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SECTION 1: TURF AREA MAINTENANCE

I. Introduction

A. Turf Types

Kentucky bluegrass is the most commonly used turfgrass for developed sites and streetscapes throughout northern U.S. climates, including the Denver metro area. It is a cool-season grass that forms excellent sod, spread by underground stems (rhizomes). In general, it is valued by the public for its uniform green, manicured appearance during the growing season. Functionally, Kentucky bluegrass has the ability to withstand heavy foot traffic and as a result, the turf is prevalent in active parks and on sports fields.

The lush appearance comes at a cost along the semi-arid Front Range, however. Kentucky bluegrass may require up to 25 inches of supplemental water per growing season depending on seasonal moisture. However, Kentucky bluegrass also tolerates drought conditions well, going dormant and turning brown under extended drought stress.

Other types of turfgrass that may also be useful in the public landscape include Buffalo Grass, Blue Grama, and various fescue varieties. These types of turfgrasses use approximately one-third less water and require less maintenance than Bluegrass. However, they are best used in areas of low foot traffic and where their appearance is appropriate.

Buffalo Grass and Blue Grama are warm-season grasses found naturally in short and mid-grass prairies. Buffalo is a sod-forming grass that grows to 6” in height, can be mowed and may only need 1-2 inches of water every 3-4 weeks during the growing season. Blue Grama is a bunchgrass that may grow 10-16” tall. Warm season grasses are late to green-up in the spring and also will go dormant when drought-stressed.

There are two general turf-grass types:

1. Cool- and Warm- Season Grasses – These terms refer to grasses and their growth periods. A cool-season grass is one that grows best in spring and fall when temperatures are cooler (60 to 75°F); and a warm-season grass is one that grows best when temperatures are warmer (85 to 9 0°F). This growth m ode results in an obvious green appearance at different times- spring and fall for cool-season, and warm summer months for warm-season. Of course, growth periods for both types of grasses are dependent on available moisture and both are dormant in the winter.

B. Cultural Needs of Turf and Soils

All the components that make up soil- organic materials, minerals, micro-organisms and chemicals- determine its ability to store water, nutrients and air. These three interdependent elements are essential for plant growth whether in cultivation or a natural setting. Managing each of these cultural needs will result in healthy turfgrass that will require less time to maintain and ultimately, less water. Omitting any of these elements will limit the effectiveness of other actions and will eventually lead to disappointing results.

1. Watering – Soils, drainage and salinity determine the rate at which water can be applied. The irrigation method and the condition of the soil beneath the turf are critical factors.

2. Air – Plants require oxygen at the root zone to survive. Over-watering or constant water-logging of the soil will deprive turfgrass roots of oxygen and result in rapid decline. Compacted or tight, heavy clay soils will have the same effect. Soil preparation and a continual, seasonal program of aeration will assure that the turf can efficiently utilize the water and nutrition supplied.

3. Nutrition – Bluegrass has a rather high fertility demand, especially for nitrogen, that cannot be supplied by our soils. Supplemental applications of commercial fertilizer are necessary to maintain bluegrass in top condition. Two to three applications through the growing season are required.

II. Bluegrass Turf Irrigation

A. Factors affecting irrigation

The following variables will affect frequency, distribution and efficiency in the watering of turfgrass:

1. Soil conditions – If soil to be irrigated is clay, then irrigation must be applied slowly to prevent water from running-off. If sandy, water can be applied more rapidly for longer duration, but care should be taken that water is not applied for too long a period and lost below the root zone.

Turfgrass should be watered deeply to encourage a deep and extensive root system. This will increase the drought tolerance of the turf and decrease the frequency of required waterings. Heavy clay soil is difficult for roots, water and air to penetrate. This compacted soil condition can be relieved in existing turf by the use of power aeration and improving the soil profile with an amendment, such as composted organic material or manure. Irrigation applied to heavy soils that have not been amended may “run-off’, fail to penetrate the soil, or promote shallow root systems.

2. Air temperature and wind – As reason suggests, the warmer the temperature and greater the wind velocity, the more water is lost from the soil and turfgrass. This loss is measured as evapotranspiration, and is known as the ET rate. The daily ET rate is available in local newspapers and TV weather reports, and through other media outlets. It can be helpful for determining how much water to replenish on the lawn each day.

3. Sprinkler design – Many design factors can affect the water efficiency of sprinkler systems- spray or drip emitters; undersized tap and low available water volumes; head pattern, spacing, size or shape; over and under pressurization; subterranean leakage; improper zoning, quality of equipment, etc. Often sprinkler design problems are best solved by re-design, modification and/ or replacement of the problem areas as identified by thorough analysis.

B. Check the subsoil moisture

These are the most accurate means of evaluating the subsurface moisture and the effectiveness of irrigation methods:

1. Soil Moisture Sensors – are commercially available and problem areas can be routinely monitored electronically. Sophisticated computer controls are available.

2. Manual Measuring – Set out several shallow containers (approximately 2" depth x 6" diameter) in a given "zone" of the turfgrass area. Turn on the water. Making note of the length of time required, irrigate the zone until the depth of water in the containers averages '/2" (generally considered a minimum application). If there is a considerable discrepancy in coverage within the zone, the sprinkler system needs adjustment.

3. Manual Drill Core Samples – Take several core samples and note the depth to which the moisture has penetrated. If 1/2" of applied irrigation water has not percolated to a depth of 4-6" or more, deep core aeration and topdressing with finely composted organic material and sand is recommended to increase soil moisture retention.

C. Sloped areas require special attention

Depending upon the degree of the slope, the soil will reach a point at which it can absorb no more water, and additional precipitation will "run-off' at or near the surface. This is the limiting factor on the length of time for one application or one "cycle" on a n automatic system. Soil condition is extremely important for sloped area, since heavy clay soils have very low infiltration rates. Even relatively flat areas may reach a run-off point, in that the soil becomes soggy and waterlogged, while 6" down the soil remains dry. At a 3:1 slope (15°) even the best of soils cannot accept more than about 3/4" of water at a time.

D. Shut off at 'run-off'

An irrigation cycle must not continue past the run-off point of the "most sensitive" area within the zone. An interval is allowed for infiltration. Then, the irrigation cycles are repeated one or more times, without reaching the run-off point and ideally until the moisture has penetrated to a depth of 8" or more.

E. Frequency of Watering

As root growth responds to deep watering (and soil improvement), intervals between watering can be progressively increased to four, five and eventually six-day intervals. Bluegrass lawns on good soils are generally considered to require about 1 1/2" of water per week during peak season, while poor conditions may increase this requirement to as much as 3" per week. Improved soil and root structure will allow the application of approximately 1" of water at a time, the full weekly water requirement, in either single or repeated cycles.

The watering schedule must take into account the influences of exposure and orientation. Sunny turf areas adjacent to buildings or driveways, as well as south and southwest-facing slopes, will obviously dry out more quickly and will require more frequent watering.

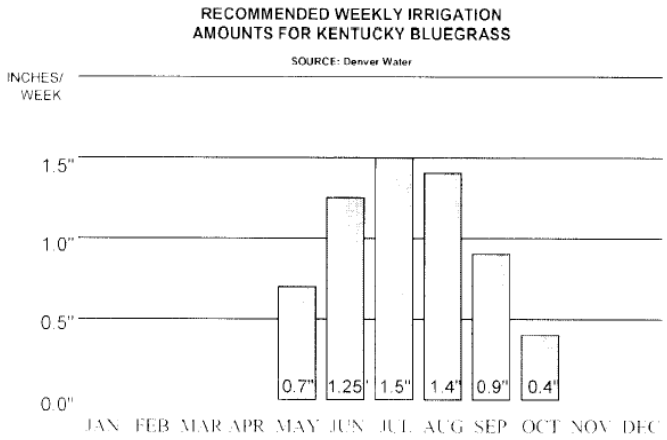
F. Time of Watering

1. 6 a.m. to 8 a.m. – The best time to water turfgrass is in the early daylight hours, from about 6 a.m. to 8 a.m.- the wind is generally calm, loss to evaporation is at a minimum, and yet the chances are very slim that the microclimate in the vicinity of the grass blades will remain excessively humid throughout the day (a humid condition is ideal for the spread of fungus

diseases).

2. 4 a.m. to 6 a.m. – The second best time is from 4 a.m. to 6 a.m. This is usually a time of minimum demand for domestic water systems, and more pressure is available; better water coverage may become a factor. Predawn watering may be somewhat more conducive to turf diseases, however this is usually not a serious problem in this area, because our low humidity conditions discourage any wide spread of the disease organism.

3. Worst Times – The worst time to water is in the middle of the day. The rate of evaporation is greatly increased, wind drift can cause very uneven coverage, and day watering can often interfere with the use of the landscape by people. Additionally, public relations may suffer. Nighttime watering provides the greatest risk of turf disease and seems to aggravate insect problems. However, for larger systems with large numbers of zones, night watering may need to be used to apply sufficient moisture.



III. Soil Testing

A. Procedure

If practical, take several soil samples at about 4-6” depth and have them analyzed. Request recommendations concerning soil texture, pH and fertility for bluegrass/ other grass cultures. Use the following steps to submit soil samples:

1. Obtain a spade, trowel, soil tube, or soil auger free of rust and soil.

2. Dig 5-10 samples (depending on the size of the area) from the soil depth where your plants will be rooting. The samples should represent a uniform area consisting of land that is similar in slope, texture, drainage, or other characteristics that make the soil the same. A front and back yard would most likely be very similar to each other, however a garden area may be different from a turf grass area.

3. Place all of the samples into a plastic container and mix well to get your final sample for submittal to the lab. If possible, air dry the sample by spreading it out on paper towels.

4. Remove about 1 1/2 - 2 pints of soil from the container and place it in a plastic bag or soil sample bag.

5. Seal the bag and label the sample with name, address and location of the sample.

6. Complete this soil sample information form as much as possible and include it with the soil sample.

7. Mail the sample to the lab using the following address: Soil, Water and Plant Testing Laboratory Colorado State University Room A 319 NESB
Fort Collins, CO 80523-1120

8. Be sure to keep samples cool before mailing. If samples heat up; the nitrogen readings can change dramatically. Keeping the samples in the shade will prevent excessive heating.

IV. Turf Fertilization

Fertilizer should be used to produce turf to meet specific needs. If a high-quality, manicured bluegrass turf is required, a great deal of fertilizer will likely be required. Conversely, natural turf that is required primarily to prevent erosion will require little or no fertilization.

A. Nutrients

Growth is most influenced by the nitrogen level in the soil and therefore most fertility programs are centered around nitrogen use. In most commercial fertilizers, phosphorous and potassium are included with nitrogen to take care of other turf needs.

B. Rate of Application

Most bluegrass varieties will give optimum performance i n the Denver area if fertilized with approximately 3 - 4 pounds of actual nitrogen per 1,000 square feet per growing season. Most commercial lawn fertilizers apply 1 pound o f actual nitrogen per 1,000 square feet per application, requiring three to four applications per year. Avoid exceeding recommended application rates.

C. Method of Application

1. Commercial fertilizers – Products advertised as “constant feeding” or “slow release” are of merit. Their formulations release more or less constant amounts of nutrition to the lawn over a longer period of time between applications (approximately two months). They are also less likely to “burn” the turf, which is an especially important consideration for applications during hot weather.

It is important to read and follow manufacturers’ recommendations for mowing, watering, etc. at the time fertilizer is applied. Product formulations and combinations vary widely in regard to the cultural practices.

D. Seasonal Applications

1. Spring (April 1-15)- A spring application will cause early “green up’ of the lawn and give it the longest possible growing season. This application should be made after aeration and thatch removal has been accomplished, and only after irrigation is available. If early-season lawn irrigation is prohibited, the spring application should be omitted or delayed until watering is possible. Pre-emergent weed control may be desirable at this time, in a combination with fertilizer.

2. Early Summer (June 1-15)- Use a standard, slow-release formula such as 20-10-5 analysis, plus iron. Dicot weed control (as a combination product) may also be desirable at this time.

3. Late Summer (August 1-15)- Use a standard, slow-release formulation plus iron.

4. Fall (October 1-30)- Fall is the prime season to fertilize bluegrass. Root growth and side-shoot growth are at a maximum and fall fertilization helps repair hot weather damage, provides better winter color, and prepares a stronger, denser turf for the next spring. Use a standard, slow-release formulation plus iron. Fall fertilization results in more root growth and less top growth. Continue lawn irrigation into the fall as necessary and practical.

V. Thatch Removal

Thatch in lawns is a layer of slowly decomposing grass stems, clippings, dead roots and debris that accumulates above the soil line and below the grass blades. A thin layer of thatch (1/4 to ‘/2”) may benefit the lawn by buffering the soil temperatures and reduction of soil compaction.

An excessive build-up of thatch at the soil surface can prevent air, fertilizer and water from penetrating the soil. Excessive thatch also provides a breeding ground for certain fungus and diseases and insects. Reduce excess thatch accumulation by aerating annually in the spring or fall.

Thatch removal is ordinarily not necessary until the build-up exceeds 1/2". Cut out a piece of sod and measure, if necessary. If hand raking is impractical, power raking will solve the problem. However, power raking can damage turf and should be done only when necessary. Power raking must be done while the turf is dormant, prior to mid-March. Use the lowest possible setting and check results before making a second run. Avoid raking recently established lawns; the root system may be insufficient to recover from the mechanical damage. Do not power rake every year.

VI. Turf Aeration

Aeration twice per year in spring and fall provides air to grass roots and room for roots to spread. Turf areas on clay or compacted soils will respond poorly to irrigation, fertilization, and other cultural practices if soil has been compacted. Compacted soils also tend to shed water, rather than absorbing and retaining it.

Aerate by use of a power drum aerator after removal of excess thatch build-up. Water the lawn thoroughly prior to using the power aerator. Mark out sprinkler heads and any

underground lines less than 4" below the surface to avoid damage. Run the aerator over the lawn several times in different directions.

It is usually not necessary to remove the plugs, but the water penetration and water hold capacity can be greatly improved by adding 1/4 – 1/2" top dressing of two-parts composted organics or manure and one-part coarse sand over the lawn. The material will eventually find its way into the holes, keeping them open and encouraging root development.

VII. Mowing

This information applies more specifically to Kentucky bluegrass and its cultivars, but the general concepts can be applied to other species:

A. Frequency

Turf should be mowed often enough so that no more than one-third of the leaf blade or ¾" maximum is removed at a time. A well-kept bluegrass lawn may need to be mowed as much as every four days during the spring and fall growing seasons. During hot weather, the interval between mowing may be as much as 10 days. The lawn should be mowed late into the fall or as long as the grass seems to be growing.

B. Mowing height

The correct mowing height varies with each turfgrass species and cultivar. For water efficiency of bluegrass, the recommended mow height is two and one-half to three inches (2½ – 3"). The lawn should never be cut lower than one-and-three-quarters (1¾").

1. Grass should not be left long heading into winter. The final mowing of the season should be about two inches (2"). This height should be achieved gradually during the late fall, lowering the mower no more than ½" each time the lawn is mowed. Cutting it shorter than this may shock the grass and make it susceptible to winterkill.

C. Equipment

Properly maintain mowers and check the equipment over carefully. Dull mower blades bruise and fray the end of the blades. and increase transpiration and the susceptibility to disease. A rotary mower should be sharpened frequently. Make sure the blade is properly balanced. If the blade is excessively worn, replace it.

D. Grass Clippings

Grass clippings have some nutrient value and may be useful as mulch in the lawn. However, when a heavy thatch or mat has developed, the clippings may prevent proper penetration of water, air and fertilizers. If thatch accumulates to a depth of one-half inch or more, it should be removed (see aeration). Any removed clippings may be saved and used as compost material or mulch.

VIII. Turfgrass Weed Control

Weeds are annual, biennial or simple perennial. Summer annuals, such as Crabgrass or Puncturevine, germinate in the spring, develop and produce seed during the summer and die with a killing frost in the fall.

A. Winter Annual Weeds

Germinate in late summer or fall, live over winter as small tufts or rosettes, resume growth in spring and mature seed early in the summer. Examples are Shepherd's Purse or Blue mustard.

B. Biennial weeds

Require two seasons to complete their growth cycle. During the first season, they store food and their foliage is limited to rosettes. During the following season, these plants draw heavily upon their stored food and grow vigorously. They produce mature seeds in summer and fall before a killing frost does them in. Examples of biennials are common Burdock, Houndstongue and Musk Thistle.

C. Simple Perennial Weeds

Such as dandelions, possess large tap roots that store food in winter and a root crown that produces new shoots every year. Some perennials, such as Canada Thistle and Field Bindweed, spread by creeping horizontal roots that reproduce by seeds and roots.

D. Control methods

Vary with the type of weeds and time of year. As a general rule, maintaining turf in good vigor through appropriate fertilizer applications, watering and mowing can effectively exclude weeds. There are three basic methods employed in weed control:

1. Mechanical – Physical removal of weeds by hand-pulling, digging or cultivation.

2. Exclusion – Maintenance of a healthy, vigorous turf as a result of the proper cultural practices tends to "choke out" undesirable weeds.

3. Chemical Control – All chemical weed killers are herbicides and are toxic to all plants and animals. Their use in turfgrass relies on correct dosage that will selectively kill an undesirable weed and not harm the turfgrass. However, the dosage may damage or kill valuable ornamental shrubs and trees.

Mowing can limit seed production. If the weed is a winter annual, it will produce mature seed in early summer. If you begin mowing flower heads off in April, the problem should be cured by June. Annuals that produce seed all summer must be mowed from mid-May through August to control seed production.

It's time-consuming to remove annual weeds by hand, but -- if done before flowering -- this is an effective means of weed control. Hand removal of perennials, however, seldom is effective. Often a large part of the root remains in the soil, and it will quickly regenerate a top.

While cultivation can kill some weeds, creeping perennials often are the exception. Examples include quackgrass and bindweed. They can be spread by cultivation because their horizontal roots get chopped up and then sprout as new plants.

Before using any chemical, identify the weed, then read the label on the package. If the weed is not listed on the label, don't use it because no one herbicide will control all weed species. You may need to use a combination of two or more herbicides to control specific weeds.

Pre-emergent herbicides are recommended primarily to control grassy weeds, such as crabgrass or foxtail. before they germinate. Crabgrass is a summer annual that germinates from mid-April to mid-May along the Front Range. Apply a pre-emergent herbicide two to four weeks before these dates. Post-emergent herbicides kill weeds present at the time of application. Weeds must be actively growing when the herbicides are applied. Selective post-emergent herbicides, such as 2,4-D, 2,4-DP, MCPP, MCPA and dicamba, offer broadleaf weed control. If the post-emergent herbicide is systemic, the most effective time to apply it is late summer or early fall. That's when plants are moving photosynthesis materials rapidly to the roots, effectively carrying the herbicide to them.

Non-systemic or contact herbicides, such as crabgrass killers, provide a quick-kill but will not move into the roots. They are effective only on sprouting annual weeds. Mature perennials will re-grow after contact herbicides are applied. Because weeds are opportunists, you will need to quickly fill in their space soon after treatment. New weeds will quickly re-infest areas left open from recent weed kills.

IX. Turfgrass Disease Control

Most of the time turfgrass diseases stem from one basic factor: SOIL. That's why correct management, starting with good soil preparation, is the key to controlling most diseases in lawns.

Most soil in the Erie area is heavy clay. When clay becomes wet, it's very wet and when it is dry, it's about the same as concrete. In either situation, turf roots have difficulty taking hold. Roots tend to stay in the shallow zone, when the turf would benefit if they grew deeply. Over-irrigation and fertilization, combined with the poor soil, lead to thatch build-up. This combination can lead to lawn problems -- from winterkill to drought, disease and insect damage.

All turf diseases in Colorado are caused by fungi and all cause the grass to thin out and to appear patchy. To identify exactly what's happening, however, you need to get down on your hands and knees and inspect individual grass blades.

Common turf diseases, followed by a list of non-chemical controls that will help promote a healthy turf are as follows:

Ascochyta leaf blight occurs during cooler parts of the growing season and is particularly prevalent in areas that lack moisture (near side walks and driveways, on south-facing exposures and slopes). Symptoms begin at the tip of the grass blade. Blades will be straw-colored and, where healthy tissue meets dead, will be a definite pinch in the blade.

Leaf spot and melting out disease probably is one of the most common diseases of the lawn.

Leaf spot is the first stage- it occurs in spring or fall. Elliptical-shaped spots are surrounded by a dark purple border. Tissue in the center of the spot may turn straw-colored. If the spot extends across the leaf, the blades wither and die. As the disease progresses and temperatures warm, the fungus works its way to the plant's base and attacks roots and crowns. Basal tissues near the ground may become dark brown and rot. This is the melting-out stage, when grass gradually thins and "melts out" the diseased area.

Dollar spot occurs during warmer summer months. It appears as small circular spots (about the size of a silver dollar) in the lawn. Individual leaf blades (at the margins of the dead area) display a characteristic band across the middle. These straw-colored bands are pinched in the middle giving them an hour-glass shape. The straw-colored banded tissue on the blade might be bordered by darker-colored tissue between healthy and diseased areas.
Powdery mildew is prevalent in shady areas and areas that are sheltered from wind and air movement. The fungus appears on the leaf blades as a white talcum-like growth or substance.

The following list of non-chemical control methods will promote a healthy lawn and help prevent turf disease as well as other problems.

When renovating a turf area, till the soil as deeply as possible and improve soil conditions by incorporating organic matter.

Fertilize to meet the nutritional needs of turfgrass, but avoid over-fertilization that stimulates lush, succulent growth. Such growth is more susceptible to disease-causing fungi. One pound of nitrogen per 1,000 square feet should be sufficient.

Raise the cutting height of the lawn mower so grass is cut 2 1/2 to 3 inches. Keep mower blades sharp to reduce the area of open wounds through which fungi can enter.

Reduce excess thatch accumulation by aerating annually in spring and fall. Thatch is a layer of slowly decomposing grass stems, dead roots and debris that accumulates above the soil line and below the grass blades.

A thin layer of thatch -- one-fourth to one-half inch -- may benefit the lawn as it buffers soil temperatures and can help reduce soil compaction. When this layer reaches more than one-half inch, however, it stops water and fertilizer from reaching the soil. Turf roots begin to grow in the thatch rather than in the soil. Plants from these roots are less temperature-and-drought-resistant. A thick thatch layer also can enhance the build-up of diseases and an increase in Insects.

X. Management Of Dryland Turfs

A. Irrigation

After the establishment year, water-conserving, warm-season grass lawns usually can be maintained with no irrigation beyond precipitation. The quality of buffalo grass, blue grama or fine fescue lawns may, however, be enhanced with timely irrigation. In especially dry springs, when the turf begins to green up, irrigation will ensure a vigorous, dense lawn that is competitive with weeds.

The greatest benefit from supplemental water is gained in late July through August during the period of active stolon growth. Irrigation applied at this time helps the stolons develop roots

at the nodes, thus establishing new plants. Unfortunately, irrigation at this time will also promote weed growth. The period of time in which the turf exhibits a green color may be moderately extended in the fall with additional water if freezing temperatures do not occur.

B. Fertilizer

For optimum results, apply fertilizer between June 15 and June 30. This nitrogen stimulates new tissue and is available during the period of active stolon development in July and August. If fertilizer is applied to an established warm-season grass lawn, actual nitrogen levels should not exceed 2 lb. per 1,000 square feet per year. Additional applications of nitrogen may be required on poor soils.

C. Mowing

Because buffalo grass, blue grama and fine fescue are naturally short grasses that grow to 4 to 5 inches, mowing requirements are reduced. These can be mowed to 3 to 4 inches to remove the slender male flower stalks that develop above the height of the leaves. These turfs can be given a uniform appearance by mowing at a 3 inch height at four to six week intervals in late spring and two to three week intervals later in the season, depending on moisture. These lower heights will require more frequent, mowing and increased management to maintain quality.

The amount of supplemental water needed to maintain good stand quality is influenced by mowing management. Minimal mowing and higher cutting heights will allow grasses to maintain a vigorous root system. Removal of more than 1/3 of the leaf material will reduce root activity and growth, making plants more susceptible to moisture stress near the soil surface. Do not cut the grass by more than 1/3 its total height at any one mowing. Because of the aggressive stolon development, buffalo grass and fine fescue may require edging along walks, driveways, shrubs and flower beds.

D. Weed Control

Once established and properly managed, weed pressure in buffalo grass, blue grama and fine fesue is minimal. If herbicides are required, follow label directions explicitly. Plateau, Ronstar G, Dimension, Dacthal, Barricade, Pendulum and Surflan are preemergence products currently labeled for use in buffalo grass and fine fescue. Except for Dacthal, Barricade and Dimension, their use is restricted to certified applicators. A spring application for control of summer annual weeds, such as crabgrass, goose grass and spurge, should be applied when soil temperature reaches 50° F. A second pre-emergence application in late summer or early fall will control winter annuals, such as henbit, chickweed and annual bluegrass.

E. Dryland Turf Care and Management Summary

Requirements
Grows best in full sun
Good soil drainage is essential
Adapted to wide range of soil types
Not suited to sandy soils

Mowing

2-4 inches for lawns
Low maintenance areas may be mowed taller or not at all
Frequency is affected by amount of watering and fertilizer
Catching clippings optional

Watering
Deep soak once a month from July to September for higher maintenance areas
Soak soil before winter if soil is dry
Occasional or no watering for low maintenance areas

Fertilizing
June 15-June 30 is best; second application, if used, July-August
1-2 lbs actual nitrogen/1000 sq ft
Less on low maintenance and natural areas

Weed control
Avoid frequent watering, short mowing and over fertilization
Minimize early season watering
Avoid 2,4-D and related products in the spring, when temperature is above 90° F, and on first year turf
Control broadleaf weeds in the fall

Insect/disease
Follow good maintenance and cultural practices control

SECTION 2: MAINTENANCE OF WOODY PLANTS

I. Irrigation Of Woody Plants

A. Introduction

The most important factor in proper watering of woody plants is to apply enough water to ensure a minimum of 8-10" soil penetration of moisture. This may require approximately 2" of water applied around the plant root zone. Depending on the water requirement of a particular plant, it may need this amount of water every week or every other month. Shallow watering must be avoided. Check moisture sensors or occasionally dig into the subsoil to verify that moisture penetration is adequate. The location of a tree in the landscape can determine its water needs. If it is planted a highly exposed location with southern exposure, it will require more water than if planted in a shaded area. Also, trees planted in concrete areas or next to buildings receive more solar radiation and will dry out sooner.

1. As a general rule, woody shrubs and trees require deep-root watering approximately once a month, year round. Groundcovers and vines generally have a greater water requirement, especially during hot weather.

2. Use of a "soil needle" or root feeder is the best method for applying irrigation to woody plants. A slow running hose, or "trickle" irrigation system, is second best.

3. It is important to avoid "'irrigation conflicts', such as mixing of water-loving versus drought tolerant species in the same planting, pinyon pines in bluegrass turf, etc.

4. If water restrictions limit irrigation of the landscape, priority must be given to woody shrubs and trees; bluegrass lawns can be renovated even after significant drought damage, but injury to woody plants can be much more permanent. Lawns can be replaced at a lower cost than trees or shrubs.

5. Consistent soil moisture is essential and allows for better root absorption. Water deeply and slowly. Drought-stressed trees or over-watered trees are more vulnerable to disease and insect infestations as well as branch dieback.

6. Utilize the following “rule of thumb” for watering: Apply 10 gallons of water per inch of tree diameter. (1” tree = 10 gallons) For mature trees 10” in diameter or larger, apply 15 gallons of water per inch of tree diameter.

B. Seasonal Requirements

The watering needs of woody plants should be accommodated regardless of the time of year. Particular times of the year that require special attention are as follows:

1. Late Summer – In late August, begin preparing trees and shrubs for winter to prevent injuries from early freezes. Taper off watering, so late growth is encouraged to "harden off' as soon as possible. Gradually reduce the frequency of deep watering. Care should be taken not to withhold too much water to the detriment of the plants.

2. Winter preparation – Prepare woody plants, especially evergreens, for winter by watering before the soil freezes. With deciduous trees, perform this task after leaves begin to develop their fall color. Check mulch cover at this time and provide supplemental mulching to help retain water and regulate flux in soil temperature. Soak the soil before the ground freezes so that the plants go into winter with adequate moisture.

3. Winter Watering – Deep root water all woody plants once a month during a dry fall and winter. The purpose of deep-root watering is to prevent winterkill or winter-burn, which is simply the dehydration of the plant. Apply water to woody plants any month that snow or rain does not provide at least one inch of precipitation (about 8-10" of snow) during the months of November through March.

Winterkill occurs during periods of very dry weather and low atmospheric humidity. It may affect only a few branches or it may be extensive enough to kill the whole plant. Winter dieback usually begins at the top and progress downward. If the "leader" of a tree dies back, the tree may need to be replaced. Dryness and high velocity winds can combine to create disastrous situations for shrubs and trees.

Special attention should be given to all evergreens since they continue to use water through the colder months and have they greatest amount of surface area exposed. Deciduous plants can lose a great deal of water from bark area on trunks and twigs even though they are basically dormant in terms of water movement,

The best way to prevent winter kill is to provide a good supply of subsoil moisture in the plant root zone. Before watering, check the subsoil to determine if watering is necessary. If

watering is needed, wait for a warm afternoon when the temperature is above freezing and the soil around the plant root zone is not frozen. It is most important to put the water down deeply to a minimum of 18" because subsurface moisture may be depleted.

C. Supplemental Watering Methods

The most efficient method to apply water to woody plants is to distribute it directly into the plant root zone. The following methods can be used:

1. Drip irrigation – Drip-irrigation distributes water in low pressures and low volumes at the root zone. These systems can be altered by timing and number of distribution points to provide adequate water to plants with a wide variety of watering needs.

2. Hose – A hose set at the base of a shrub or tree that runs with a pencil size stream will thoroughly saturate the plant root zone. This may need to be left on for several hours to supply the necessary amount of water.

3. Spray heads – A very inefficient method is to distribute the water by a spray head that throws a fine spray over a prescribed, geometrically-shaped area. With this application, it is difficult to achieve an even coverage without over watering.

4. Soil Needle – Probably the most efficient and yet labor-intensive way to water woody plants is with a soil needle or root feeder. This is especially useful for winter watering when the sprinkler system is turned off.

II. Soil Cultivation And Mulching

A. Cultivation

Cultivation opens the soil surface for greater air circulation and water penetration. By loosening the soil particles weedy growth is killed by uprooting, and materials on the soil surface are mixed with soil particles in the subsurface.

1. Method – Cultivation can be done by hand with a shovel and hoe, or power tiller, which is more appropriate for vegetable or flower gardens. Care should be taken not to overwork the soil, especially with a mechanical tiller.

2. Timing – The soil in the vicinity of woody trees and shrubs should be cultivated when:

a. Compacted soil or poor water absorption is noted.

b. Poor or high-alkaline soils warrant the incorporation of organic soil amendments or fertilizers.

c. Turf has been removed.

d. Preparing for deep root watering.

B. Mulching

Cultivated areas should be mulched as described below:

1. Benefits of mulching are such that all plant materials should be kept in a mulched condition throughout the year. Mulch cover in all tree and shrub areas should be checked continually, and especially in November and again in February when the benefits of mulching are critical. Tree wells should be installed and maintained to help conserve moisture and prevent mechanical damage from mowers or weedeaters. Tree wells should be sized at a 2' radius where possible.

a. Adequate mulch cover in late fall will hold moisture in preparation for winter, and regulate extremes of soil temperature, preventing late flushes of growth in warm fall weather and subsequent frost damage.

b. Mulch cover in the late winter will prevent early growth and subsequent frost damage.

c. If mulch is already present, check its depth. Do not add more mulch if a sufficient layer is already in place. Rake the old mulch and rough it up to improve appearance, drainage and compaction.

d. Light mulches of finer texture should be used in areas of woody groundcovers. Broadleaf evergreens, as well as such tender or marginal plants, should be mulched more heavily in the winter if exposed to drying winter sun and wind.

Because organic mulches contribute to nutrient cycling, organic mulches are preferred to inorganic materials.

Apply a 2 – 4 inch layer of mulch over well-drained soils. Use a thinner layer on poorly drained soils.

The wider the mulch ring, the greater the benefit. Mulch out to the tree's dripline when possible.

Do not pile mulch against the tree trunk. Pull mulch several inches away from the trunk of the tree so the base of the trunk and root crown are exposed. The mulch ring should resemble a doughnut, not a volcano.

An improperly mulched tree can actually harm the tree, setting the stage for insect and disease problems, root rot, and excessive soil moisture.

III. Fertilization Of Woody Plants

Fertilization of woody shrubs and trees should be based on the nutritional requirements of the individual species. The clay soils of the Erie area are sufficiently fertile for most woody plants. Fertilization should not be done without a soil test to determine which essential elements are deficient, if any. Most of Colorado soils naturally have a high phosphorus and potassium content. The limiting factors are soil pH and soil texture. High alkalinity (high pH) limits the ability of a plant to take in certain nutrients, especially iron. Compacted clay

soils can physically limit the ability of plant roots to take in nutrients by limiting movement in the soil and denying them moisture and oxygen. Trees growing in turf that is routinely fertilized or where grass clippings are returned to the soil may not require supplemental fertilization. Consideration must be given to amount and rates of fertilizer applied to turf to avoid damaging effects such as fertilizer burn, etc.

Fertilization of woody plants is necessary for the following reasons:

To promote and enhance vigor and appearance.
To promote blooming of flowering trees and shrubs.
To increase fruit.
As a measure to help outgrow certain plant diseases.

A. Time of Application

1. Nitrogen is the key element for plant growth and should be applied at least every two to three years. Application of phosphorus and potassium every three to five years is adequate for satisfactory growth. A combination of slow and fast release materials is best.

2. Avoid fertilization in late winter/early spring. Wait until possibility of frost or snow damage has past.

3. Fertilize no later than early summer (July) and avoid, late summer or early fall fertilization with a high nitrogen fertilizer followed by liberal watering. Deciduous trees and shrubs should not go into winter still actively growing. Plants still actively growing late in the fall, are more prone to winter injury than plants that are dormant or semi-dormant before freezing weather begins.

4. If fall fertilization is done, wait until October or at least until leaves are beginning to drop and fall color is showing, so that new growth is not stimulated. If done properly, and in moderate rates, fall fertilization is beneficial to plants.

5. Fertilization of plant material is not needed nor recommended the first year after planting, and should be avoided in general because of the possibility of burning tender roots. First year fertilization is not recommended because fertilization promotes shoot growth and the goal of newly transplanted trees should focus on promoting root growth.

B. Methods of Application

1. Root Feeding – Root feeding involves boring a series of holes around the plant approximately with in the limits of the drip-line. These holes should not exceed 18" in depth. Minimum depth should be 8". Use an auger or soil needle and start application one foot from the base of the trunk for small trees (2 '/2' for larger trees). Stagger holes 18" apart (24" for large trees) and locate them in a circular pattern to just past the crown spread of the branches. If the area beneath the spread of the branches is restricted (i.e., building wall, walk or drive) reduce the application in proportion to the number of holes that cannot be made. Holes shall be filled with one part composted organic material and one part sand. Any excavated soil should be removed from the site.

Use a slow-release planting tablet such as AgriformT1 Planting Tablets, effective for two years or more, or a slow-release granulated fertilizer recommended for trees and shrubs, such

as Agriform 16-7-12 + iron. Follow manufacturers' recommendations on dosage.

Quick-release, water soluble fertilizers, such as Ross Root Feeder capsules or Ra-Pid-Gro will provide short-term feeding only (less than one season). Do not make root applications of fertilizer in solution into heavy, wet clay soils.

2. Surface Feeding – Surface feeding is easy to accomplish with less labor and cost. Use a slow-release, granulated fertilizer recommended for trees and shrubs, according to manufacturers' recommendations. Incorporate into mulch o r topsoil. Surface feeding will d o little good if the tree or shrub is not properly watered at the surface to carry nutrient down to the root zone.

3. Foliar Feeding – Foliar feeding involves spraying water-soluble fertilizer directly on the plant foliage, and can be done with a hose sprayer. It generally provides short-term results, but may be of use to apply chelated iron for symptomatic relief of iron chlorosis.

4. Iron Chlorosis – The major concern thus far has been with the major nutrients - principally the nitrogen requirements- of the woody ornamentals. Generally, few of the minor elements are limiting to the growth of most woody species. However, an exception is true with high-pH soils. Iron chlorosis can develop in many species grown in such soils. Common examples are maple and Pin Oak. Iron chlorosis is generally thought to be due to low solubility of iron in high-pH soils. However, damage to root systems such as that caused by the low oxygen levels in waterlogged soils may also cause chlorosis symptoms (interveinal yellowing of leaves). Drought conditions may accentuate chlorosis, as well as a lack of certain nutrients other than iron. Soil testing can determine nutrient levels.

There are several solutions to iron chlorosis and generally these can be classified as permanent, semi-permanent, and temporary. A permanent solution is to correct the problem of high pH in the soil before planting. The area treated should be large enough to allow for the future lateral root development of the plant.

Lower pH can be accomplished by incorporation of an acidic soil amendment such as peat moss, or the use of sulfur and acidic fertilizers. In alkaline soils, changing soil pH at a depth of 18-24" with fertilizers in nearly impossible. In those soils, the tree should be fed by the deep root method, with ferrous sulfate (iron sulfate) and sulfur. Chelated iron may be used in place of ferrous sulfate. Chelated iron may give more satisfactory results in any kind of soil, if used in a soil injection or in a deep-root feeding, than it will if applied at the soil surface. The response of these techniques is slow but fairly long-lasting. Foliar sprays of chelated iron provide quick, short-term relief (less than one season).

Sometimes a tree has declined greatly because of iron chlorosis to such an extent that a quicker response is needed. Trunk injections of ferrous sulfate or capsules containing iron chelate, such as "Medicaps", can provide a response within three weeks. The treatment may last for up to five years. At the same time, soil treatments should also be made.

IV. Plant Protection

Weather and urban landscape conditions contribute to the need for plant protection. The hot winter sun, and the sudden and erratic temperature changes cause the majority of injury to plants Other damage may be due to snow, accidents, mowers or vandalism.

The following describes the most common problems:

A. Sunscald

Sunscald occurs on the southwest side of the sapling tree trunks with smooth, thin bark such as linden, honeylocust, redbud, green ash and maple. It is most prevalent during late January through March. Prior to mid-January, the tree is in full dormancy and is not normally affected by sudden temperature changes. About mid-January, many trees and shrubs are capable of coming out of dormancy on days that are clear and warm.

Sunscald occurs because the sun is at a low angle and warms the bark, causing the cells beneath the bark to become active. At night, the temperature may drop below freezing, subjecting active cells to freezing.

Signs of sunscald are discoloration of the bark and shrinking or cracking in long streaks on the south to southwest side of the tree trunk. Normally, the signs don't appear until the summer, several months after the occurrence of the desiccation.

Prevention of sunscald is accomplished by protecting the trunk from the warm winter sun by wrapping the trunk with a commercial tree wrap material which will insulate the tree trunk against sudden changes in temperature. The general rule for time of application is “on at Thanksgiving, off at Easter”. The proper procedure for placing commercial tree wrap on the plant is to start at the bottom of the trunk and wrap up to the first branch, slightly overlapping each layer. Tree wrap, to be effective, should be in place after about mid January through the month of March. After this time, the tree wrap should be removed, to prevent advent of injurious insects and diseases. Trees should normally be wrapped for two winters or until the caliper of the tree reaches 3-1/2 inches. By this time, the tree trunk should have developed a protective bark.

B. Winterburn & Desiccation

Winterburn is caused by desiccation and is common when fall and winter precipitation is lacking. Dry winds and a warm sun cause water to be lost from leaf and stem cells faster than can be replaced from the roots. This causes the cells to die and plants to wilt. This is especially severe in the winter during sudden periods of bright sun coupled with warm, drying winds. Desiccation is most severe on dry sites with exposure to wind and sun and a high rate of surface run-off.

Evergreens are much more susceptible to winterburn, because of the large amount of foliage surface. Spraying the foliage in late fall with an anti-desiccant to reduce water is of limited use. The best prevention is good winter watering.

C. Mechanical Damage from Mowers & Weedeaters

Damage to trees may result from careless operation of mowers and weedeaters. Proper installation of a tree well can help to prevent mechanical damage to trees. Extra care should be taken when operating equipment around the base of a tree.

V. Weed Control in Tree and Shrub Areas

A contact herbicide may be considered in bed areas where non-chemical means of control have been unsatisfactory. The principal dangers involved in the use of such herbicides are:
Safety to humans and animals during and after application;
Damage to valuable plants by direct contact (spray drift, etc.);
Handweeding is preferred to prevent long-term residual effects of herbicides in the soil.

Certain pre-emergent herbicides will provide good control of annual weeds, but are inefficient on perennials. Those chemicals which are sufficiently powerful to kill tougher weeds also risk contamination of soil in the root zone of valuable plants. An exception is the glyphosphate herbicide called Roundup. Roundup degrades almost instantaneously upon contact with the soil, and can be carefully applied directly around the roots of valuable ornamental plants with no ill effects. It is an extremely powerful, nonselective trans-locating herbicide which will control virtually every undesirable weed which may be encountered.

VI. Infectious Disease Prevention and Control

Plant diseases and pest problems can seriously damage or even kill valuable landscape plants if allowed to progress unchecked. Any abnormal condition which adversely affects plant processes, appearance, vitality or growth characteristics can, in general, be called a plant disease. Causal agents are as follows:

Fungi, bacteria, virus, etc. (infectious)
Insect, mite, nematode, etc (pest)
Unfavorable (to the plant) environmental conditions (physiological, cultural)

In common usage, the term "disease" ordinarily refers to an infectious disease, such as Dutch Elm Disease (D.E.D.), a fungus, or Fireblight bacterium. Also, the term "pest" can apply to any organism or "pathogen", including fungi.

A. Inspection and Diagnosis

Plant diseases are generally classified as pathogenic (caused by a parasitic organism) or non-pathogenic (physiological). Diagnosis is usually based upon changes in the plant that are visible to the naked eye.:

1. A "sign" is direct evidence of the causal agent, i.e., the actual insect, spore bodies of a fungus, bone-dry soil, etc.

2. "Symptoms" are the apparent results of a problem as seen in the plant, i.e., wilting leaves, blackened twigs, cankerous bark, skeletonized leaves, poor growth, color, vigor, etc.

The difficulty in diagnosing a disease problem is that these symptoms may have more than one cause. Sometimes it is possible to identify a pathogenic disease because there are signs of the disease along with symptoms. Such cases are very simple to diagnose but unfortunately, the "signs" of a disease are not always present. In fact, they are only present under certain conditions brought about by rather exacting environmental conditions.

B. Control Measures

May become much more difficult or even ineffectual in advanced stages. It is therefore a good investment of time and effort to conduct regular weekly inspections of plant material to check general health and vigor, and to catch possible problems before they become serious. Diagnosis is merely a matter of narrowing down the possible causes of the problem to the point where a qualified specialist can recommend a control. The most basic analysis would begin as follows:

1. Is the plant receiving proper care? i.e. (Cultural practices- watering, drainage, mulch, soil cultivation, plant protection, pruning, etc.) Make a list of past cultural practices. This is almost always a significant contributing factor, if not the direct cause.

2. What is the general appearance of the plant? Does it seem to have normal shape, color, and character?

3. Check the "growth increments". Measure back along a stem from the tip to the nearest "bud scar" or "bundle scar" where last year's buds were set. This tells you how much the plant has grown (or is growing) this year. Measure back another increment or two and compare. This gives a general indication of the plant's vigor over the years. You may be able to determine when the plant was transplanted, or when it endured a drought year, etc. A plant of declining vigor warrants closer examination.

4. Call the local specialist for confirmation of diagnosis. There are a few problems that cannot be diagnosed correctly (that is if there is enough information on which to base a decision). Seeing a problem in the field is one thing and observing a few leaves in the laboratory is another. When it is necessary to send or bring a sample to anyone, follow these suggestions:

a. Send a fresh sample; wrap in plastic for best results;

b. Collect diseased or injured parts as well as some healthy parts. Send more than you think is needed.

c. Try to get a sample of the cause or signs of the trouble as well as the symptoms. For example, nematode injury has leaf symptoms, but the problem is below the ground. A sample of soil is needed in this case.

d. Send along a statement of all you know about the possible causes. Include name of plant, age of plant, when set out, use of fertilizer, and other facts as listed above.
Perhaps not all this information will be needed, but if you don't know the problem, you can't tell what information is needed. Send it all to be sure.

Once a problem is correctly identified, the treatment needed to correct the problem can be easily prescribed.

C. Non-Chemical Control

It is estimated that some 90% of the infectious disease problems of ornamental landscape plants can be prevented or controlled without the use of chemicals. The dry Front Range

climate is not conducive to disease organisms, and the incidence of disease is less frequent here than in areas of the country with more plentiful rainfall and higher humidity.

D. Chemical Control

Nearly all chemical controls for infectious diseases in trees and shrubs are preventative in nature. That is, they lay down a chemical barrier which prevents the further spread of the disease, or may prevent the organism from entering a particular plant. An exception to this is the use of Benlate (Benomyl) in the treatment of cankers in such trees as cottonwoods, aspen, and honeylocust. This chemical will kill the canker fungus.

E. Preventative Maintenance

A program of preventative maintenance is very effective in the control of infectious diseases:

1. Proper Cultural Practices
   a. Watering – avoid frequent, shallow waterings and foliar sprays
   b. Wound repair – damage by wind or hail storms, sunscald, lawnmowers, etc., provides a point of entry for disease organisms
   c. General good health and vigor – healthy trees and shrubs are less vulnerable to attack.

2. Sanitation/ vector control
   a. Some disease organisms will over-winter or expand their numbers in debris.
   b. Insect vectors carry and spread certain diseases; Dutch Elm Disease and Blue Stain Ponderosa Pine are both fungal diseases spread by beetle vector.

F. Summary

1. Weekly (no less than biweekly), inspections of plant materials are recommended throughout the growing season (April to September) to prevent serious damage from disease and pests.

2. Proper diagnosis/identification of a disease or pest problem is absolutely mandatory before chemical controls are instituted.

3. Persons conducting regular inspections need not be highly trained pathologists; the following sections are intended to equip a conscientious individual with sufficient reference material to "narrow down" the possible cause of the problem to the point where the final diagnosis/identification can be made by your local County Extension Agent or Cooperative Extension Service. Recommendations for control of disease/pest relate problems should always be obtained from these or other qualified services.

4. Consultation/recommendations by you County Extension or Cooperative Extension Service is available free of charge.

5. Be sure to keep records of all pesticides applied.

VII. INSECT PREVENTION AND CONTROL

A wide variety of insect pests attack ornamental trees and shrubs in the Erie area, causing severe or fatal damage. Other pests are less damaging, and some are actually beneficial.

Insect pest control programs for ornamental landscapes ordinarily fall into one of the following categories:

1. Regular preventative spraying service made by a commercial applicator.

2. Regular inspection and identification of pest problems, with appropriate chemical or non-chemical control measures.

Preventative spraying by commercial applicator may be advisable in a number of situations, (i.e., large numbers of very tall trees). However, it cannot serve as a panacea for all disease and insect related problems in the landscape. In some cases, such programs kill off the natural predators of harmful insects. In any event, weekly inspections as outlined earlier in this section are recommended.

A. Non-Chemical Control

Prevention of insect damage through proper cultural practices cannot be overemphasized:

1. Watering – Trees and shrubs under drought-stress are more vulnerable to successful attack by insects.

2. Sanitation – Many insects overwinter or propagate in debris, infested or dead plant material.

3. Plant protection – Untreated wounds, sunscald damage, etc. provide entry or shelter for insects.

Specific non-chemical control measures are often available for effective control of pests, such as blowing spider mites off a plant with a strong stream of water. Such non-chemical measures should be evaluated, along with chemical controls, for effectiveness, safety, and expense before a final decision is made on the method of control. In discussing a pest problem with an extension agent or qualified specialist, be sure to ask "What non-chemical control measures are available for this problem?"

B. Chemical Control

Restraint is in order and proper diagnosis and identification is critical before chemical control is considered. Recommendations for specific chemical controls should be obtained from a qualified specialist and are beyond the scope of these guidelines. Some facts to keep in mind:

1. Pesticide availability and use is dependent upon EPA regulations. Many chemical formulations are periodically withdrawn and/or reinstated for a particular use.

2. Toxicity of chemical varies; many pesticides available to the general public are extremely poisonous. Safety precautions, including protective clothing and care i n application, are very important.

3. To be effective, timing of application must coincide with the vulnerability of the target pest. Your County Extension Agent will be familiar with the life-cycle and vulnerability of an insect for purposes of control.

4. Insects may build up resistance to certain chemicals over a period of time. It is important to keep a record of past control methods, and to seek the most current recommendations.

5. Specific recommendations may vary according to "micro-environment", local climate, etc.

SECTION 3: PRUNING

Pruning ornamental trees and shrubs is an art and is both necessary and extremely beneficial to landscape plants. Yet improper techniques can result in injured or badly misshapen plants.

It is best to inspect the trees, shrubs, and other plants regularly and prune them at the optimum time of year. This small amount of care can improve their appearance, guard their health, and make them stronger. This approach is preferable to one that consists of only repairing plants as after a storm or giving a regular "trim" every season. Pruning regularly can easily correct defects that would require major tree surgery later.
Purposes for pruning deciduous shade trees include:
Promotes good branch structure and encourages the tree to develop its natural shape and character.
Improves overall health by removing dead, diseased, and dying branches.
Reduction of the general size and/or density of the tree.
Reduces potential hazards and future breakage
Can correct poor branch structure.
Creates the opportunity to examine the tree more closely on a regular basis.

I. PRUNING METHODS

A. Barrier Zone

As trees grow, they form natural barrier zones at the base of each branch. Should storm damage or pruning occur, these barriers protect the tree from invading organisms such as decay and cankers. This barrier zone is not at the exact point where the branch and trunk appear to join when viewed from the outside. The barrier zone actually is a short distance (usually less than 1 inch) away from the trunk. Thus, when a branch is flush cut, the natural barrier zone is removed.

To identify the barrier zone, look closely at a branch. Near its base, there is a distinct swelling or collar, and often a ridge of bark that is distinct from the bark areas on either side. This ridge varies according to the angle of the branch as it is attached to the stem. The barrier zone is located in the collar area outside of the branch bark ridge. Always cut just outside of this collar to preserve the barrier zone. Some trees do not have a distinct collar and ridge that completely circles the branch. In these cases, locate an area on the branch that is distinct and make your cut at a right angle to the branch.

Depending on the tree type, this procedure may leave a knob or slight stub. Do not, however, leave stubs beyond the collar. Such stubs will die back and allow decay organisms to get a foothold to enter the tree.

B. Techniques

1. Disinfect – When moving from plant to plant, tools are to be disinfected with alcohol after each cut and between trees.

2. Not All Branches Are Branches – Most trees have a central trunk, but this trunk often divides into several stems that appear to be branches. These are referred to as codominant stems. If a stem cut must be made, always cut outside of the bark ridge. Avoid removing stems, where possible, because there is no natural barrier zone where two or more stems join. Organisms have an easier time invading such cuts. Pruning out codominant stems also tends to promote weak sucker growth (water sprouts). Avoid topping or pollarding any tree!

3. Large Branch Removal – When removing large branches, first make an undercut several inches outside of the collar. Next, remove the limb with a second cut an inch or so outside of the undercut. This removes the limb weight and prevents stripping of the bark when the limb falls. Make the third cut just outside the collar, as described above.

4. Wound Dressings Not Useful – Wound dressings have been shown to interfere with the natural development of callus tissues that eventually close the pruning wound. In some cases, wound dressings can even harbor disease organisms, much like what occurs when a band-aid is left on a skin cut too long. It is far more important to make the cut smooth, outside of the collar and allow the wound area to dry.

5. Procedure

a. Be familiar with the "ideal" natural form and character of the particular species to be pruned. Avoid attempting to force a plant into a form incompatible with its normal habit.

b. Remove any dead, dying, diseased, damaged or dangerous branches. Cuts should be made either to the trunk, or d rop-crotched to a point where a new leader can take over.

c. Stand back from the plant and determine the natural pattern of the tree. Such an assessment should be made frequently through the pruning process.

d. Remove all sucker growth, which is abnormal growth of small branches not following the general pattern of the tree.

e. Remove one of all crossed, conflicting, or rubbing branches in such a manner that the removal will not leave large holes in the general outline of the tree. Remove all but one of the branches growing from the same point on the parent stem or trunk. Determine which branch will contribute most to the tree shape.

C. Pruning Practices to Avoid

1. Avoid damaqinq the top leader on a sinqle-stem plant. This will result in a multiple top and ultimately destroy the natural shape of the plant. Multiple-topped evergreens also are more prone to storm damage from the weight of heavy snows.

2. Frequent light shearing of upright evergreens like junipers is not recommended except to obtain a formal effect. Frequent shearing encourages dense growth on the perimeters of the plant. This growth shades out the growth on the inside. When a branch on such a plant is damaged by a storm, a large and obvious gap results. Repair of such damage is often slow and difficult.

3. Do not plant vigorously growing evergreens like the Pfitzer juniper close to the

foundations of a house, in front of a low picture window or anywhere where frequent pruning is necessary for control. Pruning to correct size in this instance is only a temporary and unsatisfactory method of control.

4. Except in the case of formally clipped plantings and hedges, shearing of outer perimeter branches is to be avoided. Limbs generally should be removed all the way to the main trunk (or ground), or should be" drop-crotched" to a new leader, or in the case of very small branches, to the point just ahead of a viable bud.

5. Do not paint new cuts with a tree wound dressing as they may "trap" organisms or disease.

D. Pruning Evergreens

Many types of evergreen shrubs and trees need little or no pruning to keep them in prime condition. Some of the more vigorously growing evergreens, such as the Juniper, may require moderate, periodic pruning. Frequent pruning may be necessary to keep faster growing plants in bounds and to prevent them from interfering with a walk, driveway or view. Consider replacing such plants with a slower growing type or one of a different growing habit.

1. Broad leaf types, such as the Oregon grape holly, should be pruned little, if at all. If pruning is necessary, prune lightly just after bloom (late spring). Occasional corrective pruning to remove unwanted shoots may be done almost any time, providing the cut is made just above a side branch.

2. For narrow-leaf needle trees or shrubs, such as pines, spruce and fir, prune according to growth characteristics. Prune those that produce side buds on the shoots, such as spruce, fir and Douglas-fir, by cutting the tips back to the desired length in late winter or early spring when buds are dormant. Cut just above a side bud or side branch (see Figure 1).

3. In plants which produce few side buds, such as pines, pruning may be accomplished by pinching or snapping off with the fingers a portion of the young growth "candles" that form in late spring and early summer. The proper time to prune is when the candles snap off easily and cleanly. Avoid cutting these plants with a knife or shears. This invariably injures some of the needles and later gives the plant a general brown appearance.

4. Plants with scale-like leaves and no definite buds, such as junipers and arbor vitae, may be pruned at anytime except during sub-zero weather.

5. The optimum time for using hedge shears to prune an upright evergreen is just prior to the new growth in spring and again in late June or early July. Cutting marks will be covered up by the flush of growth.

6. Do not use hedge shears on spreading evergreens like the Pfitzer juniper. To obtain a natural look on this type of plant, prune to an upward growing branch or bud. Careful pruning will allow the remaining lateral branch to hide the pruning cut.

E. Pruning Deciduous Shrubs

Single-stem or tree-like shrubs are to be pruned in accordance with the procedures described for deciduous shade trees. All other deciduous shrubs, except formal hedges, should be pruned by a thinning or "renewal pruning" method. This is especially appropriate for shrubs

that may become too "leggy" and crowded with large canes such as lilacs, honeysuckle, viburnum and others. By properly thinning and spacing the canes to allow more light to penetrate, the shrub will develop better foliage, thus making the plant healthier, as well as prettier. Removal of older canes will also promote better flowering, since younger canes are generally more profuse. Certain shrubs with colorful bark, such as red-twig dogwood, require thinning out of the older growth to enhance the ornamental effect as only the young growth has the red colored bark.

1. Be familiar with the natural character of the shrub species to be pruned, i.e. arching, compact, spreading, etc.

2. Remove all dead wood, dying, diseased, objectionable and weak branches. Always cut the canes either all the way to the ground, or use the drop-crotch methods.

3. Cut out a small amount (no more than a third) of the older, heavy stems. Cut these at the ground level without damaging the younger stems that are to remain. This is done each year so that within 5 or 6 years a whole new top may have developed. Stand back between cuts, noting the natural general pattern which the plant is assuming.

4. Remove some of the sucker growth which may occur at the base of the plant (ground) picking a few of the more vigorous shoots to remain and "renew" the shrub as they grow.

5. Fine pruning can now be done to remove rank growth, crossed or conflicting branches, etc.

F. Hedges Or Formal Plantings

Shearinq is only appropriate in forminq hedqe type qrowth. When used on other plants it usually ruins the natural shape and eliminates most of the bloom. Also, by shearing the tops of plants, you will tend to make the plant branch heavily near the top, causing it to shade itself out, resulting in a "leggy" look.
Prune out any dead wood early in the spring, then shear to desired height when new growth extends. Shape the top of the hedge narrower than the base. Most hedges will keep the foliage longer and fuller in this manner because more light can reach the lower parts of the hedge. Frequent shearing (at least once annually) will promote dense growth and avoid large holes or voids in the peripheral foliage pattern.

II. PRUNING EQUIPMENT

Basic tools for pruning are hand clippers, pruning shears, lopping shear and a pruning saw. Proper pruning equipment and care is as important as pruning techniques.

A. Hand Clippers

Can be used for cutting twigs and small branches. It is best to buy one with a carrying sheath and to avoid cheap steel. The choices are anvil type (snap-cut) type or scissor-type. A well-constructed anvil-type is serviceable, but has one big disadvantage over the scissor-type- it cannot be sharpened without adding to the height of the anvil or cutting block. Scissor type pruners can be sharpened and readjusted time and time again. A disadvantage of the scissor type is the spring on the blades. This is usually brought about by misuse of equipment.

B. Pruning Shears

Similar to large scissors, are used for shearing foliage on hedges and similar formal plantings. Again, avoid using those of cheap steel.

C. Lopping Shears

Are the most important tool for shrubs. Avoid cheap models made of cast, unexpired metals. These will soon dull and become sprung. Some prefer the type which has "jack action" or "slip-lock" action. This type is more versatile than the conventional lopper in that the jaw can be adjusted to cut canes up to 2" diameter without losing mechanical advantage in cutting power. If you will be doing a lot of cutting, purchase loppers that also have rubber handle grips for your comfort.

D. Pruning Saw

Used for larger cuts. Pruning saws have coarser teeth than carpenter saws. They are not as likely as carpenter saws to bind when cutting green wood and the teeth are designed to cut on the pull stroke. This is an advantage over push cutting carpenter saws for operators working from a precarious position on a ladder or a tree limb.

E. Pole pruners

Pole pruners and a pole saw allow the trimmer to reach high parts of the trees while standing on the ground.

Keep all cutting tools sharp. T o prevent spread disease and decay organisms, disinfect all tools with denatured alcohol after pruning each tree.

For pruning the tops of all tall trees you will need ladders and safety ropes. Before working in tall trees, however, consider getting professional help.

III. TIME OF PRUNING

Most trees and shrubs can be pruned at any time of the year without causing any harm to the plant. There are, however, times in the year that are better to prune and trim when considering ease of accomplishing the pruning work and the effect on the blooms and fruit of the plant. These generally depend on the plant type, time of bloom and growth characteristics.

A. December to mid-March

This is the dormant period and is the best time to prune the majority of all plantinqs. On deciduous trees and shrubs, you can better see the branching structure. Don't prune anytime the temperatures are extremely low (below zero).

Don't prune back the tips on any spring flowering trees and shrubs because you will be removing the flower buds for the coming year. Use a thinning method of pruning which results in the removal of a minimum amount of flower buds while still achieving the intended goals.

Plants with scale-like leaves, such a junipers and arborvitae, which require shearing for a hedge or formal shape, can be done at this time, but wait until just before new growth.

B. June 1 to June 15

At this time of year, most plants considered to be early or sprinq flowerinq have completed their flowering period. These plants are now in the process of forming the flower buds for next year's show. By the latter part of June, most spring flowering trees and shrubs have already formed their flower buds. Therefore, any pruning of these types of plants after this period may severely reduce the quality of the bloom for the next year.

SECTION 4: MAINTENANCE OF FLOWER BEDS

I. Soil Preparation and Amendments

A good flower garden can not be grown in poor soil. Most important is the subsoil drainage and aeration. The soil must drain well and be porous in order to get a good show out of the garden plantings. Before planting any flower garden, determine the condition of the existing soil. A good way to do this is by testing the soil. Add a sufficient amount of amendments to the soil to bring the soil condition to the optimum level.

The amendment can be incorporated into the soil by hand with a shovel and a hoe, or some mechanical means such as a power tiller. Care should be taken not to overwork the soil, especially with a mechanical tiller. The soil aggregates (granules) are formed by gummy substances "gluing" together the various particles present in the soil. These soil aggregated are very fragile and the soil structure can easily be destroyed by working a soil in a wet condition or by over-cultivation.

The best time to prepare soil in a flower bed depends on the type of garden flower.

II. Planting and Growing Fall Bulbs

September and October are the best months for planting bulbs because they can become well rooted before the ground freezes. Bulbs planted after October may not have time to root adequately and therefore may not flower uniformly in the spring.

Plant the bulbs at a depth consistent with the level indicated on the planting chart. As a general rule, this depth is four times the height of the bulb between the soil surface and the tip of the bulb. Plant bulbs with the growing tip up.

After the ground freezes, cover the bed with a 3-inch mulch to prevent alternate freezing and thawing that breaks roots and damages bulbs. This mulch may be removed in April before the shoots emerge, or left in place if the shoots can penetrate it easily.

Remove flowers as soon as they wither, because seed production diverts food that otherwise would be used to produce more vigorous bulbs. Apply nitrogen at the rate of 1/4 pound per 100 square feet before the foliage withers. After the foliage has withered completely, the bulb is dormant.

The bed usually is not dug up after the first year. However, after the second year, the

developing bulbs begin to crowd and lose much of their original vigor. When this occurs, dig the bulbs in late August and allow them to dry for a few days in a shady, cool spot. Divide and replant only the best ones, preferably in a new location. If none of the bulbs is as large as the original ones, purchase new bulbs for better results. This is especially true of hyacinths, which are seldom worth transplanting.

When the bulb bed occupies a prominent place in the yard, many growers remove the bulbs after flowering, replacing them with annuals for the summer. It also is possible to interplant annuals among the withering bulb tops. However, do not remove the bulb tops until they are dead. The annuals grow faster and fill in the bed sooner if 5 pounds of 5-10-5 fertilizer per 100 square feet are worked into the soil rather than the 1/4 pound of N as suggested previously.

III. Annual Flowering Plants

The planting areas for these are best prepared in the late fall after the plants are killed by freezing temperatures. Turn into the soil any existing plants, and also incorporate compost or other soil amendments at this time to the existing soil. Any plants which have been diseases or infected with insects should be removed from the site. Leave the soil in rather large clumps and let the combined action of rain, snow, freezing and thawing temperatures during the winter break the rough clods apart. This will result in a mellow soil in the spring. Also, by leaving the soil surface open and loose (lying fallow) over the winter, moisture can penetrate more easily and deeply, providing a greater reservoir of subsurface moisture for next year's growth.

The soil should be cultivated again in the spring to loosen the soil prior to planting.

IV. Watering

All garden flowering plants need at least one thorough soaking after planting. The plants need water to start rooting and, in the case of container-grown plants, water is necessary immediately to compensate for normal water loss through transplanting. The soil must be able to accept water easily without running off the surface. If watering is difficult, then the proper amount of soil preparation wasn't accomplished.

Occasionally checking the subsoil moisture content at the depth at which the plants or bulbs were placed by digging in to the soil in the general vicinity of the flower bed. Be careful not to disturb the rooting system of the plants. Water as necessary to prevent the plants from drying out.

V. Fertilization

It is a good idea to fertilize garden flowers at the time of planting. Be careful not to apply excessive amounts, which will result in "burning" the plant roots and possibly killing the plant. Bulbs may be best planted with no fertilization since adequate food is stored in the bulb for next year's growth.

A program of fertilization for perennial flowering plants is usually advisable in terms of promoting good flowering from year to year. This can be accomplished by working some bone meal or other high-phosphate fertilizer into the soil in the spring as soon as the soil is

tillable. For bulbs, a good method is to spray foliage, after the blooms fade, with a soluble fertilizer made especially for liquid application. This will promote larger bulbs for the next year.

VI. Mulching

Early spring flowering plants, such as certain perennials, should be mulched after they are completely dormant in the late fall. It is better to mulch a little late, rather than a little too early. This is gives the soil has time to freeze on the surface. With the addition of mulch on top of it, the soil remains a more constant temperature throughout the winter. Then, in the spring, it thaws out at a later time. This keeps the plant from coming out of dormancy too early and being damaged by late spring frosts. It also prevents excessive heaving of the soil surface around the plant stems. The repeated freezing and thawing of the soil moves roots around, breaking off the smaller ones and ripping many root hairs off. As soil raises, it cracks, allowing cold to penetrate deeper and faster, it causes further damage to the root hairs. In addition, needed soil moisture escapes.

Mulching the planting beds of summer-flowering annuals and perennials is a good idea for decreasing the amount of maintenance that may be needed. The use of mulch can conserve soil moisture and reduce the frequency of watering; it can discourage weedy growth and make it easier to pull the weeds that do grow; and, it will keep soil cooler in hot weather, promoting healthier plant growth.