1) Selecting Plant Material - Factors to consider

- Exposure,
- Site analysis (sun/shade/wind/moisture)
- Soil types
- Micro/macro climates
- Special site factors
- Intended use of material
- Existing plants in the landscape

2) At the Nursery - What to look for

- Current size of plants
- Mature size of plants
- Balled in burlap or container
- Root system
- Inspecting the plant for insect or disease
- Listing of approximate weights of root balls and plant heights and calipers

3) Planting

- Digging a proper hole
- Soil amendments to add or not to add
- Setting the plant and facing
- Packing the soil and allowing for settling
- Planting B&B material
- Removal of nylon ropes
- Planting container material (proper prep of root system)
- When to plant
- Desiccation

4) Post-Planting Care

- Mulch
- Weed management

5) Cultural Considerations

- Basics of after planting care -- Watering how to, when to, how much, how often
- Fertilization -- types of fertilizer; when to; how to; how often; plant requirements understanding the analysis; figuring the amounts to use
- Pruning: How to prune trees and shrubs; when to prune; flowering shrubs, evergreens, reasons to prune; Sharp tools; (suckers and shoulder cuts)

Chapter I: Selecting Plant Material

Before venturing out to your favorite garden center/nursery to select a plant, there are several steps that you should take to ensure a proper purchase. These steps will help to eliminate a couple of trips to the nursery and reduce your overall project time. You will also be armed with the facts that can aid a nursery employee in helping you with making a selection. So, lets examine some things that you should consider.

Site Analysis

A proper site analysis, whether for one plant or an entire landscape, is the first step. This includes exposure, sun/shade analysis, wind and predominant soil condition and type.

Exposure refers to the direction the plant will be facing. This is important because plants can be grouped into three basic categories: Sun, partial sun/shade and shade loving plants. In a southwest exposure for instance you need plant material that loves a lot of direct sun or the results could be a trip back to the nursery to replace a burned up plant.

Sunshade analysis refers to the percentage of sun to shade an area receives in a day. This ties into the exposure issue and can help you refine your choice within a certain plant group. While you may have a plant facing west, it could be in shade most of the day because of factors other than the exposure for example a large tree or building near by.

Wind, especially in combination with frozen winter ground, can be a plant killer. Many times the death will not even be observed until the following spring. The resulting death of the plant is due to desiccation. This occurs when the winds draw water out of the leaves. If the water cannot be replaced by the plant, such as when the roots are in frozen soil, the plant leaf will die. So if you know that there is a corner where a strong northwest wind whips around, avoid putting in a broad leaf evergreen there. The same can be true in the summer months. A constant wind under a hot sun can cause wilt. Generally though, a proper watering program will eradicate this problem.

Soil type has a bearing on plant material selection. Soils can be loosely broken down into the categories of clay, loams and sand. Fine soil particles such as clays will form hard surfaces and can provide very poor drainage. This is especially true in construction areas where heavy traffic from builders, building materials and heavy equipment have compressed the soil. This creates a concrete type barrier where water will stand for days without moving down into the soil. The root system of plants will also have extreme difficulty in penetrating this compacted soil. Compacted soils can cause the death of large trees left by builders. Their death will be a slow one, causing gradual decline of the tree over a period of 3-5 years until the tree dies. A gradual decline will normally show itself in top (crown) die back and loss of individual branches.

(Lack of oxygen to the root system, severed roots from construction digging and damage to the trunk from equipment running into it are all factors contributing to the death of large specimen trees. This is generally referred to as 'construction damage').

Plants all have preferences to the type of soils they thrive in. Generally speaking, a plant will survive in a well-drained soil if other factors to the plant life are favorable. Some specific characteristics that come to mind are that Yews can not tolerate a wet root system. If a Yew's roots are in a wet situation for only 24-36 hours, they will start to rot. This will cause a yellowing and browning of individual needles, branches or the entire plant. Japanese Pines do well in sandy soil and as such are often seen in beachfront landscapes. They will tolerate a very dry condition along with winds and salt spray from the ocean.

Another important factor to consider is the soil ph. Ph is a measure of how sour or sweet a soil is - how acid or alkaline it is. Ph is measured on a scale of 1-14, with 7 being neutral. 1-6 is the acidic side of the scale with the lower ratings being more acidic. On the other end of the scale, with the ratings of 8-14, are the more alkaline soils - the higher the rating the more alkaline the soil. Most common landscape plants will do well in the soil if it is slightly acidic, a range of 5-6. Some examples of plants noted for favoring an acidic soil are Azalea, Rhododendron, Dogwoods. Plants that favor the more alkaline soils - Boxwood, Yews.

To determine your soil ph, a test must be conducted. Your local county extension office can usually provide you with this service. Contact them for a soil sample box or take enough of a sample to fill a sandwich bag. To take the sample, dig the soil in the area you intend to be working. Take samples from just the top 1-3". If you need a general sample for your yard - dig cores from various spots throughout. The more soil in the sample the better.

The ph of a soil can be adjusted. To raise the ph, to make the soil more basic, add lime. To lower the ph or make the soil more acidic, add sulfur. The amounts of each, if any, will be based on your soil test results. County extension agents will make specific recommendations.

So far, we have looked at the large overall site factors that will affect the plants. We can call this the **macroclimate**. Now, let's check to see if there are any special factors affecting the site - lets check the **microclimate**.

Observation is our keenest tool and when used astutely can save us much time, labor and money. When making site observations we should note such things as:

If we are putting in a foundation planting is there an over hang preventing rain from getting to the plants; If planting against a wall or foundation, will the building material reflect the hot summer sun producing a double jeopardy for the plant; Are we planting on a slope where there will be a lot of water runoff; Are we in an enclosed courtyard where temperatures will skyrocket; Are we planting near a street where winter road crews will spread a lot of salt, Is the spot under a large plant and living in a lot of shade, Does this spot stay wet or moist; Is the spot very dry; Have other plants died in this spot before? And if so - Why?.

These are just a few suggestions to check for when determining the microclimate that a plant will be living in.

The Use the Plant is Intended For

When selecting a plant, you are choosing it to perform a specific function. You may pick a plant for aesthetics, screening, as a hedge, as a specimen or focal point, or perhaps to bring a fixture of a landscape, such as a building, into scale. In many cases, the plant will be serving several functions at once. Many people use blooming plants or plants with brilliant fall color in a foundation. Such seasonal interest adds beauty to the home along with hiding an ugly foundation.

While trying to decide what variety of plant to introduce, take a look around at the existing plant material. This will give you some clues as to what goes well in the area (and perhaps what doesn't!). Also consider plant material that is indigenous to the area. Natural plant material is best adapted for the climate, and is often the most beautiful.

Another important item to consider is the mature size of the plant. It is a shame to see a plant outgrow its intended site and purpose. This tends to lead to a severe pruning, destroying the plant's natural growth habit. Always check to see what the average mature size of a plant will be.

Let's consider some specific cases. In a foundation planting we want to select plants that will

compliment the home. (This of course is a primary function of all plants in the landscape.) The plant should not attain such size and stature that it will eventually overwhelm other material or otherwise dominate the setting. Low growing plants and plants of moderate mature size, say 3-5' do well in foundation plantings. The taller material should be placed on corners with a gradual decline in height as you reach the main entrance. The front entrance should be framed by the plant material, creating a natural balance and welcoming doorway. Choosing appropriate materials allows easy passage in and out of your home, without feeling attacked by overgrown plants.

When selecting plants to form a screen, your intent may be to shield a site from the adjacent view, act as a windscreen, or provide shade. In addition, a primary reason for planting a screen is to increase the privacy of your yard. The types of plant material that you will look for in this situation form a dense, living wall. Typically the mature height will be 8-10' or greater. Placement of plants is a factor in determining the mature height necessary for the particular site. For a privacy screen around a patio, one row of evergreen trees planted 5 feet from the edge of the patio can have a mature height significantly less than material planted 15 feet from the patio.

The number of plants needed depends on size and spread of the material and to a large extent the amount of patience you have. If you can wait for your screen to develop, 5-foot centers of plantings can be stretched to 7 1/2. Also, the size of the material available at a price within your budget can make a difference. However, keep in mind that the smaller material will grow and fill out. Over planting will lead to disappointing results in the long run.

A hedge can serve a slightly different purpose, but shares many similarities with a screen. The difference may depend on the initial plant material selection. A hedge's general purposes are to define boundaries, direct foot traffic, or to frame a setting.

A hedge can be a soft structure or a very intimidating barrier. It can be a neat, compact formation, or a tangled, overgrowing feature.

The planting of the hedge, like the screen, depends on the material selected; its growth habit, mature size, size at time of purchase, and patience of the homeowner.

Chapter 2: At The Nursery

Now that we have familiarized ourselves with our site location and determined what we intend to use the plant material for, we are ready to go to the nursery.

At the nursery, you will find the plant material grouped by variety and size, the same as any retail operation. Price reflects size, shipping cost, overhead, and the plant itself. Some plants are just worth more than others are.

You will find the plants available in 2 ways - balled in burlap or container grown. Fruit trees and roses can still be found bare root. What do these terms mean and what types of plants can you find in each category?

Balled in Burlap: These plants were field grown and then dug for shipment. The roots, with the soil around them, were wrapped in burlap for protection. The larger the size of the root balls the better. This means less chance of a disturbed root system, broken, severely pruned roots, and thus less chance of transplant shock and possible death. The root ball itself should be very firm and hard. A loose, soft ball of soil or one where you can move the trunk or central leader around, like

stirring a pot with a spoon, can mean trouble. Avoid plant material in this condition.

Every ornamental plant can be delivered balled in burlap. However, balled in burlap is becoming more for trees only.

Trees can be measured in caliber. This is the circumference of the trunk 6 inches above the ground. Some examples of corresponding caliper; height and ball weight are listed below for shade trees:

Caliper	Height	Ball Weight
1.5 inch	8 - 10 feet	100 to 150 lb.
2 inch	10 - 12 feet	225 to 300 lb.
2.5 inch	12 - 14 feet	300 to 350 lb.
3 inch	14 - 16 feet	450 - 600 lb.

The measurements are approximate and will vary on tree variety; water content of the soil of the root ball and soil type.

Container Grown: Plants are grown and then shipped to the nursery in a container.

Container grown plant material is the predominant form for marketing, especially for shrubs.

There are many reasons for this. First, ease in handling; many containers have lips, making them easier to pick up and carry. Second, the containers will not rot, as burlap will. Third; they are much easier to transport. Forth, less labor is involved in the growing of the plants. Fifth; plants can be graded easier, according to the size of the container. For example; 1 gallon, 2 gallon, 3 gallon, 5 gallon, and 7 gallon, which are the predominant sizes of plants you will find in the nursery.

The containers themselves can be made out of a variety of materials. Old metal containers were what nurseries used at first. Now, heavy-duty plastic and cardboard are used extensively, as well as bushel baskets for small trees. The cardboard, or pressed corrugated paper containers are also referred to as "plantable containers". These containers will break down once they have been placed in the planting hole. The ease of just sticking the plant, container and all, into the soil is the big selling point. It also keeps root shock to a minimum. (Planting of these two types of available plants will be discussed further in Chapter 3.)

Bare root: This means that the plants have been dug, and the soil removed from around the roots. For shipment to the garden center or nursery, the roots will be wrapped and placed in a plastic bag. It is imperative that these roots be kept moist. Drought will kill them very quickly.

Picking Out the Plant

In selecting a plant you want to take home, a careful examination will provide you with a wealth of information. You want a strong, healthy specimen. The first thing to do is check the foliage and branches for any evidence of insect or disease activity.

Next, check the base of the trunk or central leader. Look for any small holes, scars, or other indications of rough treatment. Also, check to see how firm the trunk is in the container. Remember, the firmer, the better.

Make sure the leaf size is not stunted. This would indicate either a poor growing season or poor

root system. This brings us to the single most important item that you have to check - the root system. You can only have on top, the shoots, what the bottom, the roots, will support. This is called the root/shoots ratio. Consider a dogwood tree 5-7' tall with a root ball of only 6" wide by 6" deep. The root system is just not sufficient to support a plant of that size.

Many times, it is recommended that the top be reduced by pruning when planting to aid the roots in supporting the top. The plant itself will do this in times of stress. The individual twigs will die back to adjust for the restricted or damaged root system.

Now that you have picked out your plants, you must transport them home. If no wagon or cart is available to take the plants to your vehicle, carry them by the container or root ball. Do not pick up a plant by the main branch or grab a bunch of branches; this will only succeed in pulling on the root system, contributing to shock.

Once in the vehicle, you need to consider the amount of wind that will come in contact with the plant. Large plants, such as trees, should be tied or wrapped with a tarp to avoid excessive drying out on the way home. Even driving at 25 mph for 15-20 minutes can dry plants out. Most small material you will probably be able to just put in the car or truck for the ride home; however, it is always best to tarp or cover your plants. Once you get the plants home, if you are going to wait a day or more to start planting, it is a good idea to give them a thorough watering, even if they were recently watered. Remember, the only source of food and water is right around the roots at the container or root ball.

If you are transporting a tree, you will of course want to make sure the root ball is stationary. You don't want a 50-pound root ball rolling around in the trunk or bed of your automobile. Also, try to support the trunk of the tree when it is lying on its side. To help cushion the tree from bumps, and avoid breaking the central leader, place bags of mulch about halfway up the trunk and at the top. If the tree is in the trunk of a car, cushion the area where the trunk lays on the door.

Now that you have the plants safely home, we are ready to start planting.

Chapter 3: Planting

Since we have already determined where each plant is going to be placed, we are ready to start digging. It may seem ridiculous to discuss digging a hole. Though it is a simple task, proper preparation is vital to insure a long, healthy life for your plant.

Digging the hole creates the environment where the root system will live. If the roots are placed in a tight fitting restricted area, it will reflect in the growth of the plant. A hole must provide adequate space for root growth and development.

Let's take a look at digging a suitable planting hole. You will be digging an area larger than the size of the root ball or container. Again, you do not want to squeeze the plant into the ground. The depth of the hole will be greater than the overall depth of the root ball.

* Root ball should be slightly elevated, about 1/3 above ground, to allow for settling in clay soils

The drawing gives recommended dimensions for the hole as shown. If you want to lay out the area you will be digging in, measure the diameter of the root ball and add 8 to 12 inches. For the depth, add 4-6" to the depth of the root ball.

Avoid making the sides of the hole into a sheared, glass-like finish. If you are dealing with clays,

this can happen as you work with your shovel or spade around the edges to finish the hole. The clay will compact, making it difficult for the expanding root system to penetrate. The result would be a restricted roots system and an unhealthy plant. Break up the sides with your shovel or spade so the roots can move out of their root ball and into the surrounding soil.

Soil Amendments

When planting, it is often helpful to add something to the existing soil, such as topsoil, peat moss, or pasteurized cow manure. A 40-lb bag of topsoil, peat moss or cow manure will usually be enough to plant 2 or 3 3-5 gallon plants.

Mix any soil amendments with indigenous backfill. This will help the plant adjust to its new environment and encourage the roots to grow out laterally. Otherwise, the roots would grow primarily in the area of least resistance. Very little root growth would occur in outside the soil amendment area.

Before placing the plant in the hole, back fill the first 6" with your mix of soil amendment and existing soil. Firm this material up by packing it down slightly. Be sure to have enough material so that the root ball will be slightly elevated. Do not exceed 1/3 elevation of the root ball. Along with the slightly packed backfill, elevation will allow for any settling caused by the weight of the root ball.

Now that the root ball is sitting on the back fill in the hole, start filling in around the root ball with the remaining back fill. As you fill, check the statue of the plant, correcting for any angling or leaning to one side. Pack the back fill in gently around the root ball. You want the back fill to be as free of air pockets as possible.

You can now put down a 2-2.5" layer of mulch around the root ball. It should extend out to the perimeters of the hole. To water, place the end of the hose at the base of the plant (without any spray nozzle). Turn it on to the rate of a slow trickle. You want the water to soak down into the root system. A slower stream prevents run-off and reduces waste.

Preparing the Plant:

The conditions of and the way we place the root ball will depend on whether the root system came as either balled in burlap or container grown.

Balled in burlap plants are the easiest to prepare for planting. Most will come with the burlap wrapped in nylon string around the root ball. The nylon string will be wrapped around the base of the trunk. Also nails will be used as pins to hold the burlap in place.

The first thing to do with a plant wrapped like this is to cut the nylon string from around the trunk of the plant. The nylon will not rot. If this string is not cut and removed, it will eventually girdle and kill the plant. Girdling can best be described as a slow strangulation of the plant. The plant grows, but the nylon remains the same diameter, so the plant will die from the point where the string is wrapped, literally choking off the plant's life supplies.

Next, the burlap should be pulled back from around the trunk. Nails should be removed from the top of the root ball. The nails come out easily if you take a pair of pliers; grab the head of the nail, and pull. The burlap will rot and doesn't need to be removed. It should be pulled back so that just the top of the root ball is exposed. However, there is a type of "plastic" burlap, which is exactly what it sounds and usually comes in a green and white mesh or black. Like the nylon, the plastic

will not rot, and must be removed from the plant.

Container grown plants, while being a lot easier to handle, do have an inherent problem, which, if not taken care of prior to planting, can result in the plant's death.

As the plant grows and matures, the roots and shoots become larger, more numerous, and take up a larger surface area. When the plant is growing in a container, the root system is restricted by the size of the container. Once the roots fill all the available space in the container, they will start growing along the inside edge of the container. When removed from the container, the roots system of the plant will resemble the shape of the container. The plant is effectively "root bound".

Root bound plants require special treatment before planting. Because of the initial restriction of root growth, the roots will not branch out into the surrounding soil when planted. The root system must be broken up so the roots can take off and establish themselves.

After removing the plant from the container, scar the outside of the root ball. A pocketknife would be ideal for this task. Draw the blade up and down many times around the root ball, inserting the knife to a depth of about an inch to insure that you are cutting roots. What you are doing is breaking up the pattern of growth for the roots. This stimulates them to grow out and away from the plant instead of continuing to wrap around and around.

One of the most common ways of breaking up the root system is called "butterflying". To butterfly a root bound plant, first remove the plant from its container. Lay the root ball on its side or hold it so the bottom faces up. With a shovel of spade, scratch an X across the bottom of the root ball. This puts the root system into quarters. With your shovel or spade, cut from the bottom of the root ball upward towards the trunk. Go about 1/2 to 2/3 the way up the root ball. You will perform this procedure twice, thus producing 4 individual sections.

Next, pull the sections apart, but do not separate them from the root ball. Just separate them enough so there is about an inch or so of space between each quarter section. What you have effectively done here is to break up the pattern that the roots were growing in. By placing these plants in the hole with the root ball quartered and separated, the roots will now branch out and grow.

Another way to achieve the same affect is this: remove the plant from the container and lay it on its side. Take your digging tool and slice through the root ball many times. Rotate the root ball until the entire ball has been broken up. Gently pick up the plant and shake lightly to loosen the soil and any severed roots.

Many times the soil may be loose enough in the root ball that you can accomplish breaking up with just your fingers.

Some pre-planting attention should also be paid to plants in degradable containers. It is recommended that the sides of these containers be punctured. This will help to facilitate the movement of water into the root area and also the decomposition of the container. Many of these plantable containers are made with a lip. If this lip is exposed once planted, it can act as a sponge under the hot summer sun. The dry lip will draw the moisture upwards from below and sun will evaporate it. To prevent water loss from the sponge effect, it is best to break up this lip and bend it back.

When to Plant

Most people are familiar with the idea that springtime means planting time. In the spring, the biggest surge in planting occurs. The second biggest time is the fall. Many times, plant material

that is put in the ground in the fall will do better. In the fall the top or shoot growth has ceased for the season. The plant begins to go into its winter dormancy. The roots, however, will continue to grow. Thus, the plant may establish roots without having to support a growing top.

In contrast, spring is the start of a whole new growing season. Shoot growth will be plentiful, as compared to root growth. The plants will usually establish themselves quite well as long as they are provided water throughout the long, hot summer, according to the proper watering techniques. You will find, when all is said and done, that as long as the ground is not frozen, it is fine to plant.

Chapter 4: Post-Planting Care

After installing your landscaping, the follow-up care is of utmost importance. No matter how well you plant, it can all be in vain if left to fend for itself.

The first step in post-planting care, mulching, should take place immediately following planting. Mulch serves several purposes; retaining moisture in the soil, aiding weed control, insulation of roots when temperatures fluctuate rapidly, adding to soil organic matter ratio, and beautifying the finished landscape.

Mulch, as most commonly found, comes from tree bark. Bark mulch is available in a variety of forms. Perhaps the form most widely used and recommended in this region today is shredded hardwood bark mulch. Bark is first stripped off the tree and then shredded. This process produces a very functional product. It intertwines with itself and mats down well. Also this type of mulch breaks down quicker, adding to the soil. Because of its small surface area, it tends to stay put, and will not blow away as easily as other mulches.

Mulch also comes in nugget form and round chip form, sometimes called "silver dollar." These varieties will serve all of the same requirements that the shredded mulch will. However, these forms take longer to break down and add to the soil. Also, with a larger surface area, they may blow around in heavy winds, and will not mat down well.

The above mentioned varieties of mulch are the forms most commonly available in garden centers and nurseries. They are usually sold in 2 or 3 cubic foot bags or in bulk as cubic yards. There is an easy formula to determine how much mulch you will need to cover an area. First find the square footage, and multiply by the fractional expression of how deep you want the mulch. This will give you he cubic footage. Then divide by the size of the bag to get the number of bags or by 27 cubic feet for cubic yards.

Let's look at an example.

> Say a bed area is 4' by 6' or 24 square feet.
> Also, we want a depth of 2 inches, so:
> (4' X 6') (2/12 or 1/6) Converting to decimal form 2"/12' = .17
> 24 (1/6 or .17) = 4 cubic feet
> If the mulch is sold in 2 cubic foot bags
> then: 4 cu. ft./2 cu. ft. bags = 2 bags
> If the mulch is sold in 3 cubic foot bags
> then: 4 cu. ft./3 cu. ft. bags = 1 1/3 bags

If dealing with a larger area, just substitute 27 cu. ft. (1 cubic yard) for the bag size. The answer you come up with will be the number of cubic yards needed.

Mulch can also come from other sources. Pine needles make very good mulch. If you live under a stand of pines, they will provide you with cheap, fragrant mulch. Oak leaves also make good mulch in acid-loving plants, such as azaleas and rhododendrons. Maple leaves make good mulch, especially if you are mulching plants that are not particularly acid loving. In general, pine needles and oak leaves produce an acidic situation; maple leaves a more basic pH.

Stone, when laid thick enough, can be excellent mulch. It will also act as a groundcover, and can really set off a landscape. Small "pea gravel" and "washed river stone" are used quite often in landscaping. Both have a color range from cream to light purple, allowing it to compliment a variety of landscapes.

Weed Control

There are few things more frustrating than putting in a beautiful landscape and then having to constantly battle weeds. What exactly is a weed? By definition, "a weed is any plant that grows where it isn't wanted." This definition could include almost anything, and that is exactly the way it is meant to be. A weed could be an white pine in a stand of oak trees. Of course, we usually think of the garden variety of weeds. These include broadleaf weeds, like dandelion, and grassy weeds such as crabgrass.

The broadleaf and grassy weeds will often invade your planting beds. They will push themselves up from under the mulch, they can also germinate in the mulch layer. Weed seeds can lie dormant for several seasons before germinating. Also, wind and birds will transport weed seeds, depositing them in your planting beds.

There are many ways to manage weeds in you plating beds. Let's take a look at a few types of weed management.

Sod Stripping: If you are preparing a new bed area for plants you can strip off the sod layer. Stake out the area for the bed and strip the sod with a mattock, spade, or sod cutter. This will leave you with the bare soil. Having taken away many seeds in the stripped sod, this will reduce seed germination. A good 2.5" - 3" layer of mulch will then help in reducing any further germination.

Landscape Fabric: A layer of landscape fabric laid over the bed area will manage weeds. You must cut a hole in the landscape fabric of sufficient diameter to allow for watering, anticipating future plant growth. You can expect weeds to pop up at the base of plants. This method is less labor intensive than stripping.

Herbicides: These first two methods are both labor intensive. Another method of management that is less labor intensive is through the use of herbicides. Herbicides are a group of pesticides that were developed for weed management. One way to classify herbicides is as being either pre-emergent or post-emergent.

Pre-emergent Herbicides are applied before the weeds have broken the soil surface. They actually work by creating a barrier in the top layer of the soil. When a weed seed germinates, it comes into contact with this barrier. The barrier interferes with the cell division and thus no further growth can occur.

If the barrier is broken, for example, by tilling or digging up an area after the application of pre-emergents, the chemicals will be ineffective against any weeds that germinate. Most pre-emergents are used for grassy weed control such as crabgrass and goosegrass. These plants are collectively called monocots. Many also will manage broadleaf weeds before they appear on the

surface. Once a weed has broken ground, the pre-emergents will be completely ineffective to stop their growth.

Post-emergent Herbicides are generally associated with broadleaf or dicot weed management, weeds such as dandelion and plantain. This group of herbicide is applied to the soil after the weeds have broken the surface of the ground. The way this type of herbicide works, is to act as a growth regulator. They cause cell division to be abnormal. The cells will divide at an excessive rate and effectively cause the plant to grow itself to death. The plant is unable to produce sufficient food to support its increasing demands.

Many elemental factors affect the rate of management of these herbicides. Temperature, soil moisture, watering and sunlight all play important roles in weed management. The warm, bright days when the weeds are actively growing are generally the best for herbicide application. Weeds take up the chemicals and translocate them more quickly. Thus, there is a swifter response and better rate of management.

With all pesticides, read and follow label directions. Do not fall prey to the idiom "a little is good, a lot is better." This is simply not true; more damage than good occurs from overuse of pesticides. Apply the material on calm days to avoid drift, especially when using material in any liquid form. Also, do not apply when rain is expected.

There are a great many herbicides on the market today. Many are highly specialized but most have a broad spectrum of management. We have covered selective herbicides, those that kill only a select group of plants. The non-selective group will kill whatever plant they come in contact with. With this group, you must be especially careful about any runoff. The runoff will kill landscape material just as well as it kills the weeds. These materials are also used when renovating a lawn, They are sprayed onto the lawn and then the lawn can be completely reseeded.

Chapter 5: Cultural Considerations

Perhaps the most important aspects of post-planting care can be termed cultural considerations. As a group the correct practice of cultural considerations has the biggest bearing on the success of an individual plant or an entire landscape.

What exactly are cultural considerations? What are the effects of correct cultural practice? Let's take a look at these questions.

Cultural considerations are the management practices that you have control over. Such practices as proper planting, watering, fertilizing, and pruning are all included in the realm of cultural practices. These factors account for 80%-90% of problems with plant material.

The avoidance of stress is a high priority of any cultural program. Stress, due to any number of reasons, weakens a plant. A struggling plant is more susceptible to insect and disease. These pests are secondary problems masking the underlying cause for a plant's general ill health.

What is stress? Almost any foreign substance that makes a plant to alter its growth habit could cause stress. Wind, water (either too much or too little), a dog, a human foot, insect, disease, poor soil, too much fertilizer, a wrong exposure; these are all factors that cause stress.

Let us now take a look at some cultural considerations. The first one that we should look at has already been covered, choosing a correct planting site. Good exposure, soil amendment and plant

preparation all play vital roles in the success of a plant. Now, it is the post-planting aspects that we turn to.

Watering

A plant, just like a human, cannot live long without water. Over 90% of a plant's weight is water. A large shade tree can lose between 2,000 to 3,000 gallons of water in one day. Lack of water in a plant is shown by wilt. This indicates a loss of the water between cells in the plant leaves; a loss of turgidity. A turgid plant has enough water in its system to support the weight of the leaf. A turgid leaf is firm and fully expanded.

Correct watering practice is just watering when a plant needs it. This may seem rather simplistic but it means that your scheduling must be flexible. During a wet spring, you may not have to supplement nature's irrigation. In the mid-summer heat you may find yourself watering twice a week. In the fall, you will want to insure a good weekly watering occurs. A plant, especially if it is evergreen, that goes into winter with an ample supply of water stored in its system will stand a greater chance of survival through spring. You do not want to forget that wintertime foe - desiccation (for an explanation of desiccation, see chapter 1).

What time of day and how much watering is enough are perhaps the most often asked questions about watering. Most people believe that the best time of day to water is in the evening. The plant will hold more, losing less to evaporation. However, as stated before, the best time to water is when a plant needs it. This is usually during the hottest part of the day, mid-afternoon. Transpiration (water loss) by the plant is greatest when the temperatures are at their peak. Also, remember that during periods of high winds you have a higher amount of water loss than normal. Perhaps a good way to remember the best time to water is to compare it with you working in the hot afternoon sun. You perspire and thus have water loss. While you could wait until evening to drink a glass of water, this would cause undue stress. You want and need the water now, not later. Such is the case with a plant.

How much water should be put on at a time? You do not want to waste water but you want to insure that you have given the plant enough. The best way to water individual plants is to take the end of the hose and lay it at the base of the plant. Turn the hose on at a slow trickle. This will allow the water to soak down through the soil surrounding the root system of the plant, and soaking the entire root ball. Watering at a high pressure with a nozzle only causes runoff and shallow water penetration. If you need to check how far the water has soaked into the soil, take a popsicle stick and push it down into the soil. Bring it back up and measure how much of the stick is moist. Be sure to pull back the mulch before measuring. the soil surrounding the root system is what must be moist - not the mulch layer. This brings you to a point that we alluded to shortly before; shallow watering. Shallow watering will set a plant up for disaster.

Shallow watering, watering so that only the top inch or two of soil or the mulch layer becomes wet will becomes wet, will produce a shallow root system. The roots grow toward the water source. They also grow towards an area of least resistance. Wet soil will be less resistant than a dry hard soil. So what happens is that through conditioning, you produce a root system that is close to the surface. When watering ceases or a drought occurs the topsoil layer will dry out rapidly. The root system is unable to reach water that exists farther below the surface. Results are wilt, and death if the condition is not corrected.

A plant that has been watered regularly so that the entire root ball is soaked will produce a much deeper root system. Because the root system has a much larger area on which to draw on for its water needs, it can better withstand drought than a plant with a shallow system. The soil further from the surface dries out much slower, and retains water longer than the top one or two inches. This situation has a greater impact when you realize that almost all plants, including the large

shade trees, have their feeder root systems within the top 6"-8" of the soil. Azaleas are noted for being very shallow rooted. So it is crucial to aid in the development of a deep root system in these naturally shallow-rooted plants.

The basic message I hope to have communicated is this; water slow and deep, not quick and shallow.

Fertilization

Plants, like other living things, must have food, along with water to live. A plant's main food sources are nitrogen, phosphorus, and potassium, in specific forms. Each one of the major elements plays a particular role in the plant's system. These elements can be found in the soil in varying amounts and from different sources. The different sources that these elements can be supplied from and facts surrounding these are subjects in themselves. So, let's first examine the major function of these elements in a plant.

Nitrogen (N) is perhaps best known for its ability to green up a plant and to induce top growth. It is the element that causes that flush of growth when applied to a plant. Leaves are large and full when enough nitrogen is present. Too much nitrogen can be bad for a plant. It will induce top growth and cause a plant to use up its carbohydrates reserves. Also too much nitrogen in "flowering" plants will reduce flowering. As stated before, nitrogen accelerates the rate of vegetative growth. Therefore, too much nitrogen inhibits the other aspects of plant growth, including flowers and roots.

Too little nitrogen in a plant will cause smaller than normal leaves that are yellowish in color. Branches will be very thin and fewer stems and shoots will be produced. The entire plant will appear stunted, spindly, and weak.

Phosphorous (P) is associated with root growth in plants. Starter fertilizers for plants will have a higher percent of phosphorous in the analysis. An example is a fertilizer with a ration of 5-10-5. This means that the fertilizer is 5% nitrogen; 10% phosphorous; and 5% potassium. Phosphorous is also associated with bud and flower set.

Potassium (K) impacts winter hardiness, bud set and is also involved with the early stages of photosynthesis.

These are the three main elements required by plants. These three elements are also what you find in a "complete" fertilizer. A complete fertilizer is one which contains a percentage of nitrogen, phosphorous and potassium. Some plants require certain levels of other elements in their system. Examples of this are members of the Ericaceous family, acid loving plants such as azaleas and rhododendrons. They require a good supply of iron in their diet. A lack of iron will be shown as chlorosis in the leaves, with the leaves turning yellow and the veins staying a more greenish color.

As we have mentioned before, most fertilizers that are found in the commercial use are what is called a complete fertilizer. Let's look at an example to better understand what this means. The amount of each element in a bag of fertilizer is given in the order of nitrogen, phosphorous, and potassium, N,P,K. If an analysis is given as being 18-5-9, this means that 18% of that bag is nitrogen, 5% is phosphorous, and 9% is potassium.

Another way to look at it is that if that bag holds 50lb of fertilizer, then 18% or 9 lbs is actual nitrogen, 5% or 2.5lbs is phosphorous, and 9% or 4.5lbs is potassium. So in a 50lb bag you have a total of 16lbs actual fertilizer material. The rest is filler, such as cob or clay.

So let's say that it is fall and you have been given a recommendation to fertilize with 1lb of actual nitrogen per 1000 square feet. You can have a choice of fertilizer analysis to you but which one do you select? Do you use an 18-5-9, a 10-6-4, a 10-10-10 or what? Here, price enters into the picture. Remember that the price you pay for a bag of fertilizer is not the price for the actual element. If you are paying the same amount for a bag of 10-10-10 as you are for a bag of 5-10-5 and both bags are the same weight, then you are getting a better deal for the bag of 10-10-10. A larger percent of that bag is nitrogen, the material that you are really looking to buy in this example.

Organic Fertilizers

When speaking of organic fertilizers, most people think of bone meal, dried blood, compost, manure, or compacted sewer sludge. These fertilizers as a group are characterized as being slow to release their nutrients, low in burn potential and low in analysis.

These natural organics are used more for their long-term effect. They are also used as soil additives to help improve the condition of the soil. Their results are therefore slower to occur.

There is another group of organics, the synthetic organics. Examples of this group of fertilizers are urea and urea formaldehyde. They are considered organics because they contain carbon in their chemical makeup. The synthetic pre-text is because they are man-made materials.

Synthetic organics are characterized by being quicker in release of their nutrients, having a higher analysis and higher potential to burn.

Another group of fertilizers, the synthetic inorganics include ammonium nitrate and ammonium sulfate. These are very quick to release, immediately available to the plant, a short residual and a high burn potential.

The source of the nitrogen you have is on the label of each bag. No matter what source of nitrogen you apply, the plant can only take up and utilize the nutrient when it is in a specific elemental form. For nitrogen, the form available for uptake and utilization by the plant is either NO_3^- or NH_4^+. These forms are made available by their release from their original compound. Their release is triggered through reactions with water and or microbial activity. The release of these plant-available forms is influenced by factors affecting microbial activity and available soil water. Such factors are pH, temperature, and soil moisture concentration.

Some fertilizers come with micro nutrients such as iron (fe) (***read and follow all manufacturer's labels***).

Amounts of Fertilizers to Apply

Now that we have looked at what fertilizer is and how it does its job, it is time to discuss fertilizer requirements of plant materials, and when it is best to fertilize.

A standard recommendation for shade trees is for six (6) lbs of actual nitrogen per 1000 square feet. Add about 2 lbs actual phosphorous and 2 lbs actual potassium per 1000 square feet of canopy is enough for a yearly fertilizer. For smaller shrubs, an annual fertilization rate of 2-3 lbs. of actual nitrogen per 1000 square feet is good. This along with 1 lb. each of actual phosphorous and potassium will be plenty for an average yearly fertilizer.

Most recommendation for fertilization of trees and shrubs follows a fertilizer analysis of 3-1-1, 4-1-1 or 3-1-2. This is because when used in these ratios your phosphorous, and potassium availability will be sufficient. Nitrogen will leach or run out of the soil while phosphorous and

potassium tend to be more stable.

How do you determine how much of a fertilizer to use? More importantly, how much is too much? Many times, instructions will be on the bag as to how much actual material is to be spread to give you a certain amount of actual nitrogen. This may be in relation to a setting on a spreader or it may be in regards to a dry measure such as 1/2 cup or a full cup around the base of the plant. Of course, a lot depends on the way the fertilizer will be applied. Will it be injected into the soil around the root system in a liquid form, will a foliar application be given for direct uptake by the leaves, or will you use a granular application? If a granular application is to be used, will it just be broadcast around the base of the plant and out past the drip line (the base of the foliage) or will holes be drilled into the ground and then granular fertilizer poured into these holes and backfilled with dirt?

The broadcast method is easiest for the homeowner, especially for dealing with plants in a bed situation; so that the fertilizer can be spread at the desired rate without fear of burning the surrounding turf. Granular fertilization can be done in conjunction with re-mulching; first apply the fertilizer and then the new mulch.

As always, follow the manufacturer's specific instructions.

Time of Application

Most people assume that fertilizing should be done in the spring, at the beginning of the growth season. However, by understanding the growth habit of the plant, we can use fertilizer more wisely. Applying only spring fertilization is not synchronous with the plant's most efficient nutrient utilization. The roots system of a plant has a different growth period than the shoots. The shoots are actively growing in the spring. They may have an additional growth period later on in the summer. In contrast, the roots grow during the fall. Autumn is also the season when the roots take up the greatest amount of nutrients. In spring, roots do not have to continuously replace nutrients used by shoots. Rather, it is when top growth has ceased that the roots absorb any nutrients and store them for use the next spring.

So, fall fertilization is a practical, highly advisable practice for the best culture of your plant material. There is maximum root activity, maximum root absorption of nutrients, and thus maximum usage of your applied fertilizer.

Pruning

Pruning of ornamental trees and shrubs in its purest form can be considered an art. proper pruning techniques can add to the beauty of the original plant and the total landscape. In its best practice, the proper pruning procedures will help to stimulate growth, rejuvenate the plant, encourage better bud set, and extend the plant's life.

When done incorrectly, pruning will damage a plant, deform its natural growth habit and reduce or negate its contribution to the landscape. Severe improper pruning can lead to the premature demise of a plant.

One common ailment among amateur pruners is "electric shear syndrome." The symptoms are easily recognized; every plant is shaped in perfect geometric form. Rectangles and squares are, sadly, one of the most widespread indications that this "disease" has struck.

The type and function of a plant dictate the way the plant material should be pruned. Flowering

shrubs, evergreens, deciduous plants, hedges, and specimen materials should all be treated differently. Unlike people, plants are not all created equal. We will now explore in depth some basic differences in the pruning of different types of materials.

Hedges

An evergreen hedge usually requires 1 or 2 prunings a season along with some maintenance pruning in between. When pruning a hedge, the plant materials should be selectively thinned along with just taking a few inches off the top. Repeated prunings that consist of merely skimming the edges of the plant will induce a canopy of outer growth. From the outside edge to a few inches inside there is nice, green growth. The plant appears healthy. Look again; the interior will be nothing but barren twigs. The dense exterior canopy blocks all the light and air, preventing any of the interior branches from growing normally. You clearly see the effect when a hedge that has gotten too big is severely cut back, and there is nothing left but sticks. In time, the plant will produce new shoots and fill back in. But with proper techniques, you can avoid that issue. By selectively thinning the plant as you reduce its size, removing small branches allows air and sunlight to penetrate the interior of the hedge. This reduces the canopy effect and if later this hedge must be cut far back, you will be left with a healthier looking plant.

Form is another major consideration when pruning a hedge. The top must be smaller than the bottom to allow adequate sunlight throughout the hedge. If the top were larger than the bottom, the plant would effectively be shading itself, causing reduced leaf growth and a thinner, scrawnier plant.

Evergreens

When pruning needle leaf or broadleaf evergreens, plants should be thinned, for the same reasons and to the same purpose as with pruning a hedge. The best time to prune evergreens is in the spring. With warm weather and the added stimulation of pruning, the plants will grow and fill back in. The result will be a lush, vigorous plant.

Blooming evergreens, such as azalea, andromeda and rhododendron, should be pruned after the flowers have dropped in late spring. If you wait and prune later or in the early spring, you remove the flower buds. The buds set on the new growth each year. When you wait too long to prune, you remove the new season's growth that contains the next year's flower buds. The plant will not be able to produce new buds in time for the annual bloom. In addition, for rhododendrons, the removal of flower heads soon after death will ensure a heavy bud development for the following year. Pinch off the dead flowers at the leaf whorl, to prevent the plant from expending energy on seed. The plant will then direct its hormones to commence flower bud set for the coming season.

Deciduous Plant Material

Spring blooming deciduous plants such as forsynthia and spirea produce flowers in the previous season's new growth. Therefore, the best time to prune these plants is right after they have finished blooming.

Summer flowering plants like lilacs produce plants on the current season's new growth. The best time to prune this group of plants is in late fall, winter or early spring.

To keep any of your flowering deciduous shrubs healthier, it helps to periodically remove the older canes or branches.

Deciduous trees, such as maples, oaks, dogwoods, and so on, respond best to winter pruning. During the cold winter months, the trees are dormant, and so you can minimize sap flow or

bleeding from the cuts. Since all the branches are exposed, you can clearly see the structure of the tree, enabling you to shape and trim far easier than in summertime. Remember, it is the structure of the tree's branches that makes up the natural form.

Pruning tips: What do you look for when pruning? Which branches should stay and which should be removed? What exactly does thinning mean? How much is too much? How late in the season can you prune? How do you tell what is dead wood and what is live wood?

When starting out to prune, first look over the structure of the plant. Note if it has a central leader (the main upright branch which forms the backbone of a multistemmed shrub). The central leader is a guideline, showing you the growth habit of the plant. If you need to reduce the height of the plant, you can prune the central leader to a bud or a branch growing in an upward fashion. This branch will then take over as the central leader. An important point to remember: if you completely remove the central leader, say to midway down or less, you will grossly deform the plant. It will take on a squat, horizontal growth habit.

As we mentioned earlier, you are looking at the overall structure of a plant. Identify the main supporting branches. You will find that these are also the ones that provide the plant's general form. Branches that cross these main branches, branches with angles of less than 45 degrees at the crotch points, broken branches, and spindly branches should all be pruned out. This will leave you with a strong, sturdy plant.

Needleleaf Evergreens: The above method applies to deciduous plants and evergreen shrubs. But when pruning needleleaf evergreens such as pines, it's a somewhat different story. A pine puts forth new growth each through a process called "candling." The candles are the extending branch tips coming from the branches and whorls. As they grow, they take on the shape and size of a candle, hence the name. As the candle matures, the wood will harden off into new braches, and needles will emerge all along the candles.

To keep a pine's growth to a manageable size for the landscape, prune by pinching back the candles to the length you desire.

When pruning any plant it is important to remember that what you leave behind is the growth direction the plant will take. By pruning out the top of a plant, you will redirect the growth hormones to the lateral or horizontal areas. This can be desirable where you are trying to fill in for a screen or hedge and height is not a factor.

Thinning is selectively removing branches to allow adequate passage of sunlight and air throughout the interior of a plant. We mentioned thinning of plants earlier and touched on methods to avoid the problems a canopy can produce. Specifically, older top branches may be removed at the base of where they join support branches. This will reduce shading of the interior and induce dormant bud break.

As we mentioned before, any branches with weak crotch points or crossed rubbing branches should be removed. Dead, dying and decaying branches are a pathway for insects and disease. All these branches should be removed in order to prevent infestation and further problems in the future.

To tell whether a branch is dead, scrape a small area of the bark with your fingernail. If the underneath area of the bark is green, then the branch is alive. If you scrape away and find nothing but brown, hard wood, then the branch is dead. Peeling bark on branches is also another quick way to tell if a particular branch is healthy or not. A defoliating bark usually indicates a dead branch.

When pruning out a branch or twig the place to cut is at a little shoulder area where the branch joins a larger branch or trunk. This almost looks like a little nub coming out of the larger branch. This will produce the smallest wound so that the tree will heal faster. Do not make a cut that is flush to the adjoining branch. This makes a larger wound area, and takes a longer time to heal.

When removing a branch that is 3/4" or over in diameter on an ornamental plant, it should be done in a series of cuts. The first cut should be made on the underside of the branch and about 4"-6" from the main trunk. Only cut about 1/4 to 1/2 the way through. A second cut should then be made about 2" away from the main trunk. This cut will be from the top side down. You will cut all the way through with this cut.

The underside cut will collapse on itself from the weight of the branch. It will also prevent the bark from splitting and tearing al the way down past the trunk. The small stub that is left can be easily removed by pruning off with one cut form the top down at the collar. Do not flush cut at the trunk,

As for the proper time to prune, let's look at this through the process of elimination. Avoid heavy pruning in the fall, since pruning does stimulate growth and the tender shoots will not be prepared to survive the winter. Without time to "harden off" before winter, the new growth can be severely damaged by low temperatures and harsh winds. This is more of a problem with broadleaf evergreens than with deciduous or needleleaf species. Time periods associated with pruning individual plant groups should be followed as previously mentioned.

How much do I take off? This question can only be answered in a very general form; take off enough to do the job. Don't leave materials that you will have to be back in a month to prune again. On the other hand, if you have to prune something all the way down to the ground or to bare bones, consider replacing the plant altogether.

A catchall recommendation for most trees and shrubs though is that you can usually take about 1/4 to 1/3 out without worry. The plant will respond well to this amount of removal.

Pruning Tools: No matter what pruning equipment you are using, be it bow saw, curved pruning saw, hand snipper, or pole pruner, make sure it is sharp. A sharp piece of equipment is going to make a clean cut. A dull tool will make a ragged, tearing cut that makes it harder for the plant to heal.