants and the correct planting procedures.

Often times the installer, in an effort to get the job, has bid too low to do adequate preparation. This, coupled with poor design, and little oversight, leads to plant losses in the 25% plus range, and the balance struggling to survive five to ten years. Once again, the designer must provide realistic cost projections to the owner/customer.

Finally, the landscaper manager is left to hold together whatever survives the first year warranty period and bring it into "maturity." We begin to realize after 25 or so years of experience, that we are really only building "temporary" landscapes that will have to be redone every ten to fifteen years.

We as an industry must work together to create a better landscape product and help educate others to raise the standards to a minimal level.

Here are a few practical suggestions you can use to improve your landscape results a tremendous amount…

1. Proper plant selection- Here we hope for a horticultural-designer not a "graphics-artist" or worse, an architect with a superior opinion of him or herself.

   Horticulture is a humbling profession, avoid people who are too sure of themselves.

   Demand better plants, demand designers spec better plants and educate your customers to know why a plant is superior. Look to the true industry "plantsmen," like Dirr, Armitage, Halfacre, Shadow, Gilman, Coder, Reese, etc.
2. Avoid "pest hotels"- Some plants are too attractive to insects and diseases, or languish in our soils and open themselves up for attack. Here are a few that belong in the "Don't Plant List": Many euonymus and azaleas, Heller and other Japanese hollies, Leyland cypress, 'Bradford' pears, some crabapples, certain dogwoods, and crapemyrtles, White pines and non-resistant teas roses.
3. Proper Soil Preparation- This begins with soil testing, at least for pH, but hopefully for N, P, and K. Particle separation or texture tests also help quite a bit. Proper soil prep would include: lime and fertilization as needed, but do not push new plantings with excess N. Till once to break up the ground, and once more to incorporate composted ground pine bark, or other acceptable amendments.
4. If possible, try to plant in beds, as opposed to "planting pits" and really try to loosen the soil as far out as you can afford. Oxygen is the key to new plant

survival, no O, no go! Plant your plants a little above grade, one half to one inch is about right in our heavy clay soils.

5. Remove or cut off burlap and at least one third of the wire basket, "score" the roots and plant on a pedestal of firmed soil. Stake the root system, not the trunk on newly set trees. Water plants before you take them out of the pot, and again after planting.
6. Proper post-plant care- take some time to research what constitutes proper care, for instance wound painting, excess use of nitrogen and heavy dethatching are not only not useful, they actually harm your plantings.

I'd suggest a yearly soil test, perhaps more often on a valuable or marginally performing site. When you fertilize or lime, use quality materials at a properly calibrated rate at the correct time of the year. Learn to distinguish pathogenic diseases and insect damage from nutrient disorders. There are great websites on the internet dealing with all of these problems.

7. Monitor for pest problems before they get out of hand. Too many of us look for pests through the windows of our moving vehicles. Monitoring involves lots of "stoop-labor", thinking like a pest and plenty of research and networking. When you plan your management programs, work in "preventive" sprays of horticultural oils, soaps and lime-sulfur. Try to use lower rates of less toxic pesticides, do a more thorough job when you spray or drench to deliver the product as intended.

There are so many "new generation" pesticides available, with many more on the way. Products like Merit insecticide, Eagle fungicide, and Manage herbicide are a few that come to mind. In the future, many of our traditional pesticides will be gone; get ready for highly technical, well-measured and applied products. Look more to the breeders to produce pest-free plants and the landscape manager to modify habitats to lessen plant pests. Somehow, we as an industry need to raise our awareness and technical skills to prevent or lower pest levels. Today, as always, the best pest management tool is a well trained, professional employee.

If you need more information you may contact me at FKAPP@aol.com, FKAPP@callwaynes.com, or 205-985-2009. For information on horticulture from our land grant colleges, type in E-answers on your computers search engine. You can then search by topic, college, or region.

Circle the words or phrases that represent a viable practice in modern landscaping: Tree-topping, shearing Chinese hollies, butterflying container roots before planting, cover sprays with organophosphate insecticides as landscape pest preventers, watering established lawns three times a week, fertilizing shrubs in late September to green them up, leaving wire baskets intact when planting trees, flush cuts on tree limbs, placing gravel in the bottom of a planting pit to help drainage, planting junipers and azaleas or salvia and marigolds as companion plants, allowing lawns to go to seed to help thicken them up, suggesting zoysia as the best solution for a very shady yard, placing sand under

sod to help with drainage, painting tree wounds, augering planting holes to speed installation, placing excavated soil over the top of newly planted container plants…

Got any circles? Need some modern information? I'll be glad to help you find any in the future.

Landscape Management/Installation Exam
Sample Problems and Helpful Hints

1. Plant Processes – Plants make food through the process of photosynthesis. Although leaves are the primary place of photosynthesis, leaf petioles, green stems and trunks also produce food. In photosynthesis, plants exchange water vapor and oxygen for carbon Dioxide to make simple sugars. Plants break down stored food during respiration, and plenty of oxygen in the soil is needed for this to occur. Transpiration, or the loss of water by the leaves, stems, and buds is one indicator of where plants need to be sited. Plants with high transpiration rates like azaleas, need to be in the shade, where those with lower rates like junipers can handle full sun.

2. Turfgrasses do their best in full sun; grasses like zoysia, St. Augustine, and fescue tolerate shade but don't prefer it. For shady areas, mulches and groundcovers are better suited than turf. In general, it is better to mow turf higher, especially in hot summers. Higher cutting heights lead to greater food storage and less weed competition. Overseeding with annual ryegrass can lead to a beautiful lawn, but the competition with the existing turf may cause it to thin out.

3. Limes, like dolomitic lime, are needed by many acid Alabama soils. Remember, however, that plants like blueberries, azaleas, camellias, and centipede grass do better in low pH or high acid soils. As always, it is better to soil test before applying lime, and fall or winter applications are usually suggested. If you wish to add calcium without changing the pH and improve drainage, calcium sulfate or gypsum is a good soil amendment.

4. Soil texture is the percentage of sand, silt, and clay in the soil. Texture helps indicate the amount of water, lime, fertilizer, and pesticides soils need. Sandy soils often need small amounts of fertilizer, water, etc. more often where clay soils can use greater amounts of water and fertilizer less often. This feature is due to the ability of clays to hold water and nutrition, while sands exert little holding capacity. Soil texture is difficult to alter on a large scale, but even poorly textured soils can be helped with optimum additions of organic matter and lime. Soil structure is the arrangement of the particles in the soil. Well structured soils, those with "good tilth," allow for better root and plant growth. Those that are compact resist the proper movement of air and water and lead to poor growth. Improve sol structure by proper liming, additions of organic matter, and not working wet soils.

5. Modern nursery methods may lead to future landscape problems. Field grown plants lose much of their roots in harvesting, often up to 90%. Normally, field grown materials may take a year or more to recover from harvest. Container plants are often "root bound" or have a spiral of roots inside the container. These plants can be "scored" or have their roots teased or cut lightly to help allow the

roots to grow back normally. Containerized trees planted in the landscape may die years later from roots that encircle and girdle the trunks.

6. Many plants do not need to be staked or guyed at planting. If you must stake and guy, allow the plant to flex in the wind to help develop trunk taper. Studies by Dr. Ed Gilman suggest that staking the rootball is the best method for most plants.

7. To determine the amount of square yards of sod to order for a job, multiply length times width in feet and divide by 9 sq. ft. (One yard is 3'x 3' or 9)

   Example – the sod needed to cover an area 20'x 50' or 1,000 sq. ft divided by 9 = 111 sq. yds.

8. To determine cubic yards of soil, bark, concrete, etc., multiply length x width x depth in feet and divide by 27 cubic feet (One cubic yard is 3'x 3' x 3' or 27 cubic feet)

   Example – to determine bark needs for a bed 10' x 50' or 500 sq. ft., 3" deep, change the 3" into feet or .25' and multiply. 10x50x.25 = 125 cubic feet divided by 27 equals 4.6 yards.

9. Fertilizers have a grade or analysis usually showing their nitrogen, phosphorus and potassium percentages as in 32-3-10. The 32 stands for 32% Nitrogen. If you need to apply one pound of actual nitrogen per 1,000 sq. feet, simply divide 1 by .32. This will give you about 3.12 pounds of 32-3-10 to reach one pound of actual N per 1,000.

   Example – calculate the amount of 20-20-20 fertilizer needed to reach one lb. N per 1,000 for a 5,000 sq. ft. lawn. 1 divided by .20 = 5; 5lbs x 5 (1,000 sq. ft.) equals 25 lbs. 20-20-20.

   When fertilizing trees and shrubs it is best to rely on soil test results. Without these results, most tree and shrub plants will do well with 2-3 lbs. of actual Nitrogen per 1,000 sq. ft. Always calculate this on the amount of open root space. Using trunk diameter methods may lead to plant death if the plant is in a parking lot planter or some other restricted site. Also, remember that trees with roots that extend into turf can be a problem. Fertilizing the tree based on root space measurements may lead to oversupply for the lawn. In most cases simply fertilizing the turf will take care of the tree.

   Example – Calculate the fertilizer needed for a shrub bed 10'x100' if the specifications call for one pound actual N per thousand. Your fertilizer is a slow relased 16-4-8 formulation. 10'x100' = 1,000 sq. ft.

1 pound actual Nitrogen divided by .16 = 6 ¼ pounds 16-4-8
All nutrients are critical for plant growth. The concept of the "Limiting Nutrient" is that the most important nutrient for plant growth is the one that is missing. Even deficiencies of minor nutrients like iron can cause plant growth to suffer. Many nutrients lead to "green up" in a plant besides nitrogen. Nutrients like sulfer, manganese, iron, and magnesium, among others will produce greener, more healthy growth. Don't rely on a fertility program that stresses large amounts of nitrogen, excess applications, or applications made late in the year on lawns and certain shrubs and trees. Applications made after mid-August can lead to cold damage in certain years.

10. Although there is always controversy about planting and soil amendments, many believe that the addition of organic matter like decomposed pine bark fines, tilled into the soil will improve plant growth. Perhaps the biggest advantage of this technique is to pulverize the soil and raise it to increase drainage and the movement of oxygen in the soil. Organic fertilizer like bone meal, compost, manures do add beneficial organic matter but are often low in the percentage of actual nutrition. They also are often very expensive if purchased commercially and slow to act.

11. Modern pre-emergent herbicides, applied 2-3 times per year can greatly reduce annual weeds in turf. Weeds like dallisgrass, nutgrass, etc. that are perennial must be sprayed out selectively. Pre-emergents also work well in annual color and shrubs beds, but must be applied very carefully to avoid damage to certain annuals, bulbs, and shrubs.

12. Please remember there 43,560 sq. ft. per acre!

13. You will be asked to use a scale ruler to determine materials needs and spacing on a landscape plan. For your future work, an engineer's or architect's scale is a good investment. For the exam, any ruler will do.
For example – use your ruler to determine the distance from point A to point B in feet if the scale is 1" = 8'

Because the distance on the paper from A to B is 2", the actual distance in feet on the landscape job is 16'.

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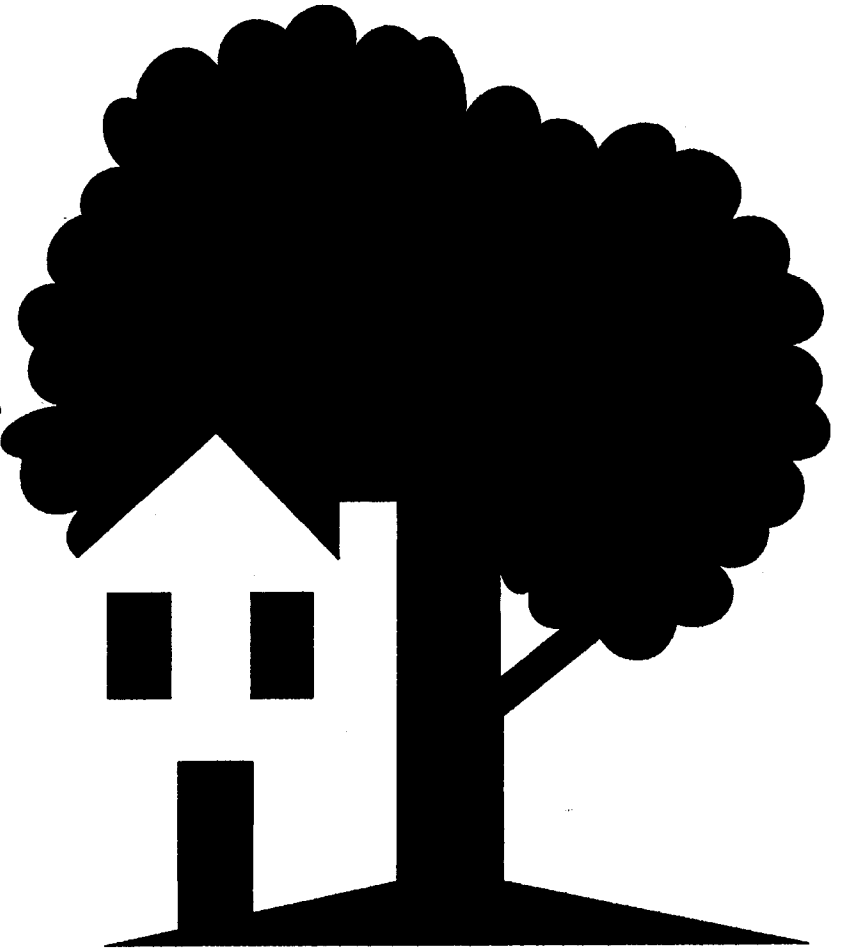
Care of Ornamental Plants In the Landscape



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http://www.ces.uga.edu/ces/pubs.html

Care of Ornamental Plants In the Landscape

Gary L. Wade, Extension Horticulturist
Beverly Sparks, Extension Entomologist

Most established ornamental plants in the landscape require care to stay healthy and attractive. Regular fertilization, pruning, watering, mulching and pest control are all part of a good landscape management program.

Some plants, such as annual flowers, roses, red-tip photinia and English laurel, are more demanding than others. Annual flowers and roses must be kept well-supplied with nutrients and water at all times, pruned and groomed routinely, and monitored regularly for pests if they are to flower abundantly. Red-tip photinia and English laurel are very susceptible to leaf spot diseases and demand more care.

On the other hand, plants such as ornamental grasses, hollies and junipers, when properly planted on a good site, require little care once established and are considered good low-maintenance plants.

Caring for ornamental plants is more difficult when they are not well-suited to the site selected or when they are improperly planted. Azaleas, for instance, prefer a moist, well-drained soil and shade from the mid-afternoon sun. When planted in poorly drained soil or in full sun without the benefit of irrigation, azaleas become stressed, susceptible to attack from insects and diseases, and require more care. Planting too deeply or too shallowly also causes plant problems.

Today, the concept of low-maintenance landscapes is more popular than ever before. The idea of putting less effort into the landscape without sacrificing quality and beauty is very appealing to a growing number of homeowners and clients of landscape professionals. By applying lower amounts of fertilizer, water and pesticides to the landscape, you not only help the environment but also save time and money. New concepts in low-maintenance landscaping, such as Xeriscaping (water-efficient landscaping) and integrated pest management (control of pests through the selective use of insecticides and encouragement of natural enemies), are proving that it is possible to have a beautiful landscape while saving time, effort and money.

This publication provides guidelines for the care of established ornamental plants in the landscape. Low-maintenance alternatives to traditional cultural practices are discussed throughout the publication.

Start by identifying areas of the landscape that require different amounts of care. A recently planted area, for instance, will generally require more attention than a well-established area. The highly visible public area of the landscape is usually an are where optimum growth is desired at all times, while a secluded, private area requires less maintenance. Once this "zoning" is done and the different levels of plant care are established, landscape maintenance becomes much more efficient and effective.

Fertilization

Fertilization is an important part of landscape maintenance, particularly in urban areas where much of the native topsoil is removed during development and subsoil deficient in essential nutrients becomes the new topsoil.

Unfortunately, fertilization is a rather simple cultural practice made complex and confusing by the wide variety of fertilizer products on the market today — from "general-purpose" garden fertilizer to specialty products, such as pre-mixed liquid fertilizer concentrates, water-soluble crystals, slow-release fertilizers, azalea/camellia fertilizers and rose specials. Plants generally do not care whether a fertilizer is granulated, liquified, encapsulated, briquetted, pelletized or solubilized! They simply want nutrients in any form they can use.

Table 1. Average nutrient content of various organic fertilizer sources.

	% Nitrogen (N)	Phosphorus (P_2O_5)	% Potash (K_2O)
Blood, dried	13.0	-	-
Bone meal (raw)	3.5	22.0	-
Bone meal (steamed)	2.0	28.0	-
Cottonseed meal	6.6	2.5	1.5
Fish scrap (dried)	9.5	6.0	-
Soybean meal	7.0	1.2	1.5
Horse manure	0.7	0.3	0.6
Cow manure	0.6	0.2	0.6
Pig manure	0.5	0.3	0.5
Sheep manure	0.8	0.3	0.9
Chicken manure	1.1	0.8	0.5
Duck manure	0.6	1.4	0.5

Source: *Soil Fertility and Fertilizers.* S.L. Tisdale and W.L. Nelson. MacMillan Publishing Co., 1975.

Fertilizers, however, differ in nutrient content and release duration. The type of fertilizer you select should be based not only on its cost but also on the types of plants being fertilized, the existing nutrient content of the soil, and the type of growth response desired. Liquid or water-soluble fertilizers, for instance, are often used on annuals and herbaceous perennials immediately after transplanting because their nutrients can be absorbed quickly and used by the plant. Woody ornamentals, on the other hand, store food reserves in their roots and do not have an immediate demand for nutrients after transplanting as short-season annuals do. They benefit from slow-release fertilizers that ensure a supply of nutrients as needed.

To determine whether a granular fertilizer has slow-release properties, look at the analysis on the back of the bag. Nitrogen listed in the form of ammoniacal nitrogen indicates that the product has some slow-release property. If the nitrogen is listed as being derived from urea, urea-formaldehyde, IBDU (isobutylenediurea), or sulfur-coated urea, the release duration of the product will be increased. Some granular slow-release fertilizers last six to eight months after application.

Other commonly available slow-release fertilizers on the market include Osmocote granules, Osmocote tablets, Jobe's Spikes, Once, Woodace briquettes, Agriform tablets and Milorganite. These fertilizers generally cost more per pound than general-purpose granular fertilizers such as 10-10-10 or 12-4-8, but they also last longer and don't need to be applied as frequently.

Organic fertilizer sources such as bone meal, cottonseed meal and animal manures can also be used. Table 1 lists the average nutrient content of several organic fertilizer sources. Compost is another good source of slowly available nutrients.

Which Analysis Is Best?

A soil test, available through your county extension office, is the best way to determine which fertilizer analysis is best for your soil. As a general guideline, most ornamental plants will benefit from a fertilizer having its primary nutrients (nitrogen, phosphorus and potassium [N-P-K]) in a 3-1-2 or 4-1-2 ratio. A 12-4-8 fertilizer, for instance, is a 3-1-2 ratio, and a 16-4-8 fertilizer is a 4-1-2 ratio. Research shows that phosphorus, the middle number in the analysis, is held be soils and does not leach with rains or irrigation as nitrogen or potassium do; so it is usually needed in lower amounts. On new sites where phos-phorus has never been applied, a complete balanced fertilizer such as 8-8-8 or 10-10-10 is sometimes recommended.

When Should You Fertilize?

Research shows that woody plants actively absorb nutrients from the soil during the growing season and require few nutrients during the dormant winter season (see Figure 1). Therefore, apply fertilizer as soon as the plants begin breaking dormancy in the spring, and avoid fertilizing after the first fall frost, which signals plants to begin resting for the winter.

How Often Should You Fertilize and How Much Should You Apply?

The frequency of fertilization depends on the type of plants being fertilized and the type of fertilizer used. If slow-release fertilizers are used, one application should be sufficient for the entire growing season. If general-purpose granular fertilizers are used, two or three applications may be needed, depending on the fertilizer's slow-release properties.

When general-purpose granular fertilizers such as 12-4-8 or 10-10-10 are used on newly-planted ground covers, annuals, herbaceous perennials and roses, light applications made at four- to six-week intervals are recommended.

During periods of limited rainfall or drought, reduce the amount of fertilizer applied and the frequency of application in non-irrigated areas.

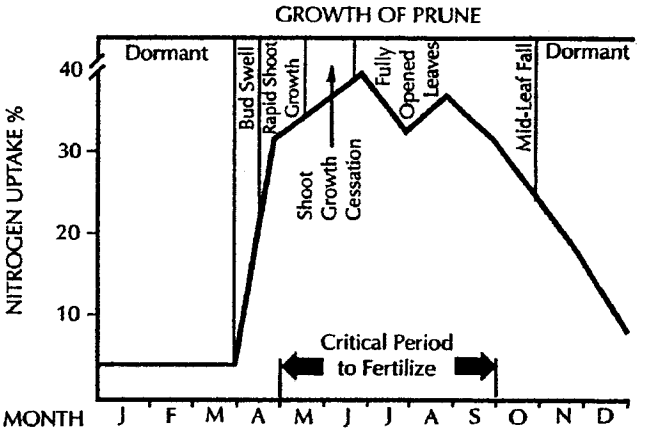


Figure 1. The relationship between nitrate uptake efficiency of nonbearing prune trees and their growth cycle. Source; S.A. Weinbaum, et. al., 1986. *J. Amer. Hort. Sci.* 111(2): 224-228.

Fertilizers may injure the roots of ornamentals under drought stress.

Newly-planted ornamental trees and shrubs will benefit from light applications of fertilizer made during the first growing season after transplanting (Table 2). Uniformly broadcast the fertilizer along the perimeter of the planting hole. **Avoid using weed-and-feed fertilizers in the vicinity of newly-planted ornamentals because injury from the herbicide may result.**

Table 2. Recommended fertilization rates for newly planted ornamental plants during the first growing season (use only one of the fertilizers listed at the rate recommended).

	Application rate[1]/plant			
Plant type/size	**12-4-8**	**16-4-8**	**10-10-10**	**Application frequency**
1-gallon shrubs	1 tsp.	1 tsp.	1 tbsp.	March, May, July
3-gallon shrubs	2 tsp.	2 tsp.	2 tbsp.	March, May, July
5-gallon shrubs	3 tsp.	3 tsp.	3 tbsp.	March, May, July
Trees under 4 feet	1 tbsp.	1 tbsp.	2 tbsp.	March, July
Trees 4 to 6 feet	3 tbsp.	3 tbsp.	5 tbsp.	March, July
Trees 6 to 8 feet	4 tbsp.	4 tbsp.	6 tbsp.	March, July
	Application 100/sq. ft			
Ground covers, annuals & herbaceous perennials	½ lb.	½ lb.	1 lb.	Each 4 to 6 weeks

[1]tsp. = level teaspoon; tbsp. = level tablespoon; lb. = pound. When using slow-release or soluble fertilizers, follow label recommendations for application rate.

Newly-planted 1-gallon size plants will respond to 1 level teaspoon of a 12 to 16 percent nitrogen fertilizer or a level tablespoon of an 8 to 10 percent nitrogen fertilizer applied in March, May and July. Small trees, fewer than 4 feet tall, should receive no more than 1 tablespoon of a 12 to 16 percent nitrogen fertilizer two to three times during the first growing season. Larger trees will benefit from 3 to 4 tablespoons of a 12 to 16 percent nitrogen fertilizer. Broadcast fertilizer along the perimeter of the planting hole. Remember that newly transplanted ornamentals are under stress while they are trying to adapt to their new location and they can be easily injured by over-fertilization.

The quantity of fertilizer applied on established ornamentals depends on the analysis of the fertilizer used, the area fertilized and the amount of growth desired. Nitrogen controls vegetative growth, so application rates are based on this primary nutrient. Table 3 lists suggested application rates for several general-purpose fertilizers.

DO NOT OVER-FERTILIZE OR FOLIAR DAMAGE MAY RESULT. To increase the application rate, increase the frequency of application, but do not exceed the amount recommended in Table 3 for each application. Optimum growth fertilization rates (three to five applications) are usually used on annuals, herbaceous perennials, roses and newly established ground covers to encourage their spread. Otherwise, low rates of fertilizer are recommended, particularly if you desire a lower maintenance landscape. As the application rate of fertilizer increases, so does the amount of new growth, which requires more water, more fertilizer and more pruning.

To determine how much fertilizer to apply, first estimate the area to be fertilized. This involves estimating the length and width of a bed in linear feet and multiplying the two numbers to obtain square footage (see Figure 2, page 7). Few plant beds are perfectly square or rectangular, so square off the rounded areas to simplify your estimate. Trees growing within a bed can be included in the bed estimate or, if they require special fertilization, estimate their canopy area by measuring the distance from the trunk to the drip line or tip of the

Table 3. Recommended application rates of various general-purpose granular fertilizers on established ornamental plants in the landscape.

	Application rate*				
	1000 sq. ft.		100 sq. ft.		10 sq. ft.
Source	pounds	cups	pounds	cups	tablespoons
10-10-10	10.0	20	1	2.0	4.0
8-8-8	12.5	25	½	2.5	5.0
13-13-13					
12-3-6	6.0	12	¾	1.5	3.0
12-4-8					
12-6-6					
16-4-8	6.0	12	½	1.0	2.0
4-12-12	25.0	50	2½	5.0	10.0
5-10-10	20.0	40	2	4.0	8.0

* This rate will supply 1 pound of actual nitrogen per 1,000 square feet. For optimum growth of young shrubs, ground covers and trees, three to five applications are recommended at 6- to 10-week intervals from March to August. Application frequency varies with the amount of slow-release nitrogen in the product, so consult the label for specific recommendations. Established trees and shrubs will benefit from one to two applications during the growing season. Annual flowers and roses should receive applications at 4- to 6-week intervals from March to August. When using slow-release or specialty fertilizers, follow the manufacturer's recommendation on the container.

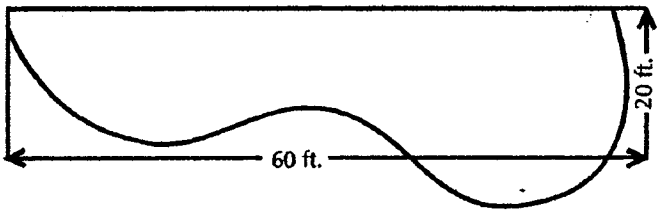


Figure 2. Question – Approximately how many square feet are in this plant bed? Answer – 1,200 square feet.

branches (this is called the *radius*). Then use the geometric formula for the area of a circle to calculate the area of the canopy: 3.14 x radius^2. For example, if the distance from the main trunk to the drip line of a tree is measured to be 20 feet, the area beneath the canopy is 3.14 x (20 x 20) = 1,256 square feet. See guidelines below for additional recommendations on tree fertilization.

Guidelines and Precautions When Fertilizing

- Broadcast fertilizer evenly over the bed area. Make certain the foliage is dry when fertilizer is broadcast over the tops of ornamentals.
- If fertilizer becomes lodged in the foliage of ornamentals, brush it off before irrigating.
- It is not necessary to remove the mulch when fertilizing. Broadcast fertilizer on top of the mulch and water it in.
- Trees growing in turf areas will obtain nutrients from the fertilizer that is applied to the turfgrass. Do not apply excess fertilizer to turf in an effort to feed trees; injury to the turf may occur.
- When fertilizing trees, broadcast the fertilizer over an area extending two to three times the canopy spread if possible. Research has shown that tree roots grow far beyond the canopy spread on established trees.
- Do not concentrate fertilizer in holes drilled under tree canopy. Research shows that broadcast application results in better growth.
- An effective technique for fertilizing annual flowers is to place a slow-release fertilizer such as Osmocote in the planting hole directly beneath the plant. This not only provides an even supply of nutrients to the plants, it also decrease the number of weeds when compared to broadcast application.
- Plants growing in shade generally require less fertilizer than those growing in the sun.
- Plants growing in sandy soils generally require more frequent fertilization than those in clay soils due to nutrients leaching from sandy soils.
- Avoid using weed-and-feed lawn fertilizers containing herbicides near ornamental plants.

Watering

Most ornamental plants in the landscape, once they are established, can go days or even weeks without supplemental irrigation. In fact, overwatering (water too frequently) is a leading cause of problems with ornamentals. Junipers, for example, are extremely drought-tolerant once they are established, but they cannot tolerate extended periods of excess moisture.

Your best guide for determining when to water is the plant itself. Wilting or a pale grayish-green color are the most common symptoms in plants needing water. Certain plants in the landscape – annuals, herbaceous perennials, azaleas and rhododendrons – need more water than others. By watering only plants that need water, you not only will save water, time and money, you also avoid watering plants that do not need a lot of moisture.

To avoid run-off and water loss, apply water slowly to the base of the plant using a hand-held hose, drip or trickle irrigation, micro-sprinklers, or an ooze hose. Do-it-yourself irrigation systems, available from most garden centers, use 30 to 50 percent less water than sprinklers, and they can be attached directly to outdoor faucets.

Figure 3. Drip irrigation saves water in the landscape and is ideal for ornamental plants. Do-it-yourself systems are available at most garden centers and are easy to install.

Figure 4. To install landscape fabric, roll it out over the top of newly planted shrubs, cut an X in it the size of the plant canopy, and push it down over the plant. Avoid gaps in the fabric by overlapping the strips of fabric 1 to 2 inches.

The amount of water needed by an ornamental plant depends on the type of plant, the soil type, the amount of existing moisture in the soil, and the time of year. As a general rule, 6 gallons of water per 10 square feet of bed area or canopy area will saturate most soils to a depth of about 12 inches (the area containing 80 percent of the roots of most ornamental plants). Because water moves readily within the plant, you do not need to water the entire root zone. Twenty-five percent of the root area can absorb enough water for the entire plant.

The best time to water is at night or in the early morning. As much as 30 percent of the water applied during midday can be lost to evaporation accelerated by the sun.

Hydrogels (water-absorbing polymers), sold in garden centers under several different trade names, are popular products on the market. They absorb several hundred times their weight in water and release it slowly, as needed, to the plant. Research at The University of Georgia shows hydrogels may provide a significant growth benefit to summer annuals in non-irrigated soil.

Mulching

Mulches are a vital part of the southern landscape. They hold moisture in the soil, help prevent weed growth, inhibit certain soil-borne foliar diseases, and insulate the roots of plants from temperature extremes during summer and winter. Mulch also provides a buffer zone between the turf and woody ornamental plants and helps prevent trunk injury from weed trimmers and lawn mowers.

The best mulch is organic, fine-textured and non-matting. Examples include pine needles (commonly called *pine straw* in the south), pine bark mini-nuggets, hardwood chips and cypress shavings. Fall leaves are an excellent and economical mulch and add valuable humus back to the soil as they decompose. Pecan hulls, a by-product of the pecan industry, are used successfully as mulch in south Georgia. Grass clippings are not a good source of mulch because they tend to mat down and inhibit the flow of water and nutrients into the soil. They also my introduce weeds into ornamental plantings. Inorganic mulches such as rock, gravel and marble are good soil insulators, but they absorb and re-radiate heat in the landscape, increasing water loss from plants. Limit their use to shady areas of the landscape.

Apply mulches 3 to 5 inches deep in an area extending beyond the canopy of the plant if possible. A small ring of mulch around the trunk provides little benefit to the plant.

Organic mulches such as pine straw or pine bark break down and decompose over time and should be replenished at least once a year.

Avoid placing plastic film under mulches; it prevents water, nutrients and oxygen from reaching the roots of the plant. Geo-textile (landscape fabric) can be used instead of plastic film under mulch. It allows water, nutrients and oxygen to reach the roots of plants and prevents the growth of some weeds. For best results, install landscape fabrics on weed-free ground and avoid getting soil on top of the fabric.

Pruning

Ornamental plants in landscapes are pruned for many reasons. We usually prune plants to achieve or maintain a certain size or form. At other times, we prune to remove old, diseased or damaged wood in an effort to promote vigorous new growth, flowering or fruiting.

Two basic pruning techniques are used to prune ornamental plants – **heading** and **thinning.** Heading (also called *heading back*) refers to the non-selective removal of branches; thinning is the selective removal of branches back to a side branch or main trunk. Shearing is a form of heading.

Table 4. Suggested pruning time for common flowering trees, shrubs and vines.

Prune after flowering:			
Azalea	Deutzia	Japanese Pieris	Star Magnolia
Beautybush	Dogwood	Lilac	Shrub Honeysuckle
Bigleaf Hydrangea	Doublefile Vibernum	Mockorange	Thunberg Spirea
Bradford Pear	Flowering Almond	Oakleaf Hydrangea	Weigela
Bridalwreath Spirea	Flowering Cherry	Pearlbush	Winter Daphne
Clematis	Flowering Quince	Pyracantha	Wisteria
Climbing Roses	Forsythia	Redbud	Witchhazel
Crabapple	Japanese Kerria	Saucer Magnolia	
Prune before spring growth begins:			
Beautyberry	Floribunda Roses	Japanese Barberry	Rose-of-Sharon (Althea)
Camellia	Fragrant Tea Olive	Japanese Spirea	Sourwood
Chaste Tree (Vitex)	Grandiflora Roses	Mimosa	Anthony Waterer Spirea
Cranberrybush Viburnum	Glossy Abelia	Nandina	Sweetshrub
Crepe myrtle	Goldenrain Tree		

Thinning is best for most ornamental plants because it opens up the plant canopy, increases air circulation within the plant, and results in a natural growth form. Shearing is frequently done on small-leaf evergreens such as boxwood and Japanese holly. Shearing is an efficient pruning technique, but it causes a thick outer canopy and loss of natural form.

If low-maintenance is your goal, keep shearing to a minimum in the landscape. Once you start shearing plants, you will have to shear them more frequently to keep them looking good. Selective thinning of branches once or twice a season is much less labor-intensive than monthly shearing.

Two ornamental plants in the landscape that are commonly sheared are liriope and ornamental grasses such as pampas grass. Shearing in late winter removes old growth and makes way for new shoots. An efficient way to prune liriope is with the lawn mower set at the highest possible setting.

Prune flowering ornamental plants at the proper time of year; otherwise flower buds might be removed. As a general rule, prune spring-flowering trees and shrubs soon after they bloom. Summer-flowering trees and shrubs bloom on new wood and are best pruned four to six weeks before spring growth begins. Table 4 provides suggested pruning times for several common flowering trees, shrubs and vines.

Some shade and flowering trees tend to bleed or excrete large amounts of sap from pruning wounds made in the early spring. Among these trees are maple, birch, dogwood, beech, elm, willow, flowering plum and flowering cherry. Sap excreted from the tree is not harmful, but it is unsightly. To minimize bleeding, prune these trees after the leaves have matured.

Avoid pruning during the fall or early winter because it may encourage tender new growth that is not sufficiently hardened to resist the winter cold.

Most broadleaf shrubs – including azaleas, camellias, ligustrum, glossy abelia, nandina, cleyera and crepe myrtle – will tolerate severe pruning when they overgrow their site or need

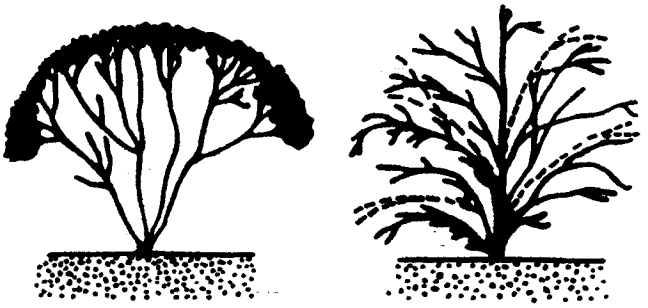


Figure 5. Thinning (right) results in an open canopy, improved air circulation and natural shape; shearing (left) encourages a dense outer canopy and unnatural form.

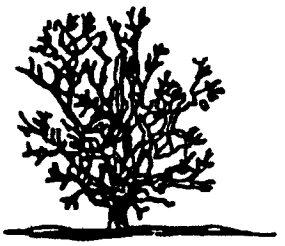
Improper method of pruning crepe myrtle

1. Cutting on line shown by dashed line is too often done when pruning shrubs.

2. Same plant after being pruned as indicated above. All sucker growth remains.

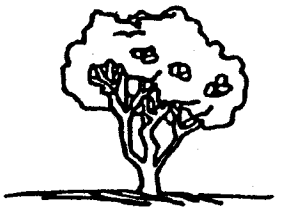
3. Final result: beautiful natural shape of shrub is lost and bloom is sparse and ineffectual.

Proper method of pruning crepe myrtle



1. Shrub before pruning. Remove all weak and dead branches.

2. Same shrub after removal of weak and interfering branches and with base sucker growth removed.



3. Final result: beautiful natural and distinctive form of plant retained. Vigorous growth and prolific and effective blooming.

The general pruning procedure illustrated above for pruning crepe myrtle also applies to many other large shrubs or small trees of similar structure.

rejuvenating. This involves cutting back the plant to within 12 inches of ground level. Boxwoods, junipers, pines, cypress, cedar, arborvitae, yews and other narrow-leaf evergreens do not respond favorably when severely pruned and may decline.

The best time to prune severely is when spring growth begins – mid-March in north Georgia and mid-February in south Georgia. Avoid pruning severely from late fall to mid-winter since it increases the chances of cold injury to the plant.

The following pruning guidelines are for selected ornamental plants in the landscape. For more detailed information on pruning, refer to the Georgia Extension Service publication *Pruning Ornamental Trees and Shrubs in the Landscape* available from your county extension office.

ARBORVITAE: The exterior foliage on this evergreen can be pruned lightly when it needs shaping. Avoid making major cuts.

AZALEA: Prune by thinning after bloom if necessary. Don't prune at all if the plant looks good. Old overgrown plants can be renewed by being cut back close to ground level in February.

BEAUTYBERRY: Thin out growth before spring growth occurs. Flowers and fruits appear on new growth.

BIRCH: Make major cuts when dormant. Light pruning in full leaf will minimize sap flow (bleeding) from wound.

BOXWOOD: Prune by thinning or shearing almost any time of the year. Avoid heavy pruning because the plant is slow to recover and may decline.

CAMELLIA: Thin out branches after bloom if necessary. Camellias generally require little pruning.

CHERRY (Ornamental): Make major cuts in late winter. Use light pruning after bloom to remove suckers or to shape.

CLEMATIS: Some of these plants bloom on old wood and some on new wood, depending on the species. It's best to wait until after bloom to prune this plant. Thin out the old wood. Some vigorous varieties can be pruned within 12 inches of ground level.

CLEYERA: Prune by thinning during the growing season to maintain a natural shape.

COTONEASTER: Make thinning cuts to remove old wood and to shape in late winter or early spring.

CRABAPPLE (Flowering): Prune when fully dormant to remove suckers and to produce a desirable shape. Young suckers can be easily removed by hand during the growing season.

CREPE MYRTLE: This plant flowers on new growth, so prune it when it is dormant. Make thinning and heading cuts to produce a desired form. For shrub forms, prune all branches close to ground level. For tree forms, save one to three of the most vigorous branches for the main trunk(s) and prune off low-growing branches to develop a tree-like growth habit.

DEUTZIA: Make thinning cuts after flowering if shaping is necessary.

DOGWOOD: This tree sets blossom buds in late summer. Make major cuts when dormant even though you may sacrifice some blossoms. Otherwise, prune it after flowering.

ELAEAGNUS: A very vigorous summer grower, it may grow a foot or more a week during the growing season. Thin out long shoots as necessary. Don't try to maintain a formal shape.

EUONYMUS: The growth habit of this plant ranges from upright shrubs to ground covers. Prune by thinning as necessary any time during the growing season.

FRINGETREE: Prune by thinning in late winter to achieve desired shape. Birds enjoy the late summer fruit, so avoid pruning after flowering.

GOLDENRAIN TREE: Prune to tree form in late winter.

HEMLOCK: This plant normally needs no pruning. Light shearing of the outer canopy may be necessary to correct its form. Avoid major cuts.

HOLLY: There are many different growth habits and forms. Most are evergreen, but some species are deciduous. If plants are prized for berries, prune them in late winter, before spring flowering. If berries are not a concern, thinning (or shearing of small-leaf types) can be done any time during the growing season.

HONEYLOCUST: Maintain desired shape by thinning in late winter.

HYDRANGEA (Bigleaf, French, Oakleaf): Flower buds form on old wood. Prune after flowering.

HYDRANGEA (Panicle, Smooth): Blooms form on new wood. Prune when dormant, and remove spent blossoms after flowering.

JASMINE (Winter): Thin out after flowering to maintain desired shape.

JUNIPER: Maintain shape or eliminate undergrowth of groundcover types by thinning during the growing season. Avoid heavy pruning to old wood because new growth will not occur.

LAUREL (English): Prune by thinning as needed during the growing season.

LIRIOPE: Remove old foliage four to six weeks before the spring growing season. On level ground, a lawn mower set to make the highest cut is an efficient way of pruning this plant.

MAGNOLIA (Japanese): Prune to desired shape after flowering.

MAGNOLIA (Southern): Generally requires little pruning. Shape by thinning during the growing season, preferably after bloom.

MAPLE: Prune in late winter if major cuts are necessary. Light pruning in mid-summer can also be done. Avoid early spring pruning because unsightly sap will flow from the pruning wounds.

MOCKORANGE: Prune after flowering by thinning out old wood. The plant may be cut back to ground level if desired.

MOUNTAIN LAUREL: Prune lightly by thinning to desired shape after flowering.

NANDINA: As plants age, thin out old canes by cutting them back to ground level. Selectively cut back one-third of the remaining canes by half their length to encourage a full-dense canopy. Do this pruning in late winter or after fruiting.

OAK: Prune to desired shape when dormant.

OLEANDER: Flowers appear on new growth, so prune just prior to spring growth. Thin out old wood and head back top for desired shape and height.

OSMANTHUS: Shape by thinning during the growing season. The plant responds well to heavy pruning.

PEAR (Ornamental): Make major cuts in late winter (when dormant), even though some blossoms may be sacrificed. Lightly prune after flowering if necessary.

PHOTINIA (RED-TIP): Prune any time during the growing season. Early spring and late summer pruning result in new growth that turns brilliant red.

PINE (Also spruce, fir): Prune to desired shape by removing all or part of the new growth (called candles) in spring. Avoid pruning into old wood.

PITTOSPORUM: Prune to desired shape any time during the growing season.

PYRACANTHA: Prune after fruit set to remove non-fruiting wood.

QUINCE (Flowering): Prune after flowering. Thin out old branches and head back others to desired form and size.

REDBUD: Make major cuts in late winter. Light pruning can be done after flowering.

RHODODENDRON: Prune, if necessary, to achieve desired shape and to increase branching after bloom.

ROSE (Hybrid tea, grandiflora, floribunda): Prune in early spring when new growth begins.

ROSE (Climbing): After flowering, thin out old canes and head back remaining shoots by about one-third, depending on their vigor.

ROSE-OF-SHARON: This plant flowers on new growth, so prune it in late winter.

SPIREA: Prune by thinning after bloom. Most species respond well to severe pruning.

TRUMPETCREEPER: Flowers on new growth, so prune it during the dormant season. This plant will tolerate severe pruning.

VIBURNUM: Prune after flowering or fruit set to thin out oldest non-fruiting wood and to improve shape.

WAXMYRTLE: Prune to desired shape during the growing season.

WISTERIA: Prune after flowering. This is a very vigorous vine and it can be heavily pruned.

WITCHHAZEL: Prune by thinning after flowering.

Weed Control

Weeds in the landscape can be controlled mechanically (by hand, with mulch and landscape fabric) or chemically (with herbicides).

For chemical control, preemergence and post-emergence herbicides are available. Preemergence herbicides control weeds in the early stages of weed seed germination, and post-emergence herbicides are used to kill established weeds. Examples of preemergence herbicides are Dacthal, Surflan and Treflan. Commonly used post-emergence herbicides include Roundup (also called Kleenup or Blot-Out) and Vantage (formerly Poast). For specific detailed information on weed control, consult the Georgia Extension Service publication *Weed Control in Landscape Plantings* available at your county extension office.

Pest Management

Landscape plants are attacked by a diverse and complex group of insects and diseases. Management of these pests can be achieved by following these guidelines:

- Many insect and disease problems can be prevented by using plant materials that are seldom attacked or are less prone to pest problems. When buying new plant materials, consider the history of potential insect and disease problems for the plant before your purchase. Your county extension office can help you with your selection.
- The best defense for pest problems is a healthy,

actively growing, well-maintained plant. Follow proper management programs to maintain plant health.

- Monitor plants for pest problems on a regular basis, particularly during the growing season. Early detection of a pest problem will provide adequate time for control measures to be taken before the plant is extensively damaged.
- The correct diagnosis of a plant pest problem is the cornerstone of a successful control program and often requires careful study of the plant and surrounding environment. Diagnosis can often be based on symptoms expressed by the infested plant or by pests seen on the plant.

Diagnosis of some insect and mite problems often requires close examination of the plant. Chlorotic spots on leaves, a rust coloration of the upper leaf surface, or the silvering of the upper leaf surface may indicate the presence of mites, lace bugs or thrips. Curling or distortion of new plant growth, stunting of the plant, the presence of a sticky substance on the upper leaf surface, or a black sooty mold growing on the upper leaf surface indicate the presence of aphids, scale insects or whiteflies. These pests are small and difficult to detect when present in small numbers, so if a plant starts to show any of these symtoms, examine it closely for the presence of these pests.

Another sign of insect problems is the removal of plant tissues. Beetles, caterpillars, bagworms and grasshoppers damage landscape plants by removing the feeding on leaves. When holes are observed in leaves or portions of leaves, or when entire leaves are consumed, examine plants for the presence of one of these pests.

Insects such as borers, twig girders and leaf miners damage plants through their tunneling activities. Holes in the bark of trees, tunnels underneath the bark, tunneling activity in leaf tissue, dead terminal growth on a plant, or girdled twigs indicate an infestation of one of these pests.

The presence of strange plant growths, webbing or silk on plants can also indicate an insect or mite problem. Tent caterpillars and webworms construct silken webs or tents on their host plants. When spider mite populations become large, they cover their host plant with silken webbing. Gall insects often cause their host plants to produce abnormal growths on leaves, stems and twigs.

The presence of insects on ornamental plants does not always mean that control measures need to be taken. Non-pest insects may rest or hide on plants without posing a threat to plants. Light infestations of pest species can be controlled by beneficial insects or environmental factors and no additional control measure are needed. Healthy, actively growing plants can withstand some insect damage with no adverse long-term effects.

Once a pest problem has been properly diagnosed, a control program can be determined. If a chemical treatment is to be used as part of the control strategy, its effectiveness depends on strict adherence to the following: 1) apply the product when the pest is in a susceptible stage, 2) select a pesticide that is labeled for control of the insect application on the host plant, 3) closely follow label directions concerning dilution rates, 4) apply the product as specified on the label, and 5) apply the product to ensure good coverage of the host plant or target pest.

For more information on insect and mite identification and control recommendations, consult Georgia Extension Service publication *Control of Common Pests of Landscape Plants,* available at your county extension office.

Be a Detective When Solving Plant Problems

Plants in the landscape cannot talk, but they will let you know when they are sick by the symptoms they express. Wilted or discolored leaves, dying branches and premature leaf drop are just a few of the symptoms of plant stress.

Often plant problems occur when a plant is not able to adapt to the site in which it is planted. For instance, junipers are extremely drought-tolerant once established, but they cannot tolerate poorly drained soils. Shade-loving plants like azalea, rhododendron and hosta often have problems when planted in areas that receive hot, mid-afternoon sun. Forcing plants to grow in harsh or unsuitable sites weakens them and encourages secondary insect and disease infestations.

At other times, plant problems result from poor cultural or management practices. We can literally kill plants with kindness by applying excess quantities of fertilizer or water. Planting too deeply is a common cultural mistake. When plants are set too deeply in the soil, the lower portion of the root

system becomes deprived of oxygen and dies. When attempting to diagnose and remedy a plant problem, be a detective and gather all the clues before attempting a cure. Ask yourself these questions:

- What has the recent weather pattern been? Has there been heavy rain or drought?
- Are other plants in the vicinity showing the same problem, or is this just an isolated case?
- What are the soil drainage patterns? Does the soil stay wet for a long period after rain or irrigation?
- What is the light level in the area and is the plant well-suited to the amount of light it receives?
- Has there been a chemical or fertilizer spilled in the vicinity of the plant?
- Have there been any chemicals sprayed on the plant recently?

If you cannot diagnose the problem, seek help from your county extension agent or nurseryman. A sample of a live plant showing the symptoms and a soil sample (of at least 1 pint) taken from around the plant will help these professionals provide an accurate diagnosis of the plant problem. Taking the time to properly diagnose a plant problem before trying a cure will save you time, effort and money.

Attention! Pesticide Precautions!

1. Observe all directions, restrictions and precautions on pesticide labels. It is dangerous, wasteful and illegal to do otherwise.
2. Store all pesticides in original containers with labels intact and behind locked doors. KEEP PESTICIDES OUT OF THE REACH OF CHILDREN.
3. Use pesticides at correct label dosages and intervals to avoid illegal residues or injury to plants and animals.
4. Apply pesticides carefully to avoid drift or contamination of non-target areas.
5. Surplus pesticides and containers should be disposed of in accordance with label instructions so contamination of water and other hazards will not result.
6. Follow directions on the pesticide label regarding restrictions as required by state and federal laws and regulations.
7. Avoid any action that may threaten an endangered species or its habitat. Your county extension agent can inform you of endangered species in your area, help you identify them and, through the Fish and Wildlife Service Field Office, identify actions that may threaten endangered species or their habitats.

When you have a question ...

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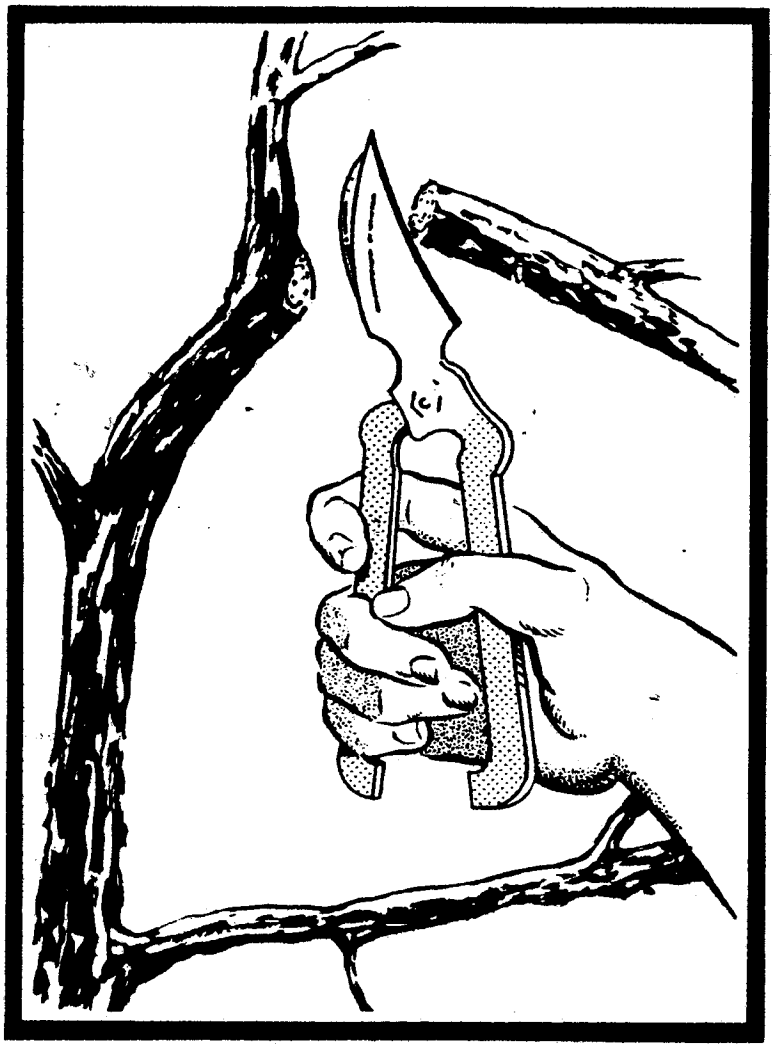
Gale A. Buchanan, Dean and Director



Basic Principles of Pruning Woody Plants

The University of Georgia College of Agricultural & Environmental Sciences

Cooperative Extension Service

Basic Principles of Pruning Woody Plants

G.L. Wade and Robert R. Westerfield, Extension Horticulturists

Pruning is one of the most important cultural practices for maintaining woody plants, including ornamental trees and shrubs, fruits and nuts. It involves both art and science: art in making the pruning cuts properly, and science in knowing how and when to prune for maximum benefits.

There are numerous reasons for pruning. Sometimes you want to train or direct the growth of plants into a particular form or a specified space, like a formal hedge. Or you may want to prune mature plants to control their size and shape, as in the case of fruit trees that are pruned low to the ground to aid picking or hedge plants pruned at a particular height. For fruiting plants, pruning plays an important role in improving overall fruit quality, primarily by increasing light penetration into the tree.

Unfortunately, many people approach pruning with a great deal of apprehension. Others view pruning as a chore and give little forethought to technique as they hastily do the job. Proper pruning requires a basic understanding of how plants respond to various pruning cuts. The principles and guidelines in this publication will help you master common pruning techniques.

Shoot Growth and Apical Dominance

You can partly determine the characteristic shape and size of a woody plant and its response to pruning by the plant's natural pattern of shoot growth. When a seed germinates and grows, only one growing point exists, the apex or *terminal bud* (Fig. 1). When a terminal bud begins growing after being dormant, it leaves a bud scale scar on the branch. You can use the scars to determine the age of a limb or tree by counting the scars. As the new shoot elongates, structures called *nodes* are formed. A *node* is the area on the shoot where a leaf is attached (Fig. 1a). One to three *lateral buds* are produced at each of these nodes. Growth of lateral buds is directed by the terminal bud, which produces a hormone called *auxin*. Auxin moves downward in the shoot (toward the Earth's center) from the shoot apex and inhibits the growth and development of lateral buds (Fig. 2). This phenomenon is called *apical dominance.*

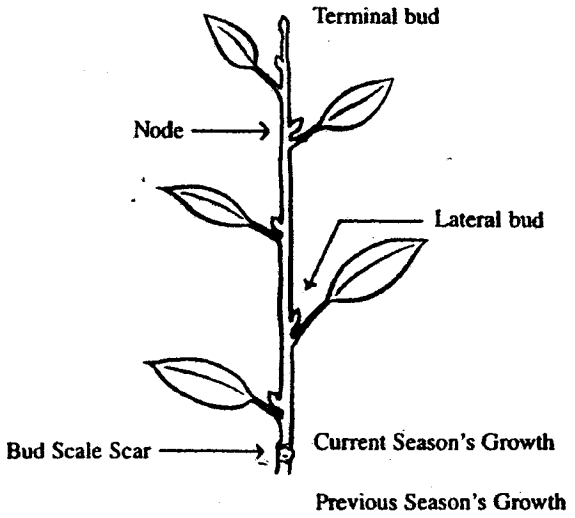


Figure 1. Current season's growth.

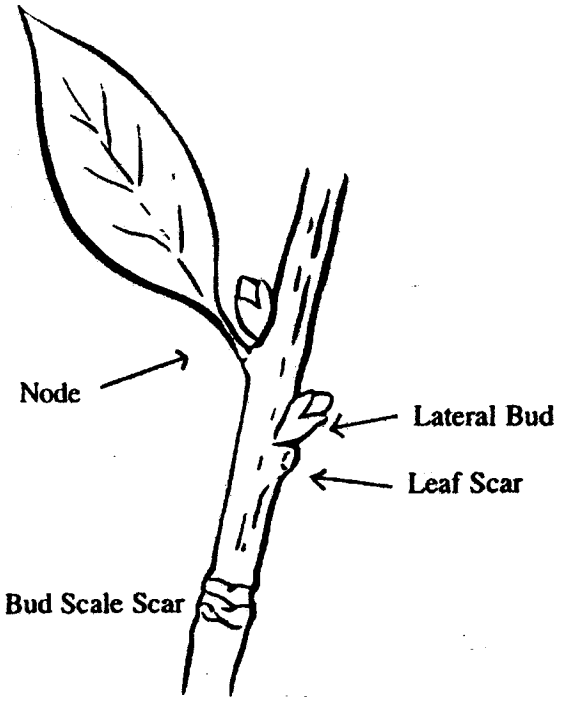


Figure 1a. Close-up of a node.

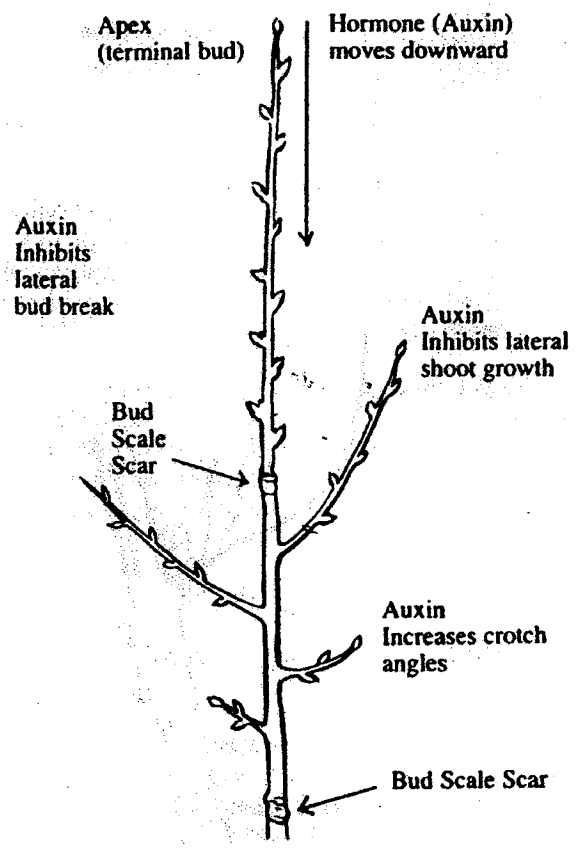


Figure 2. Apical dominance and its effects.

The intensity of apical dominance varies from one plant species to another. Some plants suppress the growth of their lateral buds until the second growing season; others develop both lateral shoots and terminal buds during the first growing season. Apical dominance influences not only the number of shoot-forming lateral buds and the lengths of lateral shoots formed but also the angle at which the shoots emerge from the main limb.

The orientation of a limb or shoot along the main branch has a major influence on growth by its effect on apical dominance (Fig. 3). Because auxin moves downward in the shoot toward the Earth"s center, apical dominance is strongest in vertical or upright shoots or limbs. In vertical limbs, vigorous shoot growth occurs near the terminal bud with lateral shoots becoming more sparse with increasing distance from the apex. On the other hand, orientation of lateral branches at 45°to 60°angles from the vertical or main shoot reduces the vigor of shoot growth near the apex and increases the number and length of laterals along the limb further from the apex. On horizontal limbs, apical dominance is totally lost. Without apical dominance to control their growth, lateral buds on the upper side of horizontal limbs develop into vigorous, upright shoots, called *water sprouts*. As they develop, water sprouts show very strong apical dominance. Water sprouts are a common problem on the upper surface of flat limbs in fruit trees and are removed by pruning.

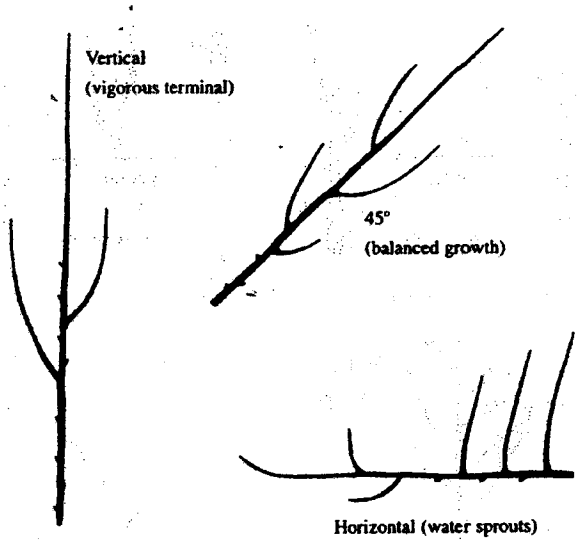


Figure 3. Limb orientation affects apical dominance.

General Responses to Pruning

Pruning is an invigorating process (Fig. 4). By removing the apex, pruning temporarily destroys apical dominance and stimulates the growth of lateral buds into shoots.

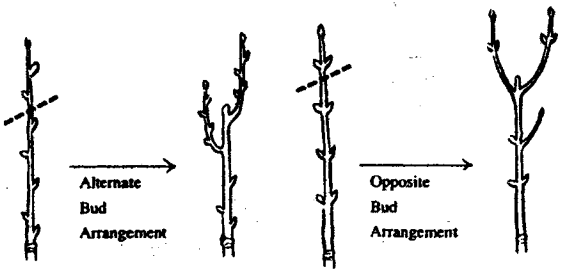


Figure 4. Pruning stimulates lateral shoot growth close to the cut.

Pruning also reduces the size of the above-ground portion of the plant in relation to the root system (Fig. 5). As a result, the undisturbed root system services a smaller number of shoots and buds. The relative uptake of water and nutrients by the remaining shoots and buds increases, and a flush of growth (regrowth) occurs.

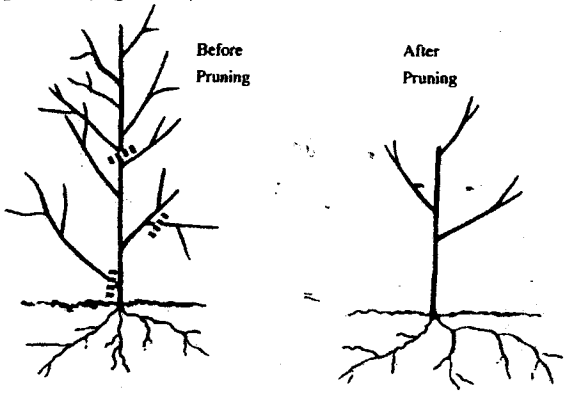


Figure 5. Pruning reduces the top in relation to the root system.

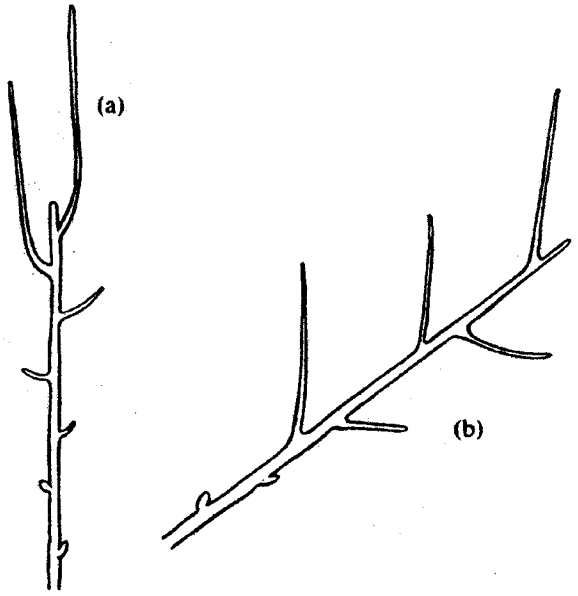


Figure 6. Pruning stimulates growth closest to the cut in vertical shoots; farther away from cuts in limbs 45 to 60 from vertical.

Generally, the more severe the pruning (greater size or number of limbs removed), the greater the resulting regrowth. In essence, the plant is regrowing in an attempt to restore a balance between the top and the root system.

Pruning generally stimulates regrowth near the cut (Fig. 6). Vigorous shoot growth will usually occur within 6 to 8 inches of the pruning cut. This is particularly true for vertical limbs that have been pruned (Fig. 6a). However, regrowth on limbs having a 45 to 60 angle from the vertical will develop farther away from the cut (Fig. 6b).

Pruning also may indirectly stimulate growth of lateral shoots by allowing more light to penetrate the canopy of the plant.

Pruning a young plant will stimulate vigorous shoot growth and will delay the development of flowers and fruit. The length of the delay, of course, will depend on the species pruned and the severity of the pruning.

Types of Pruning Cuts

There are two basic types of pruning cuts, *heading* and *thinning* (Fig. 7). Each results in a different growth response and has specific uses.

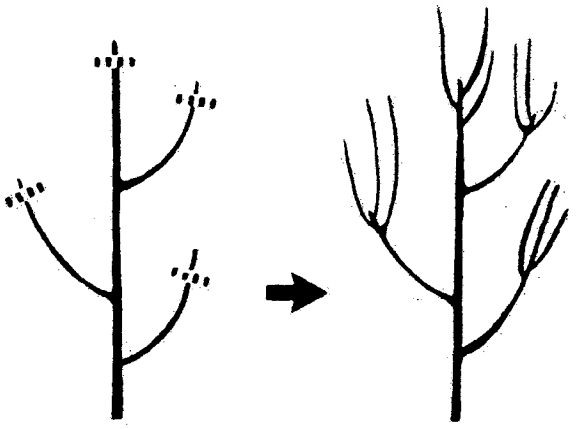


Figure 7. Heading removes a part of a shoot or limb.

Heading removes the terminal portion of shoots or limbs (Fig. 7). By removing apical dominance, heading stimulates regrowth near the cut. It also is the most invigorating type of pruning cut, resulting in thick compact growth and a loss of natural form, as in the case of a formally pruned hedge. Sometimes ornamental shrubs along a foundation

overgrow their planting space and are rejuvenated by heading to within 12 inches of ground level. Many broadleaf shrubs such as burford holly, ligustrum, abelia and crape myrtle tolerate this type of pruning. Other types of heading are topping, dehorning, hedging and clipping.

Thinning, on the other hand, removes an entire shoot or limb to its point of origin from the main branch or lateral (Fig. 7a). Some shoot tips are left undistributed, so apical dominance is maintained. As a result, new growth occurs at the undisturbed shoot tips while lateral bud development and regrowth is suppressed.

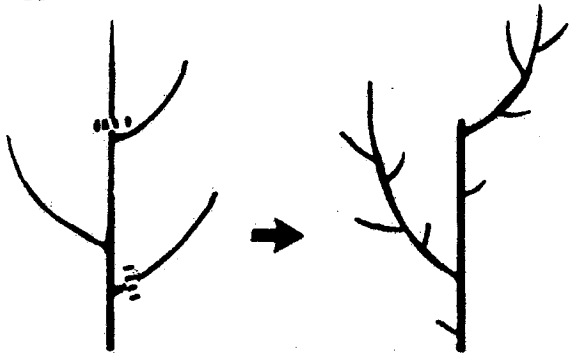


Figure 7a. Thinning removes the entire shoot or limb.

Thinning is generally the least invigorating type of pruning cut and provides a more natural growth form of plants. Important in maintenance pruning, thinning cuts are used to shorten limbs, to improve light penetration into plants and to direct the growth of shoots or limbs.

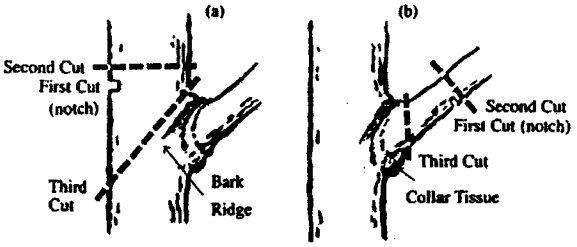


Figure 8. Types of thinning cuts: (a) drop crotching and (b) limb removal.

Drop-crotching, a form of thinning used to reduce the size of large trees, involves the removal of a main branch by cutting it back to a large, lateral branch (Fig. 8a). The cut through the main branch is made parallel to the angle of the remaining lateral. When removing large tree limbs, a series of three cuts are recommended in order to avoid tearing the bark along the main truck and severely wounding the tree (Fig. 8b). One undesirable form of thinning is the *bench cut*, where a vigorous upright limb is thinned to horizontal limb (Fig. 9).

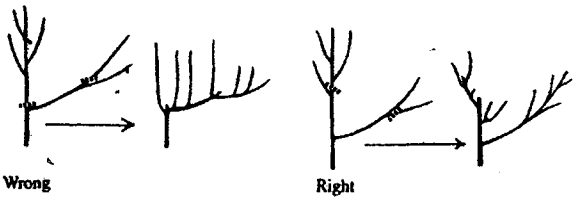


Figure 9. Compare branch cut (left) with correct method (right).

Vigorous, upright shoot growth, called water sprouts, often result from the "bench" area because of the absence of apical dominance in the horizontal limb. Such regrowth is weak and often results in an undesirable umbrella-shaped plant. The correct method is to make the thinning cuts to limbs that are similar in angle to the limb being removed but not greater than 45°to 60°from vertical.

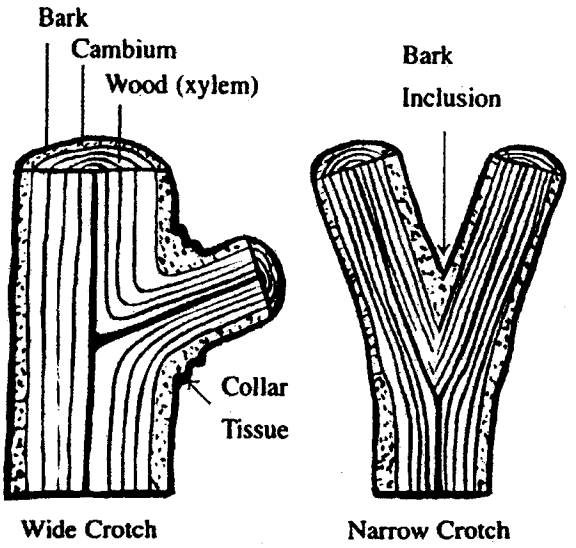


Figure 10. Wide crotches (left) are stronger than weak, narrow crotches (right).

Shoots or limbs having narrow-angled crotches are weaker than those having wide crotch angles (Fig. 10). The bark of the adjoining branches becomes tightly compressed or "included," preventing normal wood development. Winter ice, trapped down in crotches, often causes narrow-angled branches to split.

Healing Response to Pruning

Healing naturally follows pruning or wounding. It starts in the cambium, a thin layer of cells between the wood and bark. Two areas of the cambium, the *bark ridge* at the junction of two limbs, and the *branch collar*, a ring of slightly raised tissue where the lateral branch joins the main limb, function to close off the wound between the plant and the pruning cut. For fastest healing, prune close to the main branch without injuring the bark ridge or branch collar areas (Fig. 11). Leaving a stub will slow healing and invite decay. Wound dressings or pruning paint are cosmetic and do little to promote healing of the pruned area.

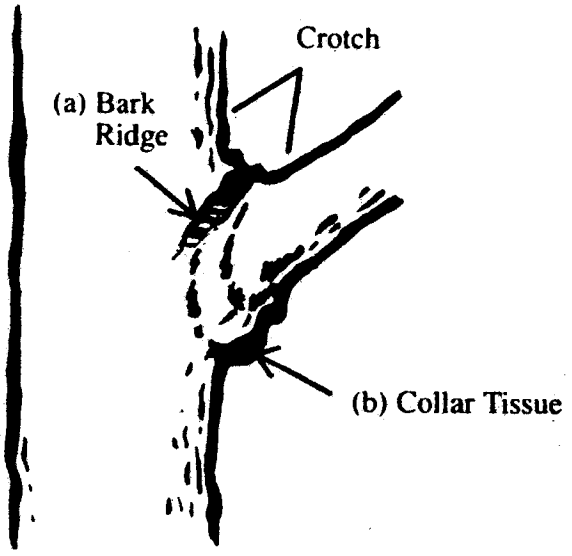


Figure 11. Areas of cambium important for healing: (a) bark ridge and (b) collar tissue.

Time for Pruning

Time of pruning varies with plant species. Prune at times that best complement the growth characteristics, flowering, and other objectives you desire.

Many woody ornamentals are pruned according to their date of flowering (Table 1). For example, spring-flowering plants, such as dogwood or forsythia, normally are pruned after they bloom. Pruning spring-flowering shrubs during the dormant season will remove flower buds formed the previous fall. Summer-flowering plants generally are pruned during the dormant winter season. If plants are not grown for their flowers, the best time for pruning is during the dormant winter season before new growth begins in the spring. Avoid heavy pruning during the late summer and fall because regrowth may occur and make the plants more susceptible to cold injury. Peach trees, for example, should not be pruned from October through January.

Table 1. Time of pruning based on time of flowering.

Prune After Flowering	
Azalea	Japanese Pieris
Beautybush	Lilac
Bigleaf Hydrangea	Mockorange
Bradford Pear	Oakleaf Hydrangea
Bridalwreath Spirea	Pearlbush
Clematis	Pyracantha
Climbing Roses	Redbud
Crabapple	Saucer Magnolia
Deutzia	Star Magnolia
Dogwood	Shrub Honeysuckle
Doublefile Viburnum	Thunberg Spirea
Flowering Almond	Vanhoutte Spirea
Flowering Cherry	Weigelia
Flowering Quince	Winter Daphne
Forsythia	Wisteria
Japanese Kerria	Witchhazel
Prune Before Spring Growth Begins	
Beautyberry	Goldenrain Tree
Camellia	Japanese Barberry
Chaste Tree (Vitex)	Japanese Spirea
Cranberrybush Viburnum	Mimosa
Crapemyrtle	Nandina
Floribunda Roses	Rose-of-Sharon (Althea)
Fragrant Tea Olive	Sourwood
Grandiflora Roses	Anthony Waterer Spirea
Gloss Abelia	Sweetshrub

Some plants bleed heavily after pruning. Bleeding is unsightly but not usually harmful. Trees subject to bleeding should be pruned in the late spring or early

summer when leaves are on the tree. Actively growing leaves tend to reduce the amount of bleeding from pruning cuts and allow the cuts to heal more quickly. Plants that bleed readily include willows, birches, maples, beeches and dogwoods.

Summary

Pruning is an invaluable tool for developing and maintaining woody plants. Developing clear pruning objectives is important. By combining these objectives with a basic understanding of pruning and how plants respond, you can derive maximum benefit from the effort.

Several key points concerning the use of pruning in woody plants are summarized below.

- Pruning is an invigorating process, stimulating regrowth in proportion to pruning severity. Light annual pruning is better than periodical severe pruning.
- The two basic types of pruning cuts are *heading* and *thinning*. Thinning cuts are the least invigorating type of cut and are the most effective pruning cut for maintaining woody plants in their natural form.
- Pruning, particularly heading cuts, stimulates regrowth very close to the pruning cut. Heading cuts, such as topping, dehorning and hedging, often are misused and destroy the natural shape of plants because they stimulate regrowth near pruning cuts.
- Bench cuts, pruning upright limbs back to flat limbs, result in vigorous regrowth and weak limbs. Instead, thin out limbs leaving those oriented at a 45°to 60°angle from vertical.
- Pruning time should be dictated by specific requirements or characteristics of the plant such as flowering date, susceptibility to cold weather, etc.
- Wounds heal fastest when pruning does not disturb important areas of cambium such as the bark ridge and branch collar. Wound dressing is cosmetic and does not promote healing.
- All too often, improper pruning techniques seriously damage or kill woody plants. If you wish to have woody plants properly maintained, personally supervise or conduct the pruning operation.

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Gale A. Buchanan, Dean and Director

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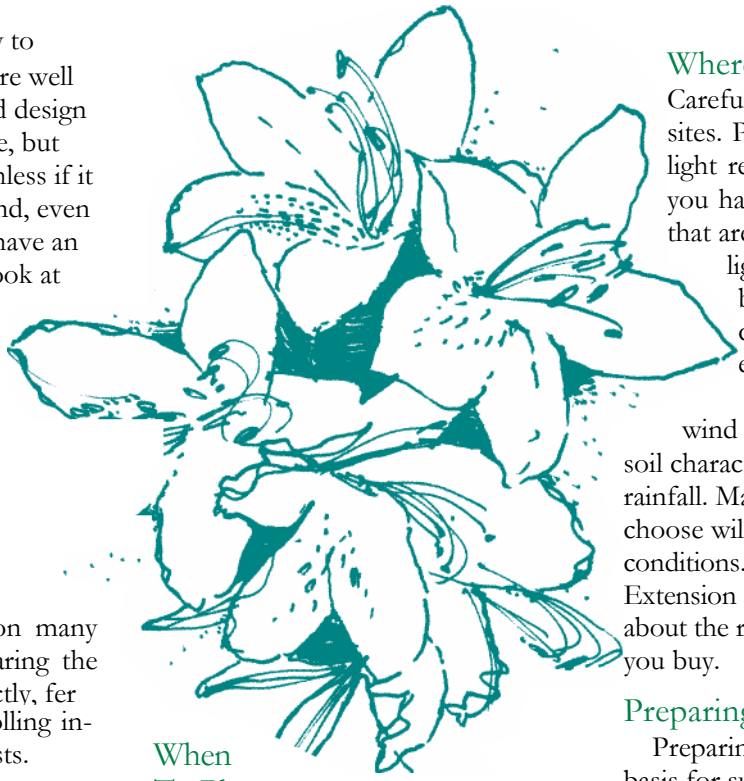
ALABAMA A&M AND AUBURN UNIVERSITIES

Care and Maintenance *of* Landscape Plants

Shrubs and trees add beauty to grounds and homes if they are well placed and cared for. A good design is important in any landscape, but even the best design is worthless if it isn't properly maintained. And, even some landscapes that don't have an especially good design can look attractive if they are given a little extra care. The environmental conditions in Alabama make it possible to grow healthy ornamental plants throughout the state. The many beautiful gardens and yards over the state prove this fact. Success in growing landscape plants depends on many things. These include preparing the soil properly, planting correctly, fertilizing, pruning, and controlling insects, diseases, and other pests.



How To Plant Trees And Shrubs

Successful landscaping involves learning how to properly plant your shrubbery and trees. Taking just a little extra time to study planting procedures may save a considerable amount of time and money later on. In order to have a healthy landscape and reduce maintenance, you must have a good design, proper site, proper planting, and good follow-up care. Here are some important methods for you to learn and remember.

When To Plant

Even though most landscape plants can be planted any month during the year, the ideal planting season begins in October and continues until new growth appears in the spring. Early fall planting is most desirable. Roots grow during fall and winter months, enabling them to become established before warm weather and spring growth. Plant deciduous trees and shrubs (those that lose their leaves in the fall) after they become dormant (November to January).

Shrubs and trees grown in containers may be planted throughout the spring and summer if plants are watered properly. With extra care, balled and burlapped plants can be planted in spring and summer, but the risk of the plants dying increases.

Where To Plant

Carefully consider your planting sites. Pick a place that meets the light requirements for the plants you have chosen or select plants that are adapted to the level of light received in the area to be planted. Remember to consider other environmental factors such as typical wind velocity, temperatures, soil characteristics, and amount of rainfall. Make sure the plants you choose will adapt to each of these conditions. Ask your county Extension agent or nursery manager about the requirements of the plants you buy.

Preparing The Soil

Preparing the soil properly is the basis for successful gardening. Beginners do not always realize how important this step is, and the ornamentals they plant often grow poorly as a result. The only way to know what nutrients your soil needs for growing ornamentals and whether the soil pH needs correcting is to test the soil. Get information and supplies for soil testing at your county Extension office.

For best results, spend the little extra money needed to buy some good organic matter, or better yet, begin collecting and preparing your own composted organic matter. Organic matter helps the root growth of your ornamentals in several ways. It loosens tight clay soils and causes loose sandy soils to hold more water for a longer period of time.

There are several good organic materials. Peat moss is ideal for most ornamentals. Ground pine bark is also

very good. Leaf mold from the woods and compost are satisfactory as well.

Sawdust is used by a number of Alabama nurseries. However, sawdust can rob the soil of its nitrogen supply. If this happens, plant leaves will turn light yellow. This discoloration can be corrected by light application of nitrogen during the growing season in addition to regular fertilization.

Peanut hulls can be bought in some areas of the state, and they may be used. However, they should be composted or treated to reduce the possibility of adding nematodes to your soil. Check with your county Extension office to find out how to treat peanut hulls.

Generally, peat moss is best to use, followed by pine bark, leaf mold, sawdust, and peanut hulls.

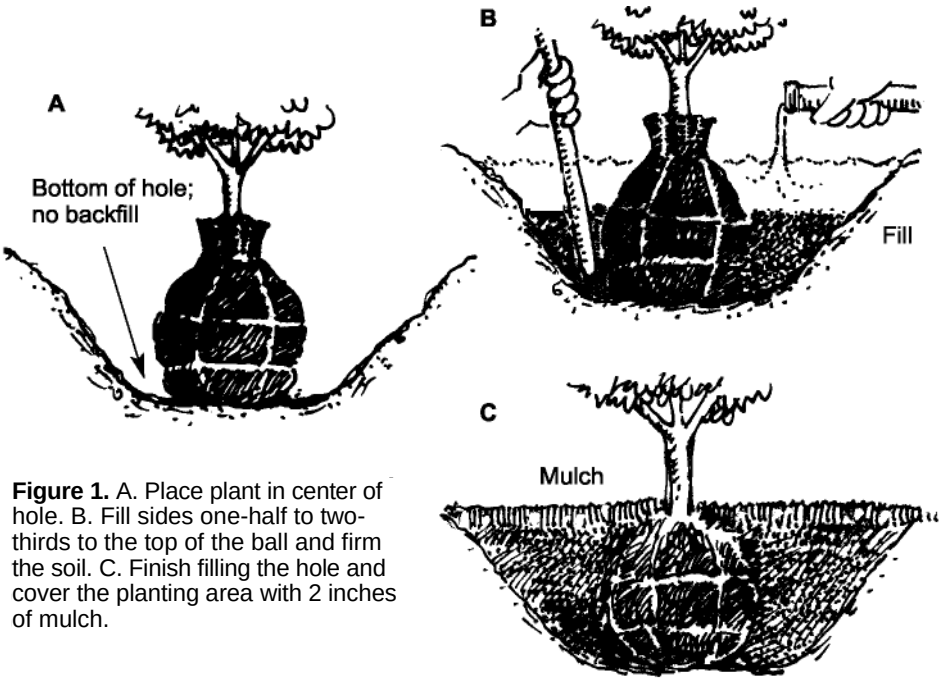


Figure 1. A. Place plant in center of hole. B. Fill sides one-half to two-thirds to the top of the ball and firm the soil. C. Finish filling the hole and cover the planting area with 2 inches of mulch.

Planting

If you are planting a bed of ornamentals, put 2 to 3 inches of organic matter on the soil surface. Then work it in to a depth of 8 to 10 inches.

If planting a single plant, dig the hole twice the width of the root ball. Make the hole no deeper than the height of the rootball; in fact, in most soils the hole should be shallower than the height of the rootball (Figure 1A). The sides of the hole should slant slightly outward from bottom to top. For root balls greater than 2 feet in diameter, dig holes 2 feet wider than the diameter of the ball.

For individual plantings, soil amendment is not needed. After planting, the top of the ball should be 1 to 2 inches higher than ground level or even with the ground level in sandy soils.

Place the plant in the center of the hole and, using the native soil, refill around the sides one-half to two-thirds to the top of the ball. With the shovel handle, tamp the soil downward and under the ball. Lightly firm the remaining soil toward the ball with your foot. Fill the hole with water and allow it to settle. This removes air pockets (Figure 1B).

With the remaining mixture, finish refilling the hole but do not firm the soil. Apply 2 to 3 inches of mulch around the base of the plant (Figure 1C).

Balled and Burlapped Plants. It is not necessary to remove the burlap from balled and burlapped plants if real, untreated burlap is used. It will decompose in a short time. However, make several slits through the burlap on the sides of the ball after the plant has been set in the planting hole so that the roots may penetrate more quickly (Figure 2A) or fold the burlap away from the ball into the bottom of the hole. Other plastic or synthetic materials do not decompose and should be dropped to the bottom of the hole. Cut strings that are wrapped around the base of the plant. Fold the top of the burlap back into the hole before adding backfill soil.

Follow these good planting steps for balled and burlapped plants.

1. Handle plant ball carefully; do not lift it by the stem.
2. Dig a hole deep and wide enough for the ball and stem (no deeper than the ball).
3. Leave burlap on the root ball or remove other material; cut rope or string at the stem.
4. Fill the hole and firm the soil gradually with your hand or foot.
6. Water thoroughly.
7. Cover area with 3 inches of mulch.

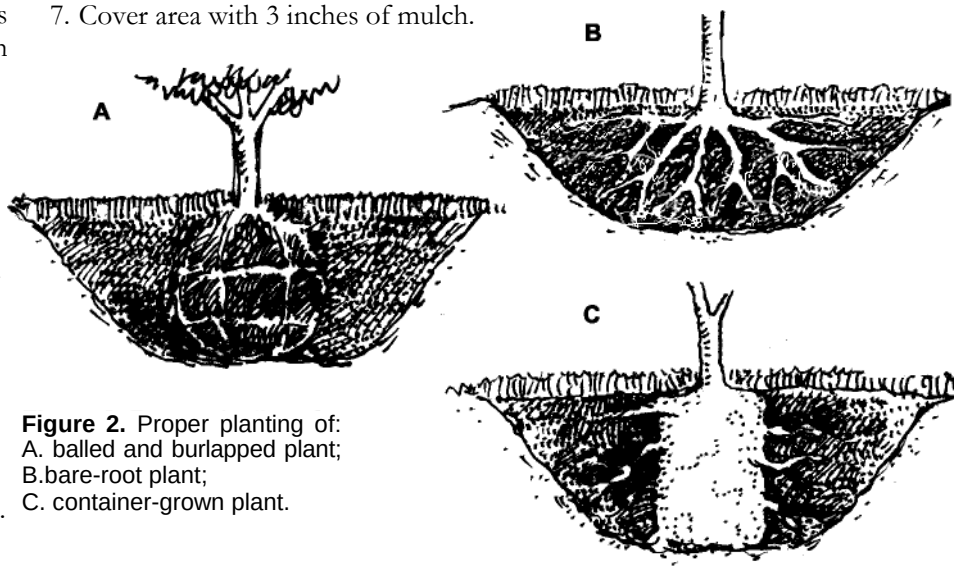


Figure 2. Proper planting of: A. balled and burlapped plant; B.bare-root plant; C. container-grown plant.

Bare-Root Plants. Bare-root plants must have their roots spread out to full length to take the greatest advantage of moisture and fertilizer (Figure 2B). Transplant bare-root plants only from October through January.

Follow these good planting steps for bare-root plants.

1. Store bare-root plant in shade and keep moist until planting.
2. Remove plant from package.
3. Soak roots in water.
4. Dig a hole deep and wide enough to spread roots their full length.
5. Spread roots at 6-inch depth.
6. Fill the hole and firm the soil gradually.
7. Water thoroughly.
8. Cover area with 2 to 3 inches of mulch.

Container-Grown Plants. Container-grown plants need to be planted much like balled and burlapped plants. However, always remove the container. Container-grown plants suffer less shock when planted than other transplants do, but they are sometimes pot-bound, which means they have a mass of roots growing around the outside of the ball of soil. If you notice this when you take the plant out of the container, massage the rootball to rough up the roots and pull bottom roots to loosen the rootball slightly. This helps the roots to spread out and grow away from the original ball of soil (Figure 2C).

Follow these good planting steps for container-grown plants.

1. Handle plant by container.
2. Dig a hole twice the width of the root ball.
3. Remove the container carefully.
4. Massage the root ball to loosen mass slightly.
5. Fill the hole and firm the soil gradually with your hand or foot.
6. Water thoroughly; make sure surrounding soil is wet.
7. Cover the area with 2 to 3 inches of mulch.
8. Water every 2 to 3 days for the first 3 to 4 weeks; then be sure plants are watered about once a week.

Frequently, azaleas, boxwoods, and camellias are set too deep for proper growth—or even for survival. When these plants are "buried" in soil, they grow poorly and eventually die.

Drainage

One of the greatest drawbacks to successful gardening is poorly drained ground. Wherever water lies in the ground at a depth easily reached by the roots, cultivated plants will not survive.

Once a bed settles it needs to have good surface drainage (no standing water). Many times poor drainage can be corrected by anticipating the problem and raising the bed 2 or 3 inches to allow run-off.

Sometimes the drainage problem will be more serious, and internal drainage must be improved. Clay soil or soil overlying a hard subsoil is susceptible to water-logging. Also, low-lying land that is barely above the high watermark of a river or lake in the vicinity is subject to water-logging. If this is the case, raised beds or berms may be needed (Figure 3). In some situations, a drainage system may need to be installed.

Care for your plants promptly. Plant them at once, or keep them shaded and watered until planting.

How To Care For Landscape Plants

After your shrubs or trees are planted, there are several important things to remember. Young transplanted ornamentals need special attention the first year in their new location. Some trees may need to be staked, and all plants should be properly watered and mulched.

Staking Trees

Trees planted in open areas subject to strong winds should be staked or guyed.

Stake all trees that have a diameter of 2¹Ú₂ inches or less with 2- 2-inch stakes. They should be long enough for you to drive them 2 feet into the ground and still reach mid-height of the tree. Soft twine, water hose, strips of webbing, or soft rope may be used to tie the tree to the stakes. If you use wire, pad it at the point of contact with the tree. Do not leave wire on the tree more than 1 year or long enough to cause girdling.

Guy all trees over 2¹Ú₂ inches in diameter with three or four guys equally spaced around the tree. Use two

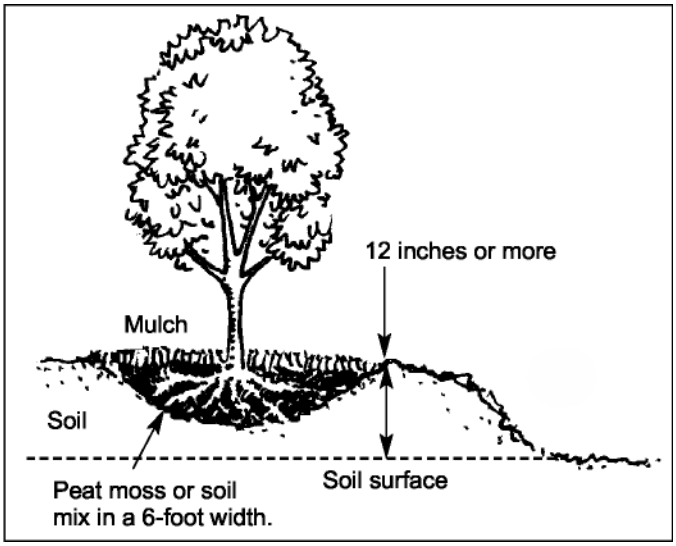


Figure 3. Example of one type of raised bed.

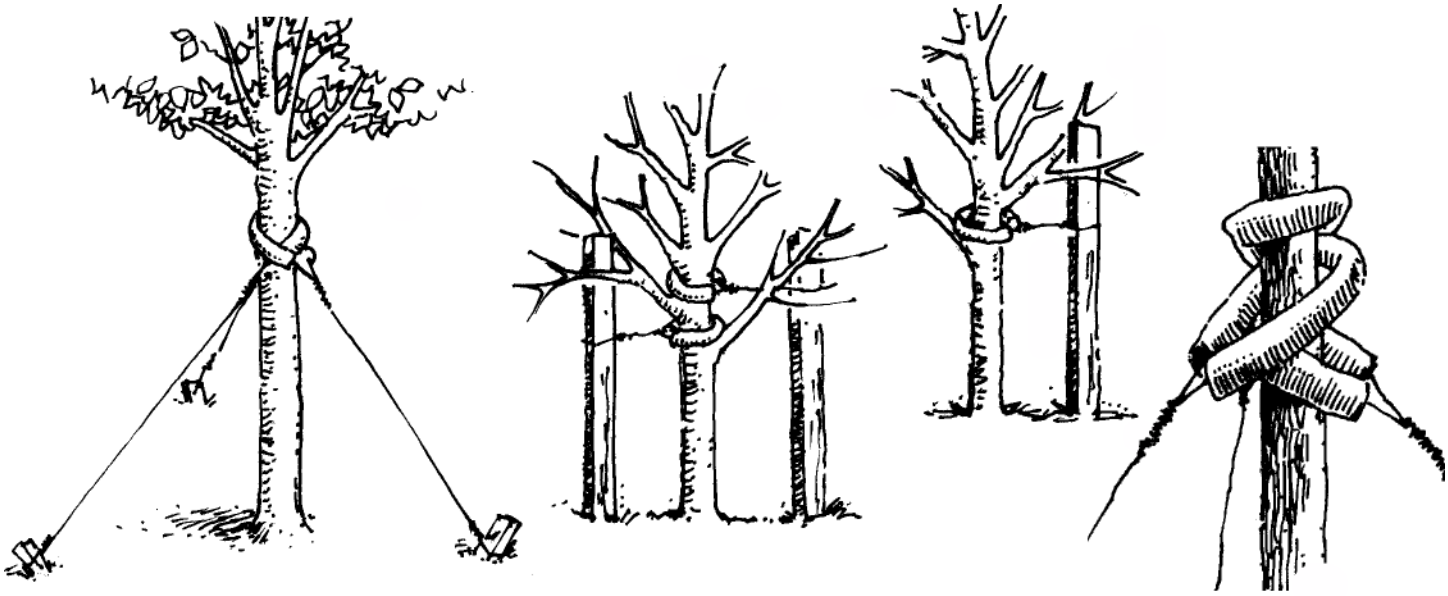


Figure 4. Ways to stake and guy newly planted trees.

strands of No. 12 wire. Cover the wire with rubber hose or heavy cloth padding at points of contact. Run wires from the trunk about 8 feet above the ground at an angle of about 45° to stakes driven in the ground (Figure 4). Trees should be staked so as to allow some movement of the trunk. Trunk movement allows the tree to increase in taper and develop a strong trunk.

Watering

Soil characteristics and condition of the plants are the main guides to watering. Under most weather conditions, one good watering, saturating the soil to a depth of 8 to 10 inches every 5 to 7 days, is enough. After the first year, most landscape plants will naturally obtain water from the soil and not need your watering. However, there are cases where extra water is needed as in periods of drought or when fast growth is desired.

When watering, keep these points in mind.

1. Apply water slowly so it can soak into the soil. A 50-foot hose and sprinkler will generally take about 2¹Ú₂ hours to apply the amount of water needed for a 1,000-square foot area.

2. Wet soil thoroughly to a depth of 8 to 10 inches. Light watering encourages shallow root development. Then, if the shallow watering is neglected a day or so in a sudden period of hot weather, plants may be damaged.

3. Avoid too much water; it leaches plant nutrients from the soil and may drown the plant's root system.

4. Avoid setting plants so close to a wall that the gutter or overhanging roof blocks natural rainfall.

Mulching

Mulching offers several advantages over clean cultivation (no mulch). The greatest is conservation of soil moisture. Evaporation of water from the soil is greatly reduced when the soil is protected from direct rays of the sun and moving air. Also, rain falling on the mulch does not pack the soil surface. With less crusty soil, water that is applied penetrates the soil more easily, thus erosion is eliminated.

A second important advantage of mulch is the control of weeds. Using mulch greatly reduces the need for weeding. If you also use a herbicide that kills weeds before germination, the benefit in weed control will be even greater.

Controlling soil temperatures is another advantage. High summer temperatures may injure beneficial microorganisms as well as the roots near the surface of the soil. Maintaining lower and more uniform soil temperatures in summer will promote bacterial activity in the soil. In winter, frost penetration is less likely to occur where mulching is practiced. Evergreens must absorb moisture in the winter as well as summer. Therefore, winter mulch may prevent the soil water from freezing and becoming unavailable to plants.

Organic matter used as mulch can improve soil structure and tilth. As it decays the material works down into the topsoil. Decaying mulch also adds nutrients to the soil. Mulch is much better for the health of a plant than being surrounded by grass, which competes for nutrients and water. Grass roots are highly competitve and can stunt the root growth of desirable landscape plants.

It is especially important to mulch rather than cultivate shallow-rooted plants such as rhododendrons, azaleas, and camellias to prevent damage to roots.

Mulching material, such as pine bark or pine needles, improves the appearance of the landscape. It is

valuable for covering beds near the house or in areas where neatness is important.

These advantages of mulching far outweigh the disadvantages, but there are a few. First, the cost and unavailability of some materials can be a drawback to large-scale mulching.

When using sawdust as a mulch, nitrogen starvation sometimes occurs. However, this is easily corrected by using additional nitrogen when needed.

Heavy mulching over a period of years may result in a buildup of soil over the crown area of plants. This condition is especially harmful to camellias. After the first 3 years, it may be advisable to rake off the old mulch before applying a new layer to prevent the roots from becoming too deeply buried.

Fertilizing

Ornamental plants require nutrients for healthy growth. Soils that are not well fertilized often provide insufficient plant nutrients.

Different soils contain varying amounts of nutrients. Therefore, one soil or area may require larger amounts of fertilizer than another to grow plants well. The major nutrient needs for landscape plants in Alabama are nitrogen, phosphorus, and potassium. Fertilizers are available to supply these needs. For example, 100 pounds of 12-4-6 fertilizer contain 12 pounds of nitrogen, 4 pounds of phosphorous, and 6 pounds of potassium.

Refer to your soil test report to determine the amounts of lime and fertilizer to add to your soil. Keep in mind that a soil test is needed every 2 to 3 years. These reports will allow you to keep your soil at the proper fertility level. For example, the phosphorus level can build up to an excessive amount if a complete fertilizer (such as 8-8-8) is applied every year.

If this is the case, a fertilizer with little or no phosphorus (such as 15-0-15) will be recommended. Soil fertility levels cannot be determined by looking at the plant.

Chlorosis of plants is a condition that sometimes can be corrected by adjusting fertilizer rates (Figure 5). The leaf areas between the veins become a light green or yellow while the veins remain a darker green. In extreme cases, the entire leaf may become yellow. This chlorotic condition occurs when the chlorophyll (responsible for photosynthesis and green color) in the plant fails to develop normally.

Figure 5. Photo of a plant with iron chlorosis.

Chlorosis can also be caused by poor drainage, high soil pH, or too much phosphorus. If soil tests indicate high phosphate levels, use a fertilizer containing a low level of phosphorus. High phosphorus levels often cause iron in the soil to be less available to plants. In such cases, you can apply iron to the plant leaves as a spray or to the root system as a soil drench. You may have to adjust the pH to correct this problem. The soil test will indicate what steps you need to take.

Pruning

Pruning is cutting out unwanted growth to make a plant develop or respond in a desired manner (Figure 6). You prune plants to produce more or better blooms and fruit, to develop or maintain a desired shape or size, to remove older stems and encourage vigorous young ones to take their place, to remove diseased or seriously injured parts, or to remove dead wood or wood that is winter-killed.

Shrubs often cannot go without pruning if they are to serve their intended purpose in the landscape. Except for a few dwarf or extremely slow-growing plants, prune all shrubs regularly or as needed—usually every year or two in areas where neatness is important. For all practical purposes, shrubs and smal trees can be pruned at one of two periods, during dormancy (before growth begins in spring) or immediately after flowering.

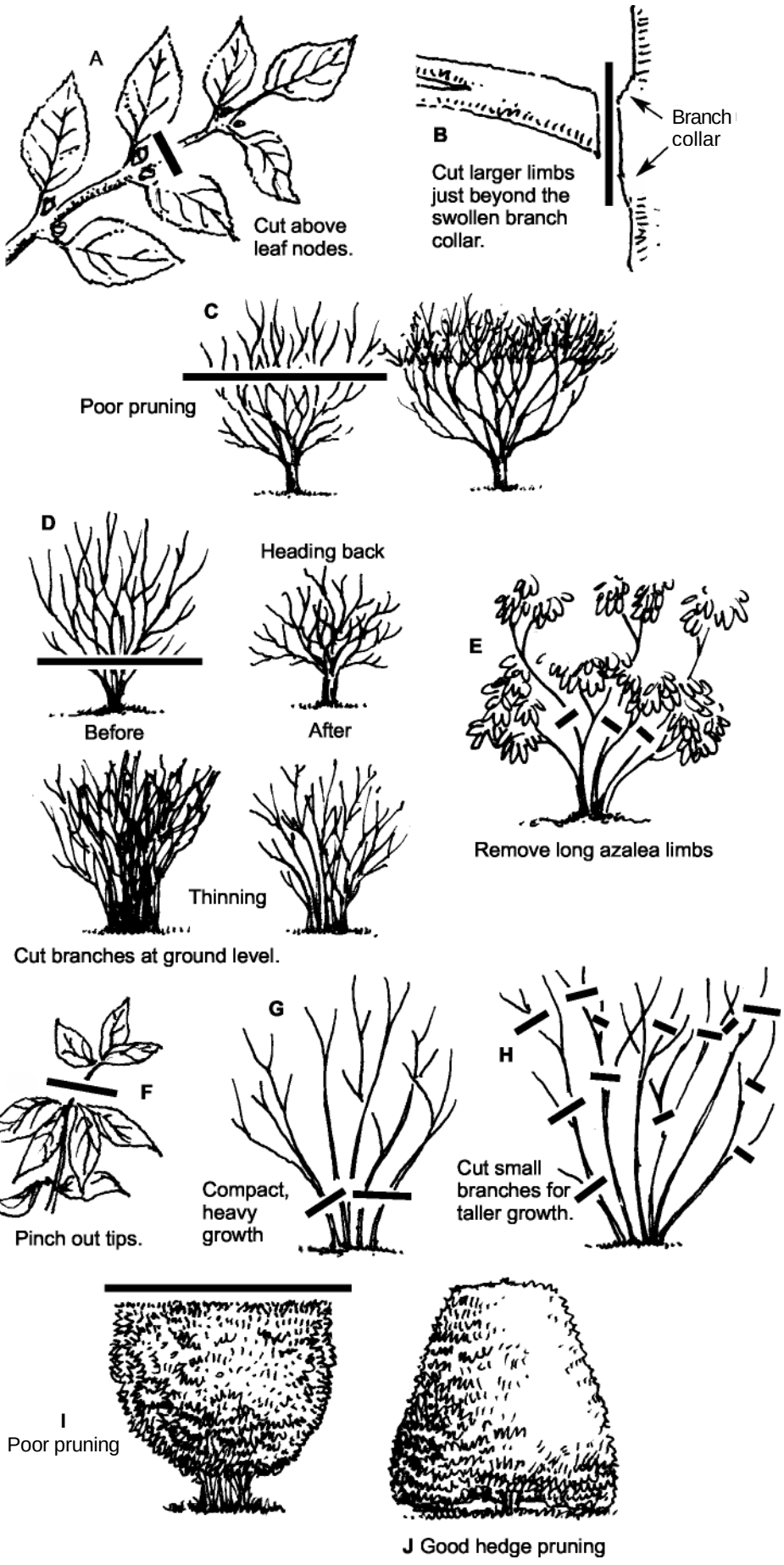


Figure 6. Pruning.

A. Cut small branches just above leaf nodes.

B. Cut limbs over 1 inch in diameter just beyond the swollen branch collar of a larger limb or trunk.

C. Results of poor pruning methods.

D. Examples of proper pruning methods (Heading vs thinning cuts.)

E. Remove long limbs back inside the plant.

F. Pinch out tips of new growth to induce branching.

G. Prune multistem plants back 6" to12" off ground level for compact, heavy growth.

H. To produce taller plants, cut out only small branches.

I. Pruning hedges straight across top will produce unnatural shape. Prune entire plant to produce rounded effect.

J. Hedges should be pruned so that the base of the plant is wider than the top.

Spring Flowering Shrubs. Since blooms on these plants are formed on the previous year's growth, they should be pruned in the spring after flowering. Generally, pruned plants will have more or larger flowers than nonpruned ones. The following spring flowering shrubs should be pruned in a selective manner to maintain size and promote growth:

Azalea
Barberry
Blueberry
Crab Apple
Dogwood
Forsythia
Winter Honeysuckle
Star Magnolia
Nandina
Flowering Quince
Spirea
Sweet Shrub
Viburnum

Summer Flowering Shrubs. Blooms on plants in this category are produced on new spring growth. Therefore, pruning should be done during the dormant season, usually in the early spring before growth begins. Shrubs in this group include the following:

Abelia
Crape Myrtle
Elaeagnus
Hibiscus
Bush Honeysuckle
Magnolia *(virginiana)*

Broad-leaved Evergreen Shrubs. These shrubs can be pruned slightly at any time of the year to shape the plant. However, plants that go into the dormant period with their flower buds already formed should be pruned immediately after flowering. Those that produce their flowers on new wood may be pruned anytime during the dormant period. Some of the plants with these general pruning requirements are as follows:

Aucuba
Boxwood
Camellia
Cherry Laurel
Holly (all species)
Cleyera

Coniferous Evergreens. Shrubs in this group should be pruned shortly before or just as growth begins in the spring. The following plants should be pruned in this manner:

Arborvitae
Hemlock
Cedar
Spruce
Yews
Juniper

Tools. You can't prune properly without the right tools. Pruning tools are specialized—adapted to a particular type or work. Select pruning tools made of good steel and always keep them sharp.

One of the first tools you will buy is a hand pruner. Other tools include long-handled pruners (loppers), hedge shears, pole pruners, and pruning saws. Wound dressings or "tree paint" offer no healing powers or identifiable benefit to a tree wound.

Pest Control

Insects and diseases must be controlled to grow trees and shrubs successfully. Some pests attack roots; others feed on leaves and stems or damage flowers. One of the most important steps in the control of insects and diseases is to prevent infestation in the beginning. Buy well-grown plants from a reputable nursery. Inspect plants frequently for signs of diseases and insects.

Most weed control around the home is the hand pulling method. However, the best control is a good mulching program with hand pulling as needed.

If you prefer to use herbicides for weed control, contact your county Extension office to find out what is available. Chemical control of weeds for the homeowner is often quite expensive.

Another concern of using chemicals is that they must be evenly distributed at the recommended rate to prevent injury to your plants. Always follow the label!

Summary

This publication includes information that will make your plants more successful. You can readily see that a great deal of work is not required.

However, it is important to know what to do and when to do it.

For information about insect, disease, and weed control, please refer to the following Extension publications:

ANR-854, "Weed Control in Residential Landscape Plantings."

ANR-392, "Control Of Entomosporium Leaf Spot on Woody Ornamentals."

ANR-407, "Powdery Mildew on Ornamentals."

ANR-416, "Control of Camellia Flower Blight."

ANR-505, "Diseases of Roses And Their Control."

ANR-542, "Fireblight On Fruit Trees and Woody Ornamentals."

ANR-551, "Dogwood Diseases in Alabama."

ANR-571, "Phytophthora Root Rot on Woody Ornamentals."

ANR-753, "Identification and Control of Botrytis Blight on Floral Crops and Woody Ornamentals."

ANR-753a, "Chemical Control Recommendations—Identification and Control of Botrytis Blight on Floral Crops and Woody Ornamentals."

ANR-857, "Lichens on Woody Shrubs and Trees."

ANR-188, "Controlling Flower Thrips on Ornamentals."

ANR-189, "Controlling Aphids on Ornamentals."

ANR-190, "Controlling Mealybugs on Ornamentals."

ANR-191, "Controlling Bagworms on Ornamentals."

ANR-192, "Controlling Spidermites on Ornamentals."

ANR-193, "Controlling Lace Bugs on Ornamentals."

ANR-272, "Controlling Whiteflies on Ornamentals."

ANR-274, "Controlling Scale Insects."

ANR-484, "Controlling Insects and Diseases on Azaleas and Rhododendrons."

ANR-484a, "Chemical Control Recommendations—Controlling Insects and Diseases on Azaleas and Rhododendrons."

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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Home Lawn Maintenance

A properly maintained lawn not only provides aesthetic value and "curb appeal" to your home but also provides many benefits to the environment. A well-maintained lawn will prevent soil erosion, act as a living filter for water and air pollutants, act as an air conditioner during the hot summer, and provide oxygen to the atmosphere.

The quality of a home lawn can vary depending on the level of maintenance that is provided. An average-quality home lawn requires only basic maintenance, such as mowing and fertilizing, and may have several different types of turfgrasses present, as well as some weeds. This level of lawn quality can be obtained with a minimum amount of maintenance, money, time, and effort.

Lawns in the above-average to superior quality range have a dense stand of turfgrass with a minimum number of weeds and other pest problems. However, in order to have a lawn of such quality, additional turfgrass maintenance practices are required, such as watering, thatch control, and pest control. Homeowners can obtain a high-quality lawn with a "do-it-yourself" approach, or they can hire a lawn care service company to maintain their lawn for them.

Whatever level of quality you desire, the objective should be to have a healthy, dense stand of turfgrass. Correctly implementing proper turfgrass maintenance practices can reduce the need for supplementary practices such as pest control. Following the home lawn maintenance tips outlined in this publication should help you achieve the quality you desire.

Basic Maintenance Practices

Mowing and fertilizing are considered basic maintenance practices, and each has a significant impact on the quality of a lawn. These routine maintenance practices are normally done when it is convenient for the homeowner; however, they should be done on a schedule and at the proper time in order for them to be most effective.

Mowing

Mowing is probably the most important maintenance practice for a good-quality lawn but is probably the most overlooked maintenance practice as well. Fertilizer, pesticides, turfgrass seed, and other treatments will accomplish very little if lawns are not mowed at a height that is healthy for the turfgrass plant. This maintenance chore is often taken for granted unless you realize that mowing directly affects the health and quality of a lawn and that it has a measurable effect on the way a turfgrass plant grows. The ability of a grass plant to sustain itself after frequent close mowing is one factor that distinguishes a specific grass species as a turfgrass versus just a grass. Grass plants such as corn or wheat cannot tolerate frequent close mowing.

Mowing is the process that creates a lawn rather than a pasture or a meadow. Proper mowing is important in creating a good-quality lawn because it encourages a dense stand of turfgrass plants, which keeps out weeds through competition for nutrients and sunlight. In addition, frequent mowing provides control of many weeds, especially broadleaf weeds.

Some important factors to consider are mowing height, mowing frequency, and the type of mower used.

Mowing Height

For the best appearance and quality, turfgrasses should be mowed at the optimum mowing height for the proper growth and health of the specific turfgrass species that is present in the lawn. Each turfgrass species has a range of mowing heights that are preferred for its optimum performance. Turfgrass species that spread or grow horizontally, such as bermudagrass, can usually be mowed at a lower mowing height than an upright-growing "bunch-type" turfgrass like tall fescue. Turfgrasses with smaller leaves (fine textured) such as zoysiagrass can usually be mowed lower than turfgrasses with larger leaves (coarse textured) like St. Augustinegrass. Turfgrasses that are under environmental stress such as drought, heat, or shade

should be mowed at a higher mowing height. Table 1 outlines the suggested mowing heights for the turfgrass species used for home lawns in Alabama.

Table 1. Recommended Mowing Heights for Lawn Turfgrasses

Turfgrass	Optimum Mowing Height (inches)	Mowing Frequency (days)	Mower Type
Bahiagrass	3 to 4	7 to 17	Rotary
Bermudagrass	½ to 1 ½	3 to 5	Rotary or Reel*
Centipedegrass	1 ½ to 2	10 to 14	Rotary
St. Augustinegrass	2 ½ to 2	7 to 14	Rotary
Tall Fescue	2 to 3 ½	7 to 14	Rotary
Zoysiagrass	1 to 2	10 to 14	Rotary or Reel*

* Reel mowers provide a superior-quality cut.

Mowing Frequency

How often should a lawn be mowed? Mowing frequency should depend on the growth rate of the turfgrass plants, but it is often based on a service contract or when a convenient opportunity presents itself. The rate of turfgrass growth depends on the type of turfgrass (turfgrass species) present in the lawn, soil fertility (especially nitrogen), and weather or environmental conditions.

Another factor involved with mowing frequency is mowing height (see Table 1). A good rule of thumb is to mow your lawn regularly and to never remove or mow off more than one-third of the turfgrass height at any one mowing. For example, if you are maintaining your lawn at a mowing height of 2 inches, you should mow the lawn when or before the turfgrass reaches 3 inches in height. Also, by following this "one-third" rule of thumb, you will have fewer and smaller turfgrass clippings to deal with. If the turfgrass becomes too tall between mowings, raise the mowing height and then gradually reduce it until the recommended height is reached.

Type of Mower

Another important factor in mowing is the type of mower used. Most homeowners mow their lawns with a rotary-type mower. Rotary mowers are the most popular because of their low cost, easy maneuverability, and simple maintenance. Most rotary mowers cannot give a quality cut at a mowing height less than 1 inch; however, they are versatile and can be used on taller turfgrasses and weeds, for mulching turfgrass clippings, and for general trimming.

Reel mowers are for highly maintained turfgrass where appearance and quality are most important. Reel mowers cut with a scissorslike action to produce a very clean, even cut. They are used on turfgrasses where mowing heights of 1 inch or less are desired. Reel mowers require a smooth surface to obtain a quality cut. Using reel mowers on uneven surfaces will result in "scalped" areas.

Maintaining a sharp cutting blade is as important with rotary mowers as it is with reel mowers. A dull mower blade will damage the leaf blades of the turfgrass, causing them to turn brown at the point of impact and giving the lawn a general brown cast or appearance. Sharp mower blades cut the turfgrass leaves cleanly, ensuring rapid healing and regrowth.

For many years, there has been a lot of discussion about what to do with turfgrass clippings. The classic response was that turfgrass clippings must be removed from the lawn because they can cause thatch buildup. Recent research has shown that this is wrong. In fact, turfgrass clippings contain approximately 58 percent of the nitrogen that we apply to our lawns, so removing the clippings is equivalent to "sweeping up" almost one-half of the nitrogen fertilizer you have applied. In addition to containing about 4 percent nitrogen, turfgrass clippings contain ¹Ú₂ to 1 percent phosphorus, 2 to 3 percent potassium, and smaller amounts of other essential plant nutrients. Therefore, turfgrass clippings should be returned or recycled to the lawn because these nutrients will eventually return to the soil.

Turfgrass clippings should be removed, however, if they form clumps on the lawn surface after mowing. These clumps of clippings can block necessary sunlight from the turfgrass plants. Clumping occurs with infrequent or inconsistent mowing and when turfgrass plants are mowed when wet.

Fertilizing

Understanding the nutritional requirements of your lawn and the "baseline" soil nutrient levels are important steps toward producing a quality lawn. Fertilization of lawns is essential for the production of a quality turfgrass stand; however, applying more than the recommended amount of fertilizer or applying it at the wrong time can create problems, such as groundwater contamination. A wellplanned and environmentally sound fertilization program takes into account several factors, including the native soil fertility levels, fertility requirements of the specific turfgrass species, desired turfgrass quality, source of nutrients in the fertilizer, fertilizer application rate, fertilizer application frequency, and time of fertilizer application.

All plants require certain nutrients or elements for proper growth and appearance. There are 16 known essential elements that are required by turfgrasses for their growth. All of these essential elements, with the exception of carbon, hydrogen, and oxygen, are obtained from the soil and absorbed by turfgrass plant roots. Insufficient nutrients in the soil may limit turfgrass growth and the quality of the lawn; however, these essential elements can be added to the soil through fertilizer applications. Elements that turfgrasses require in the greatest quantities are nitrogen, phosphorus, and potassium.

Nitrogen is probably the most important element you can apply to a lawn. Nitrogen affects turfgrasses in several ways, including color, density, leaf growth, root growth, tolerance to environmental stresses, susceptibility to pests, and recuperative potential of the turfgrass after it has been damaged. The proper nitrogen fertility program should allow for a slow, steady growth rate of the turfgrass. Applying excessive amounts of nitrogen fertilizer will encourage leaf growth at the expense of root growth and may even cause a reduction in root mass. Fertilizing with high levels of nitrogen will also increase the incidence of diseases and thatch accumulation and reduce cold tolerance, making the lawn more prone to winter damage.

Several factors influence the nitrogen requirement of your lawn, including the turfgrass species that is present in the lawn, the soil type, and the environmental conditions of the area. The timing of lawn fertilization is also important. Fertilizing warm-season turfgrasses too early in the spring can cause a reduction in root mass as the turfgrass plants emerge out of winter dormancy, and fertilizing them too late in the fall may increase the chance of winter injury. Cool-season turfgrasses should be fertilized during the early spring and fall because fertilizing them with nitrogen during the summer increases the chances of disease and/or heat-stress problems.

Phosphorus is also needed for turfgrass growth and is involved in energy transformation within the turfgrass plants. It is generally required in smaller amounts than nitrogen or potassium and plays a critical role in the establishment of turfgrasses. On soils that are low in phosphorus, an application of this element will increase the growth rate during establishment of turfgrasses. However, high levels of phosphorus can cause problems, especially with centipedegrass.

Potassium is almost as important an element as nitrogen to turfgrass growth. Potassium affects how well a turfgrass plant is able to withstand environmental and mechanical stresses. Most turfgrasseswill better tolerate cold, drought, and heat stresses when potassium levels are adequate.

Soil sampling and testing should be performed in order to determine the amounts of phosphorous and potassium in the soil and to determine how much of each needs to be applied to reach the recommended level.

Soil Testing

The best philosophy for a successful turfgrass fertilization program is to have an annual plan. The basis of that plan should be soil sampling and testing to determine the "base" nutrient levels and then testing again every 2 to 3 years to ensure you are maintaining the proper levels.

Proper soil sampling is important to ensure representative soil test results and proper fertilizer and lime recommendations. Soil test results supply a wealth of information concerning the nutritional status of your soil and may aid in the detection of potential problems that could limit turfgrass growth and lawn quality. A typical soil test report will supply information about soil pH, lime requirements, and soil nutrient levels for phosphorus, potassium, calcium, magnesium, manganese, and zinc. Instructions for taking soil samples and having them analyzed can be obtained from your county Extension office.

The nitrogen requirements for a lawn cannot be reliably evaluated by a soil test; therefore, the soil test report will not contain a nitrogen recommendation. The type of turfgrass that is present in the lawn, as well as the desired level of quality, will determine the amount of nitrogen that should be applied to a lawn (see Table 2). If you have any questions regarding the soil test report and/or recommendations, contact your county Extension office.

Fertilizer Analysis

Fertilizers are often recommended or described by their analysis, or three nutrient percentages or numbers, such as 10-10-10 or 16-4-8. These three numbers represent the percentage by weight of nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O). For example, in a bag of 16-4-8 fertilizer, nitrogen makes up 16 percent of the total weight; phosphorus makes up 4 percent, and potassium accounts for 8 percent. The remaining weight of the fertilizer (total must be 100 percent) is comprised of secondary nutrients, such as calcium, iron, magnesium, manganese, copper, sulfur, molybdenum, and zinc, and/or filler materials such as clay or corn cob. A fertilizer that contains all three nutrients (N-P-K) is considered a "complete" fertilizer.

Fertilizer analysis is often referred to in terms of the fertilizer ratio. If the fertilizer analysis is 16-4-8, then the fertilizer ratio is 4:1:2; similarly, a 10-10-10 fertilizer has a 1:1:1 ratio. Mature lawns generally require equivalent levels of nitrogen and potassium, especially if the soil type is of sandy texture. Therefore, fertilizers with ratios of 4:1:4 or 4:1:3 are commonly recommended for mature lawns.

Nitrogen Sources

The source of nitrogen in a fertilizer influences its availability to the turfgrass and also the growth response of the turfgrass. There are two basic categories of nitrogen sources: (1) fast or quick release and (2) slow or controlled release. Fast-release nitrogen sources are water-soluble and can be readily used by the turfgrass plants; however, these can cause foliar burn if not applied properly. These fast-release nitrogen sources are also susceptible to leaching and have a short "feeding," or nitrogen-release, period. Fast-release nitrogen sources include ammonium nitrate, ammonium sulfate, and urea.

Slow- or controlled-release nitrogen sources "feed" or release nitrogen over an extended period of time and therefore are applied at higher application rates on a less frequent basis than fast-release nitrogen sources. When properly applied, these slow-release nitrogen sources reduce the chance of foliar burn to the turfgrass plants. Foliar burning of turfgrass plants occurs due to the fact that the fertilizer acts like a salt and extracts the moisture from the turfgrass plants. To minimize the risk of foliar burn, apply all fertilizers to dry turfgrass plants, and water or irrigate the lawn immediately after fertilizing. Slow-release nitrogen sources are also less susceptible to leaching and are preferred for use on sandy soils. Slow-release nitrogen sources include sulfur-coated urea (SCU); polymer-coated urea (PCU), isobutylidine diurea (IBDU), urea formaldehyde, methylene urea, and natural organics such as manure.

Fertilization Scheduling

The application timing for nitrogen fertilizers is also very important. Because they have different growth cycles, cool- and warm-season turfgrasses need to be fertilized at different times. Nitrogen fertilizers are used to simulate growth; therefore, they should be applied only during periods of optimum growth of the turfgrass. For example, fertilize warm-season turfgrasses during the summer when they are growing most rapidly. In contrast, fertilize cool-season turfgrasses during the early spring or fall. Table 2 shows the recommended fertilization schedule for lawn turfgrasses used in Alabama.

To calculate the amount of a particular fertilizer needed to supply 1 pound of actual nitrogen per 1,000 square feet, you must read and understand the fertilizer analysis. Since nitrogen is the first of the three numbers in a fertilizer analysis, it will be used to make the necessary calculations. To make this calculation, divide the percentage of nitrogen in the fertilizer into 100. This will give the number of pounds of that particular fertilizer that is needed to supply 1 pound of actual nitrogen per 1,000 square feet. For example, if the fertilizer analysis is 16-4-8 (16 percent nitrogen), then 6¼ pounds of 16-4-8 is needed per 1,000 square feet to supply 1 pound of nitrogen (100 divided by 16 = 6.25). For all practical purposes, these numbers can be rounded off for ease of application.

Table 2. Recommended Fertilization Schedule for Lawn Turfgrasses in Alabama

Turfgrass	Desired Quality	Total pounds of nitrogen per 1,000 sq. ft. per year	Pounds of nitrogen per 1,000 sq. ft. per month											
			Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bahiagrass	Low	2				1				1				
	High	4				1	1	1		1				
Common Bermudagrass	Low	2					1		1					
	High	4					1	1	1	1				
Hybrid Bermudagrass	Low	4					1	1	1	1				
	High	6				1	1	1	1	1	1			
Centipedegrass	Low	1						1						
	High	2				1			1					
St. Augustinegrass	Low	2				1			1					
	High	4				1	1		1	1				
Tall Fescue	Low	3	1								1			1
	High	5	1		1	½					½		1	1
Zoysiagrass	Low	2					1		1					
	High	4				1	1		1	1				

It is recommended to apply only half of the total desired fertilizer rate in one direction and then apply the remaining half perpendicular to the direction of the first application. This will provide a more even and uniform application of the fertilizer and reduce the chances of skipping a section.

Warm-season turfgrass lawns that are overseeded with a cool-season turfgrass like perennial ryegrass for winter color can benefit from the application of low amounts of nitrogen fertilizer during the winter months. A maximum of 3 pounds of nitrogen per 1,000 square feet can be applied between the months of October until March for the overseeded cool-season turfgrass. It is recommended to apply between 1Ú4 to 1Ú2 pound of nitrogen per 1,000 square feet per month.

Additional Maintenance Practices

The quality of a lawn can be somewhat limited if only the basic maintenance practices of mowing and fertilizing are implemented. There are some additional turfgrass maintenance practices that are needed to take the quality of a lawn to a higher level. These additional maintenance practices include irrigating, reducing soil compaction, thatch control, topdressing, and pest control.

Irrigating or Watering

Turfgrasses, like all plants, require water for growth and survival. Due to the variable rainfall patterns and rainfall distribution in Alabama, it is not uncommon to experience seasonal droughts during the year. During these drought periods, a homeowner has a couple of options: (1) water the lawn to keep the turfgrass green, or (2) do not water the lawn and allow the turfgrass to turn brown and go into a state of dormancy. If the lawn happens to be a warm-season turfgrass such as bahiagrass, bermudagrass, centipedegrass, St. Augustinegrass, or zoysiagrass, choosing not to water the lawn would not result in the death or loss of the lawn. These turfgrasses will go dormant under such stress, and when more favorable growing conditions occur, they will recover and prevail. However, if the lawn is comprised of a cool-season turfgrass such as tall fescue and the decision is not to water, then the end result may be injury or death of the lawn. If the tall fescue is well established and has a deep root system, it may be able to go dormant during the stress period without serious injury; however, if the turfgrass has a limited root system, the lawn may be severely injured from the stress.

The most efficient way to irrigate or water a lawn is to apply water only when the lawn starts to show signs of drought stress from the lack of moisture. There are several ways to help determine when this time has come.

One of the first signs of drought stress is that the color of the turfgrass turns from green to a bluish-gray to even a white cast. Another indication of drought stress is "footprints" on the turfgrass. If you walk across your lawn late in the afternoon and look where you have just walked and see that your steps have left any footprints, the lawn may need watering. When your feet compress the leaf blades of the turfgrass, the low water levels in the plant tissues prevent the leaf blades from recovering, or "springing" back up, after being pushed down. If the footprints remain for an extended period of time, water the lawn to prevent the turfgrass from turning brown and becoming dormant. The visual condition of the turfgrass leaves can also be used to evaluate drought stress. Turfgrass leaves respond to drought stress by folding, rolling, and/or wilting.

Another means of evaluating drought stress on a lawn is the "screwdriver" test. To do this test, push a screwdriver down through the lawn and into the soil. If the soil is very dry, it will be difficult to push the screwdriver down into the ground. Use this screwdriver test to confirm the results of the other visual indicators above to help determine when a lawn should be watered.

If your lawn exhibits the visual symptoms of drought stress, apply about 1Ú2 to 1 inch of water, which will moisten the soil to a depth of 4 to 6 inches, depending on the soil type and degree of soil compaction. Then, after watering, use the screwdriver test to determine the depth of water penetration. This will prove valuable in the future in determining how much water should be applied.

When watering, avoid applying water to the point of runoff. Allow the water to soak into the lawn and soil. If needed, apply less water and allow it to soak in before continuing with the watering process. Once you have watered the lawn, do not water again until you observe similar drought stress symptoms. Never water a lawn every day except during the establishment phase or renovation. Frequent watering only encourages shallow rooting of the turfgrass plants, making the lawn less drought-tolerant. The best time of the day to irrigate or water is early in the morning because it minimizes the potential for water loss through evaporation. In addition, watering in the morning will not create conditions that promote the occurrence of diseases.

Reducing Soil Compaction

Very few homeowners understand soil compaction or the hazards it presents. Diseases, insects, improper watering, and/or lack of fertilizer are often blamed for a lawn's decline when the real problem is soil compaction. The problem starts when the soil particles in the top few inches are compressed from traffic and overuse, reducing the air space between them and thus impeding the flow of air, nutrients, and water to the turfgrass roots. This causes stress to the turfgrass, making the lawn less able to compete with weeds and recover from damage and stress. In time, a compacted lawn will require some form of renovation. Soil compaction can also contribute to other lawn problems such as thatch accumulation and weed invasion.

If you conclude that you have a soil compaction problem with your lawn, the solution is very straightforward —you need to initiate soil aeration as part of your lawn maintenance program. Soil aeration can be performed in several different ways, from using a potato fork or pitchfork to using a mechanical aerifier. The most effective type of soil aeration is called core aerification, in which cores of soil are removed mechanically, leaving holes in the lawn. This aerification procedure loosens compacted soil and increases the flow of water into the soil. Some other benefits include enhancing the oxygen levels in the soil and stimulating new turfgrass growth. Soil aeration is generally used to correct a soil compaction problem rather than as a routine maintenance practice. However, if the desired quality for the lawn is quite high, you should consider implementing soil aeration as a routine maintenance practice every year.

The best time to aerify a lawn is when the turfgrass plants are actively growing to allow for their rapid recovery. The best time to aerify a warm-season turfgrass lawn is during the summer. The best time to aerify cool-season turfgrass lawns is in the early spring or fall.

Thatch Control

Thatch is defined as a layer of living and dead turfgrass plant parts that is located between the soil surface and the green vegetation of the turfgrass. Thatch consists of a loosely interwoven collection of this living and dead plant matter that can impart a "sponginess" to the lawn. Thatch originates from old turfgrass plant stems, stolons (aboveground stems), rhizomes (underground stems), and roots that are shed by the plant during its growth and development of new plant parts. This "sloughed off " plant matter collects at the soil surface andgradually decomposes. When this plant matter accumulates faster than it decomposes, a thatch layer develops.

Thatch is not always present with all turfgrasses and/or lawns. Certain turfgrass species have a greater propensity to produce thatch than other turfgrasses do. Turfgrass species that are vigorous in terms of their growth rate, such as bermudagrasses, have a greater tendency to produce thatch than slower-growing turfgrasses do. However, slowergrowing turfgrass species such as zoysiagrass may also produce thatch due to the fact that their plant tissues do not decompose quickly.

Lawn maintenance practices can also contribute to the development and accumulation of thatch. If lawns are overfertilized, overwatered, mowed too infrequently, or mowed too high, then thatch accumulation may become a problem. Excessive thatch (more than 1 inch) can create many problems for a home lawn. For example, the turfgrass plants may begin to grow within the thatch layer instead of the soil, disease and insect problems may increase, and air and water movement may be restricted. The sponginess that can be associated with a thatch layer may sometimes cause the mower to sink down into the lawn and cause the turfgrass to be scalped when mowed. Excessive thatch may also increase winter injury. The rate of thatch accumulation can be decreased and somewhat controlled by reducing the nitrogen fertility levels, watering properly, following the correct mowing schedule, and applying annual topdressings of sand and/or soil to the lawn.

Thatch can be physically removed using a hand rake or various types of mechanical equipment. The two most common types of mechanical equipment used are core aerifiers and vertical mowers. These mechanical operations are sometimes referred to as "dethatching." All of these mechanical dethatching treatments work by physically removing as much of the thatch layer as possible. After the thatch debris has been removed, it should be collected and removed from the lawn. Then, apply a light topdressing of either sand and/or soil to the lawn. This will further aid in the decomposition of the thatch layer.

As with soil aerification, the best time of the year to dethatch a lawn is when the turfgrass is actively growing. This will allow the turfgrass to recover as quickly as possible from this physical stress.

Topdressing

Topdressing is a turfgrass maintenance practice that is used to help decompose thatch, to reduce

surface compaction, to improve the soil, and to smooth the lawn surface. Topdressing involves spreading a thin layer of topsoil or other soil mix (sand) on the soil surface. The topdressing material should be of similar composition and texture as the underlying or native soil. Topdressing rates may range from ½ to 2 cubic yards per 1,000 square feet of lawn. These amounts will produce a layer from ⅛ to ⅝ inch in depth. After applying the topdressing, work it into the lawn by brushing, dragging, or raking it.

Pest Control

Diseases, insects, and weeds are the main pests of home lawns. Chemical controls of most of these pests are available but in many instances may not be necessary. If you follow the proper mowing, fertilization, watering, soil compaction, and thatch control procedures outlined in this publication, you will have a healthy, vigorous turfgrass that is capable of withstanding most pest problems. Of course, there are always exceptions, and your county Extension office can help you identify and control any pests that do occur.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

ALABAMA COOPERATIVE Extension SYSTEM

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ALABAMA A&M AND AUBURN UNIVERSITIES

ALABAMA COOPERATIVE Extension SYSTEM

AN R-388

Liming and Fertilizing Ornamental Plants

Lime and fertilizers are applied to encourage healthy, vigorous plants. Too much lime or fertilizer can actually harm or kill plants. Therefore, soil testing is necessary to determine the soil nutrient status and provide recommendations for applying lime and fertilizers in correct amounts. Contact your county Extension office for instructions and materials for soil testing.

Lim e

Liming materials neutralize acid in the soil and provide some nutrients essential to plant growth. Some common materials used to lime acid soils include ground calcitic limestone, basic slag, ground dolomitic limestone, wood ashes, and flue dust. Calcitic limestone contains calcium. Dolomitic limestone contains calcium and magnesium. Basic slag contains calcium, magnesium, and a few micronutrients and is often fortified with phosphorus, potassium, and micronutrients. Wood ashes and flue dust also contain some plant nutrients, particularly potassium. The primary purpose of liming, however, is to neutralize soil acidity, not to add plant nutrients.

Lime can be applied any time of the year, but a winter application will begin to neutralize soil acidity before spring growth. On established plants, space lime and fertilizer applications at least 2 weeks apart or plants may be injured. Use finely ground lime materials to assure quick neutralization of soil acidity. Most liming materials are in fine, dusty powders. A pelleted limestone is available in some locations that will dissolve in rain, is dust free, and is easy to apply accurately using a lawn spreader.

Lime moves about 1 inch per year down through the soil. This slow movement of lime makes it important to mix lime deeply into the soil before planting ornamentals. For established plants, apply a maximum of 5 pounds of ground limestone per 100 square feet per application. This is equivalent to 1 ton per acre. When soil test recommendations call for more than 1 ton per acre, space applications 6 months to a year apart to avoid a band of concentrated lime moving down through the soil. Too much lime can cause plant nutrient deficiencies. You will need 7 or 8 pounds of basic slag to equal the liming action of 5 pounds of ground limestone.

Fertilizer Nutrients

Fertilizers are liquid or dry materials containing plant nutrients. The three numbers found on the fertilizer container refer to the percentage of nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O), in that order, in the fertilizer.

The N in many fertilizers is lost quickly from the soil. It is used by plants, washed through the soil by water, or lost to the air as ammonia or nitrogen gas. Therefore, to promote growth, apply N frequently, or use a slow-release N source such as sulfur-coated urea, manure, or compost. Fertilize lightly or not at all with N if additional growth is not needed.

Phosphorus (P) is held very tightly by soils (except pure sand) and cannot be washed out of the soil by watering. Furthermore, high levels of P make other plant nutrients, such as iron, unavailable and may result in discolored leaves and poor growth. This makes soil testing important to determine the need for P.

Potassium (K) can be washed through the soil by water but not as quickly as N. In sandy soils, K may need to be applied once every year. In clay soils, K may be needed only every few years.

SLOW RELEASE FERTILIZERS —Many commercial fertilizers release their nutrients quickly, and this fast release will “burn” or kill plants if too much fertilizer is applied at one time. “Slow release” fertilizers allow large applications without hurting plants. These fertilizers are sold as granules or as spikes for houseplants, shrubs, or trees. Some have a sulfur or resin coat to slow

down the nutrient release. Others contain synthetic substances, processed sewage sludge, or other organic materials that take a long time for soil organisms to break down into usable plant nutrients.

Slow release fertilizers are a safe, convenient way to fertilize in large amounts, thus reducing the number of applications per year. They are also expensive, typically costing four or five times as much per pound of fertilizer nutrient. They are a good alternative for special plants, such as a prize rose. Follow the manufacturer's recommendations on the use of these fertilizers.

LIQUID FERTILIZERS—There is no magic to liquid fertilizers. They work the same as dry fertilizers, except the liquid may reach the roots more quickly. A dry fertilizer can be mixed with water and applied as a liquid. Or, a dry fertilizer can be watered lightly and dissolved after it is applied.

One advantage to liquid fertilizer is that it can be used for foliar feeding, that is, spraying weak nutrient solutions directly on a plant's leaves. The leaves then take up some of these nutrients. Foliar feeding may be needed to supply a plant with micronutrients, such as iron or zinc. If soil P is very high or, if soil acidity is very low (high soil pH), soil micronutrients may be unavailable to plant roots. A leaf burn is likely from foliar feeding if the nutrient solution is too strong.

Some houseplant fertilizers and specialty fertilizers for particular plants, such as azaleas and camellias, are sold as liquids. Follow the manufacturer's recommendations for these products.

Plants growing outside in tubs, pots, window planters, or raised planters might best be fertilized with houseplant fertilizers or slow release fertilizers. Replace this soil every year or two to avoid build-up of P typically present in high levels in these fertilizers.

Amount Per Application

If soil test results indicate a need for P or K, select a fertilizer containing appropriate amounts of these nutrients. Soil test recommendations will provide an example of a fertilizer or fertilizers that can be used. Other fertilizers may also correct soil nutrient deficiencies if used at the proper rate. Call your county Extension office if you need help in deciding whether another fertilizer can be substituted for the recommended fertilizer. Use the same percentage of N in the fertilizer to determine the maximum amount per application. The size of the plant or the area of soil to be fertilized also determines the amount of fertilizer to apply.

The amount per application for a shrub should not exceed 3 teaspoons (1 tablespoon) per foot of height, for fertilizers containing 10 percent nitrogen. See the applications table for the maximum amount when using fertilizers with different levels of N. For trees, measure the width (diameter) of the trunk at 4 feet from the ground. For each inch in trunk width apply 0.1 pound of N. See the table for amounts needed to supply 0.1 pound of N from different percentages of N in the fertilizer. The amount of a particular fertilizer needed to supply 0.1 pound of N can be calculated by dividing the percentage of nitrogen in the fertilizer into 10. If the area under the tree or in the shrub bed is known, simply apply broadcast 0.1 pound of N per 100 square feet.

Applying Fertilizer

Spread fertilizer evenly under the limb spread of a shrub or tree to avoid burning roots. A shaker jar can be helpful. Sprinkle the fertilizer on top of the soil or mulch and water lightly. Rinse fertilizer off leaves to prevent foliar burn.

One method for trees is to bore holes 18 inches deep, 2 feet apart, under the entire tree and 2 feet beyond the dripline. Divide the fertilizer into as many equal parts as there are holes and place it in the holes. This tedious method will get fertilizer below turfgrass roots to tree roots. Boring holes in soil will also increase air movement into the soil, which often stimulates tree root growth and results in healthier, vigorous trees.

A reasonable alternative to boring holes is to fertilize trees with a lawn fertilizer spreader in February. Early spring rain will move the fertilizer below turfgrass roots. A good lawn fertilization program will also benefit trees, making a separate fertilization program for trees unnecessary. Do not use lawn "weed-and-feed" fertilizers under trees or shrubs unless the label says it is safe.

Timing Applications

To stimulate growth, fertilize three times a year. Normally, the first fertilization is made in February for trees and in March or April for shrubs. Space later fertilizations 2 months apart. If the trees or shrubs are large enough, fertilize only once or not at all. Do not fertilize later than mid-August with N, or the new growth is likely to be injured by cold weather.

For roses and annuals, follow soil test recommendations for lime, P, and K, then fertilize with

Table 1. Maximum Safe Amount Of Fertilizer Per Application.

One pound of fertilizer is assumed to be equivalent to 2 cups of fertilizer. One cup is equal to 8 ounces or 16 tablespoons or 48 teaspoons. One tablespoon equals 3 teaspoons.

Fertilizer	Cups per 100 Square Feet[a]	Pounds per 100 Square Feet[a]	Teaspoons per foot of shrub height
8-8-8	2.5	1.25	4
10-10-10	2.0	1.00	3
13-13-13	1.5	0.77	2
15-15-15	1.3	0.67	2
15-0-15	1.3	0.67	2
Ammonium nitrate (33-0-0)	0.6	0.30	1
Sodium nitrate (16-0-0)	1.3	0.63	2
Ammonium sulfate (21-0-0)	1.0	0.48	1 ½
Urea (46-0-0)	0.4	0.22	½
Muriate of potash (0-0-62)	0.3	0.16	½
Sulfate of potash (0-0-50)	0.4	0.20	½
Superphosphate (0-20-0)	1.0	0.50	1 ½
Bonemeal (0-20-0)	1.0	0.50	1 ½
Triple superphosphate (0-46-0)	0.4	0.22	½
Ground limestone[b]	10.0	5.00	15

[a]The numbers in these columns are also equal to the cups or pounds of fertilizer per inch of tree trunk diameter at a 4-foot height.

[b]These rates of limestone are equivalent to applying one ton per acre.

N monthly from March through August at half the rates recommended for shrubs. Perennial herbaceous ornamentals, such as tulips, irises, daffodils, dahlias, peonies, and daylilies, can be fertilized at the same rates as shrubs. However, one N application per year is usually sufficient. Disease and insect infestations are more likely when lush growth is stimulated by high rates of N.

Examples:

1. An established bed of daylilies, about 10 feet wide and 15 feet long.

Soil test recommendations: no lime, 120 pounds N per acre, 40 pounds P_2O_5 per acre, and 120 pounds K_2O per acre. The comment on the soil test report suggests: per 100 square feet, in March apply 2.5 cups 8-8-8; in May and July apply 1.3 cups 15-0-15.

The bed is 150 square feet (10 x 15 = 150). Therefore, half again as much fertilizer as suggested per 100 square feet will be needed (150 ÷ 100 = 1.5) in each application:

2.5 cups 8-8-8 x 1.5 = 3.75 cups 8-8-8

1.3 cups 15-0-15 x 1.5 = 1.95 cups 15-0-15

However, 8-8-8 and 15-0-15 are not available in the local garden store! A 13-13-13 fertilizer, ammonium nitrate (33-0-0), and muriate of potash (0-0-62) are available. The 13-13-13 can be substituted for the 8-8-8 if the right amount is used. Referring to the table, you see that:

2.5 cups 8-8-8 = 1.5 cups 13-13-13

1.5 cups 13-13-13 x 1.5 (for 150 sq ft) = 2.25 cups 13-13-13

Ammonium nitrate and muriate of potash can be substituted for the 15-0-15 (again, from the table):

1.3 cups 15-0-15 = 0.6 cups ammonium nitrate + 0.3 cups muriate of potash

0.6 cups ammonium nitrate x 1.5 (for 150 sq ft) = 0.9 cups ammonium nitrate

0.3 cups muriate of potash x 1.5 (for 150 sq ft) = 0.45 cups muriate of potash

Therefore, this daylily bed can be fertilized in March with 2.25 cups 13-13-13, and in May and July with 0.9 cups ammonium nitrate plus 0.45 cups muriate of potash.

2. Chinese hollies around a home, all about 4-feet tall.

Soil test recommendations: 1 ton lime per acre, 120 pounds N per acre, 80 pounds P_2O_5 per acre, and 40 pounds K_2O per acre. The report suggests: per 100 square feet, apply 5 pounds lime now; in March apply 2.5 cups 8-8-8; in May apply 1.0 cup superphosphate; and in May and July apply 0.6 cups ammonium nitrate.

Now use the table to convert fertilizer materials to a per foot of shrub basis:

First, apply lime as recommended to the soil:

Lime = 5 pounds per 100 square feet

8-8-8 = 4 teaspoons per foot of shrub

Superphosphate = 1 ½ teaspoons per foot of shrub

Ammonium nitrate = 1 teaspoon per foot of shrub

Now multiply these figures by four, since the shrubs are 4-feet tall. This will give you the actual amount of fertilizer material you will need to apply.

3. A rose bed.

Soil test recommendations: no lime, 120 pounds N per acre, 40 lbs P_2O_5 per acre, and 80 pounds K_2O per acre. The report suggests: per 100 square feet, in March and May apply 1.25 cups 8-8-8; in April and June apply 0.65 cups 15-0-15; and in July and mid -August apply 0.3 cups ammonium nitrate.

You already own a lawn fertilizer with a 24-8-16 analysis. No pesticides are in this product, so it is safe to use if used at the proper rate. Also this fertilizer contains the same ratio of nitrogen, phosphorous, and potassium as recommended by the soil test results. Therefore, it can be used for each of the six fertilizations alone to provide the needed nutrients. Roses should be fertilized monthly athalf the rate of normal shrubs. This rate should be 0.05 pound nitrogen per 100 square feet. To determine the amount needed, divide the pounds of N desired by the percentage of N in the fertilizer:

0.05 pound N desired ÷ 0.24 pound N per pound of 24-8-16 = 0.21 lb of 24-8-16

So, 0.21 pound of 24-8-16 per 100 square feet per application will supply the recommended nutrients at the correct rate. This would be about 0.4 cup of 24-8-16 per 100 square feet or ½ teaspoon per foot of height of each rose.

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