Canadian Nursery Landscape Association

Association Canadienne des Pépiniéristes et des Paysagistes

GARDENCENTRES CANADA

Retail Horticulturist Exam Training Manual of Garden Centre Associates

SECOND EDITION

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Certified Horticultural Technician
Exam Training Manual for Retail Garden Centre Associates

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Preface

The retail nursery industry in Canada has seen phenomenal growth in the last decade. This growth has been fuelled by a tremendous interest in gardening and landscaping across the country, and by the collective efforts of garden centres, nurseries and the industry to attract customers and to improve and promote gardening.

An effective garden centre professional has to know and/or be familiar with a dizzying amount of information. He or she must possess a wide skill set. One has to know not just about plants and gardening practices, but also about human interaction, sales, customer service, display techniques, and what to do about aphids.

The varying educational opportunities available, and the wide diversity of backgrounds among people in the retail horticulture industry, has created the need to establish, recognize and promote a level of minimum standards identifiable by both the public and the horticulture industry.

This manual serves as a guide to meeting this standard. While every attempt has been made to ensure that the topics tested by the Retail Garden Centre Professional exam are included within this manual, the exam may require the use of practical skills and knowledge (e.g. basic mathematics and science), which are beyond the scope of this guide. Little emphasis is placed on pesticide use and safety as the required provincial Pesticide Dispenser, Pesticide Vendor and Applicator Certificates vary from region to region. You are encouraged to source further readings, and a list of recommended resources has been provided.

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Chapter 1

Plant Nomenclature

Botanical names can be overwhelming to learn. They are often long and many people find them difficult to pronounce and remember. They serve several vital purposes, however, and follow rigid conventions that allow them to be universally understood. While the same plant may have several common names, and one common name may apply to a few **species** or varieties, each species or **variety** has only one botanical name (except in the case of isolated squabbles among taxonomists). This section will supply the basic information to assist in understanding and memorizing botanical names. The more of them one memorizes, the easier they become to learn.

All living things are classified and organized in a hierarchy based on their physical similarity and closeness in evolutionary history. The present system of classifying and naming living things is based upon the work of Carolus Linnæus who began developing the system in the 18th century. All species were given a Latin binomial (two-part name) made up of their genus and species, which are the two lowest levels in the classification of a species.

Let's look at an example. In Table 1-1 you will find the taxonomic details of a plant known by as many common names as sand strawberry, beach strawberry, Chilean strawberry, and Chiloe strawberry.

Table 1-1 Simplified key to the taxonomy of *Fragaria chiloensis*

Group (taxon)	Features	Classification
Kingdom	Organism is obviously a plant.	Plantae
Division	Plant bears distinct flowers and seeds.	Spermatophyta
Class	Seeds are born in an ovary.	Angiospermae
Subclass	Leaves are net-veined. Seeds have two cotyledons.	Dicotyledonae
Order	Flower petals are separate. Corolla is present.	Rosales
Family	Terrestrial, stamens numerous, more than one pistil Leaves alternate. Usually four or five sepals and petals.	Rosaceae
Genus	Ovaries superior. Herbaceous, stem-less plants producing runners.	*Fragaria*
Species	Leaves thick, blue-white on underside. Achenes (seeds) are sunken in pits on receptacle (base of flower).	*chiloensis*

From Table 1-1 above, a plant meeting those features listed above must be *Fragaria chiloensis*. It is a member of the family Rosaceae (the family that includes, but is not limited to, roses, spiraea, apples, cherries, and plums), and of the genus *Fragaria* (which includes the species *Fragaria virginiana*, *Fragaria vesca* and others).

It is important to be familiar with the families of plants. They are distinguished primarily by their flower structure, but plants within a family often share similar cultural requirements, and are prone to similar pests and diseases. Table 1-2 outlines a few families, common traits of plants grouped within those families, and some examples of plant species belonging to those families.

Table 1-2 A few plant families and their identifying characteristics

Plant Families	Some Identifying characteristics
Aceraceae Maple Family	Trees or shrubs. Opposite leaves. Winged seeds (samaras) occurring in pairs. Example: Acer spp.
Asteraceae (Compositae) Aster Family	'Flowers' are actually clusters of many tiny florets (mini flowers). Ray florets usually comprise the outer petals; disk florets comprise the centre. Example: *Aster* spp.
Caryophyllaceae Pink Family	Opposite leaves. Nodes on stems (where leaves join stem) are swollen. Example: *Dianthus* spp., *Sagina* spp.
Iridaceae Iris Family	Usually rhizomatous (forming rhizomes). Leaves usually sword-shaped, enfolding one another. Flower parts in multiples of three. Examples: *Iris* spp., *Crocosmia* spp.
Lamiaceae (also called Labiatae) Mint Family	Square stems. Aromatic. Opposite leaves. Two-lipped flowers. Nutlet. Examples: *Salvia* spp., *Nepeta* spp.,
Scrophulariaceae Snapdragon Family	Flowers are throated, often two-lipped with sterile stamen and fruit capsule present. Stems are round. Examples: *Verbascum* spp., *Digitalis* spp.
Apiaceae (Umbelliferae) Carrot Family	Flowers are arranged in umbels; flat-topped flower clusters. All pedicels (flower stems arise from the same point (umbel). Shizocarp fruit. Examples: Carrot, Dill, Parsnip, Parsley
Salicaceae Willow Family	Unisexual spike-like flower clusters (catkins). Examples: *Salix* spp. *Populus* spp.

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Family names usually end with "aceae".

A species is simplistically defined as a group of plants, usually interbreeding freely and having many characteristics in common. Natural crosses between species within a **genus** are uncommon, and crosses, natural or manipulated, between genera are very uncommon.

Within a species, there may be **subspecies** or **varieties**. In the strictest sense, a subspecies is more inclusive than a variety. Subspecies usually denote a geographical variant. For example, *Pinus contorta* subsp. *contorta* (commonly referred to as Shore Pine) is the coastal variant of Lodgepole Pine (*Pinus contorta*) but it has a shorter, more heavily branched habit than the species.

The words variety and subspecies often become intermixed, and they are very close. A variety is a noticeable, naturally occurring difference within a population of a species. White flowered or variegated forms of plants are good examples.

Many horticulturally important plants have been bred, and plants have been selected from the variable offspring for beneficial characteristics. These selections are called **cultivars** (short for cultivated variety). They are propagated by cuttings or other vegetative means, but not usually from seed. This ensures that all propagated plants are genetically identical (clones). Propagation from seed usually results in variable offspring, and requires further breeding to develop a strain that reproduces 'true' to the parent.

The word **strain** is usually used to describe annuals or perennials that share growth characteristics, are part of the same species or hybrid, but are variable in some way (flower colour, for example).

Following are the basic rules regarding the botanical names of plants:

1. A botanical name consists of the **generic epithet**, always capitalized, and the **specific epithet**, always lower case; both should be italicized:

   Fragaria chiloensis

2. Hybrids occurring from crosses between different species are noted by an X between the genus and specific epithet:

   Forsythia X *intermedia*

3. Hybrids, occurring from crosses between genera (rare), are noted by an X before the genus:

   X *Cupressocyparis leylandii*

4. In a list of species, the generic epithet may be abbreviated to the first initial:

   Fragaria chiloensis = *F. chiloensis*
   Fragaria vesca = *F. vesca*

5. Subspecies are not capitalized but are italicized, like the specific epithet. It is preferred that the abbreviation "subsp." is used, however "ssp." Is commonly found also. Neither abbreviation is italicized:

   Pinus contorta subsp. *contorta*
   Pinus contorta ssp. *contorta*

6. Varieties are noted similarly to subspecies, but use the abbreviation "var.":

   Magnolia sargentiana var. *robusta*

7. Most cultivars have non-Latin names, which are not italicized and are placed in single quotation marks. Although cultivars named prior to 1959 may have Latin epithets, the same punctuation rules apply:

   Fragaria vesca 'Yellow Wonder'
   Chamaecyparis lawsoniana 'Aureomarginata'

8. The abbreviation "sp." is used when only the genus name is known, and you want to refer to an unknown species. To refer to several unknown species, use "spp.".

   Fraxinus sp. = an unknown species of Ash (singular)
   Fraxinus spp. = several unknown species of Ash (plural

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The word cultivar is short for "cultivated variety".

Chapter 2

Plant Hardiness

One of the most important considerations gardeners face when considering the purchase of plants or seeds is whether a particular species will survive under the environmental and climatic conditions in their garden. The measure of a plant's tolerance to these conditions is called **hardiness**.

Often, we use the term "hardiness" to refer specifically to cold tolerance because we know that every plant has a genetically determined resistance to a certain minimum temperature, below which the plant suffers damage or perishes. However, updated Canadian and USDA plant hardiness zone maps—which number and detail geographic areas susceptible to climatic lows—also incorporate other important indicators in their determination of plant hardiness (see inset). The Canadian and USDA systems differ significantly, and because they employ varying indicators, it is difficult to compare the two. Table 2-1 following lists the minimum temperatures used in assigning Canadian and USDA zone ratings.

Table 2-1 Approximate minimum temperatures by zone

Canadian Zone	USDA Zone	Minimum Temperature	
1	1	< -46°C	< -51°F
2a	2	-46°C	-51°F
3a	3	-40°C	-40°F
4a	4	-34°C	-29°F
5a	5	-29°C	-20°F
6a	6	-23°C	-9°F
7a	7	-18°C	-0.4°F
8a	8	-12°C	10°F
9a	9	-7°C	19°F
10a	10	-1°C	30°F
11	11	> 4°C	> 39°F

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"Hardening off" is the term we use to describe acclimatization to a cool environment.

While a plant's predisposition to cold tolerance is an important factor determining its hardiness, many other environmental factors also affect the plant's ability to withstand cold. These factors include:

1. The age of the plant: small, young plants of a species may perish if under stress, whereas established plants may endure the stress of cold.

2. Rapid temperature changes: plants that experience a gradual decrease in temperatures through fall will become dormant, having acclimatized to cooler temperatures. A rapid drop in temperatures will unduly shock the plant and may cause it harm.

3. Root protection: plants in containers, or roots not protected by an insulating layer of mulch or snow, may suffer from the cold and are particularly susceptible to fast temperature changes such as nightly lows or snap frosts. Ground-planted or sheltered plants may be better protected.

4. Soil moisture: drought-stressed plants are often weaker and less hardy. Plants that have been 'watered in for winter,' will tolerate cold more effectively.

5. Soil fertility: applying fertilizer, especially nitrogen, to trees and shrubs in fall encourages new growth and thus impairs a plant's hardening off for winter.

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Snow cover and mulch both help to protect a plant from winter damage.

Plant Hardiness Zone Maps

The Canadian Plant Hardiness Zones Map is divided into nine major zones; the coldest is 0 and the warmest is 8. Sub-zones (e.g. 4a or 4b) are also noted in the map legend (see Appendix A). The original plant hardiness map created by Agriculture Canada scientists in 1967 was based on Canadian plant survival data and climatic variables, like minimum winter temperatures, length of frost free periods, summer rainfall, maximum temperatures, snow cover, January rainfall, and maximum wind speeds. The map was revised in 2000 to also include the effect of elevation on plant hardiness.

The USDA Plant Hardiness Zone Map includes eleven zones ranging from 1 (coldest) to 11 (warmest). It is further divided into sub-zones (e.g. 4a or 4b). This map was last revised in 1990 in order to show, in detail, the lowest temperatures that can be expected each year in the United States, Canada, and Mexico. These temperatures are referred to as "average annual minimum temperatures" and are based on the lowest temperatures recorded for each of the years 1974 to 1986 in the United States and Canada and 1971 to 1984 in Mexico. It also introduced Zone 11 to represent areas that have average annual minimum temperatures above 44.4°C (40°F) and that are therefore, essentially, frost-free.

There exists yet another map for the western United States and western Canada, which is referred to as "Sunset Western Climate Zones". Produced for the Sunset Western Garden Book, this map is divided into 33 zones. These zones are based on winter minimum temperatures, summer high temperatures, growing season length, humidity, and rainfall. For more information on Sunset's Climate Zone refer to the latest edition of the Sunset Western Garden Book.

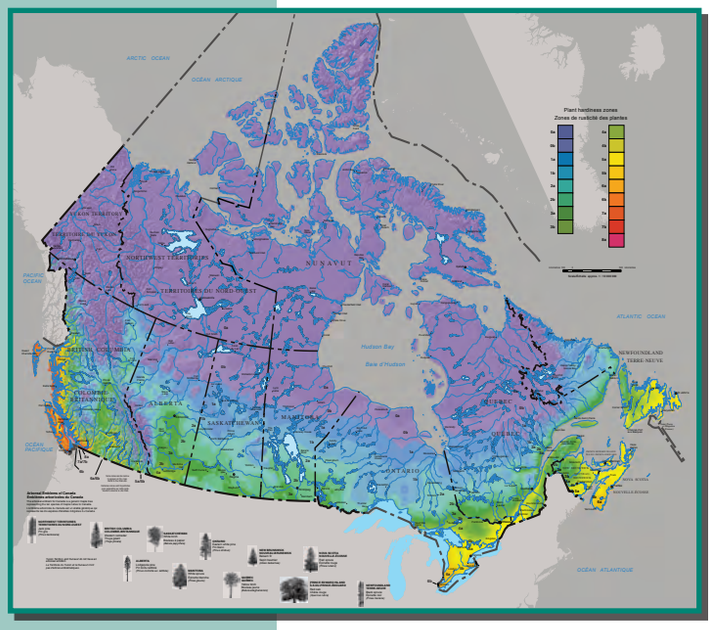


Figure 2-1 Canadian Hardiness Zones

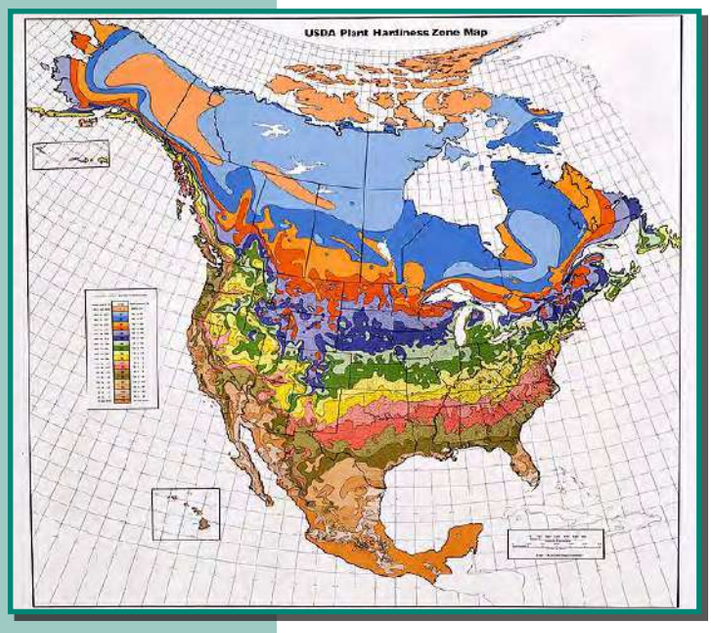


Figure 2-2 USDA Hardiness Zones

Learn Online

Plant Hardiness Zones in Canada
sis.agr.gc.ca/cansis/nsdb/climate/hardiness/intro.html

USDA Plant Hardiness Zone Map
www.usna.usda.gov/Hardzone/ushzmap.html

Chapter 3

Basic Plant Morphology

Plant **morphology** is the study of the external structures of plants and their forms. These are the elements that make plants and their habits so extremely diverse. Appropriately so, the science of plant morphology is rather complex. To simplify, this section will provide some basic diagrams describing the terminology you will require in a retail environment.

A complete glossary is located at the end of this guide. Ensure that you are familiar with each of the terms. While learning these terms, keep in mind that they will assist you with the numerous questions that customers will ask. When a client asks, "These twigs came from my neighbour's shrub—what kind of plant is it?" the arrangement of leaves will help identify it. If you can relate some of these terms to a question you have already been asked by a customer, they may be easier to remember.

Leaves and Their Characteristics

It is easiest to understand the arrangements of leaves by seeing how they differ. Use the figures below to assist you in learning leaf arrangement, types and parts. Then, take a few moments in the garden centre to identify and note some examples of each leaf arrangement in the spaces provided.

Figure 3-1 Parts of a simple leaf and compound leaf

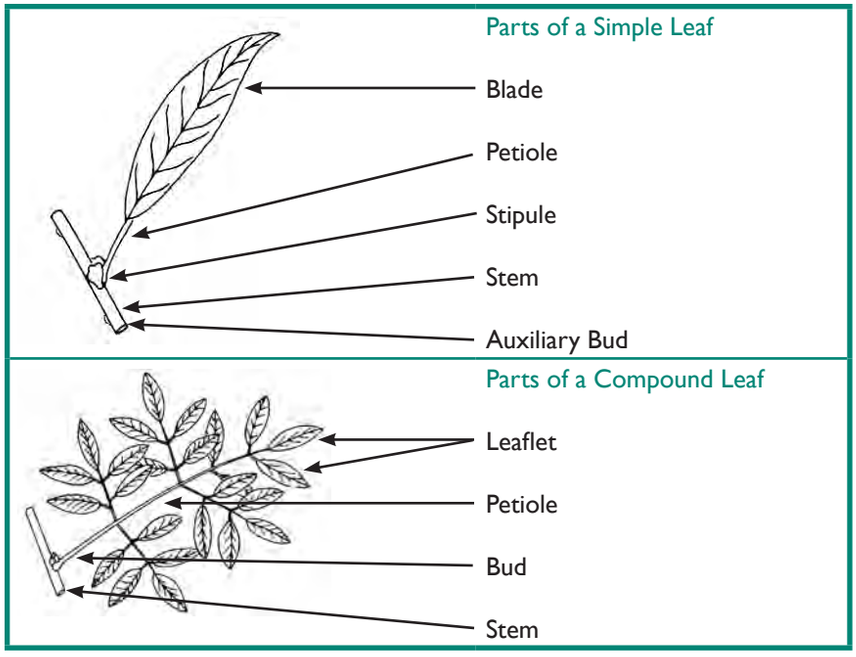
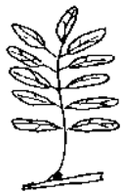


Figure 3-2 Leaf Shapes

		
Acicular Leaf Example: _____	Cordate Leaf Example: _____	Deltoid Leaf Example: _____
		
Elliptic Leaf Example: _____	Falcate Leaf Example: _____	Hastate Leaf Example: _____
		
Lanceolate Leaf Example: _____	Linear Leaf Example: _____	Lyrate Leaf Example: _____
		
Obcordate Leaf Example: _____	Oblanceolate Leaf Example: _____	Oblong Leaf Example: _____

		
Obovate Leaf Example: _____	Orbicular Leaf Example: _____	Oval Leaf Example: _____
		
Ovate Leaf Example: _____	Reniform Leaf Example: _____	Runcinate Leaf Example: _____
		
Sagittate Leaf Example: _____	Spatulate Leaf Example: _____	

Figure 3-3 Descriptions of leaf arrangements and types

	Alternate Leaf Arrangement One leaf occurs at each node, rising successively on either side of the stem. Example: _____
	Opposite Leaf Arrangement Two leaves occur at each node, and pairs commonly rise at right angles up the stems. Example: _____
	Whorled Leaf Arrangement More than two leaves are borne at each node. Example: _____
	Once Pinnately Compound Leaf Type Leaflets occur around a central axis. Example: _____
	Palmately Compound Leaf Type Leaflets occur around a central point. Example: _____
	Bipinnate Leaf Type Pinnately compound leaf in which the leaflets are themselves are pinnately compounded. Example: _____
	Tripinnate Leaf Type Pinnately compound leaf in which the leaflets themselves are bipinnately compounded. Example: _____

Flowers and Their Characteristics

A flower is a highly specialized and distinctive plant part bearing modified leaves. They are generally responsible for the sexual reproduction of plants, and their end result is a seed. For this reason, flowering plants are also called **spermatophytes** (seed plants).

Spermatophytes include two large groups: **gymnosperms** and **angiosperms**. Evolutionarily older, gymnosperms are the more primitive group. They are, in a strictly systematical sense, not class on their own but enclose two real classes—conifers and cycadeans— that do not have the same ancestors. Angiosperms do belong to just one class, and they represent the overwhelming majority of species.

The images below indicate the parts of simple flowers. Use the glossary at the end of this guide to learn the functions of these parts.

Figure 3-4 Parts of a flower

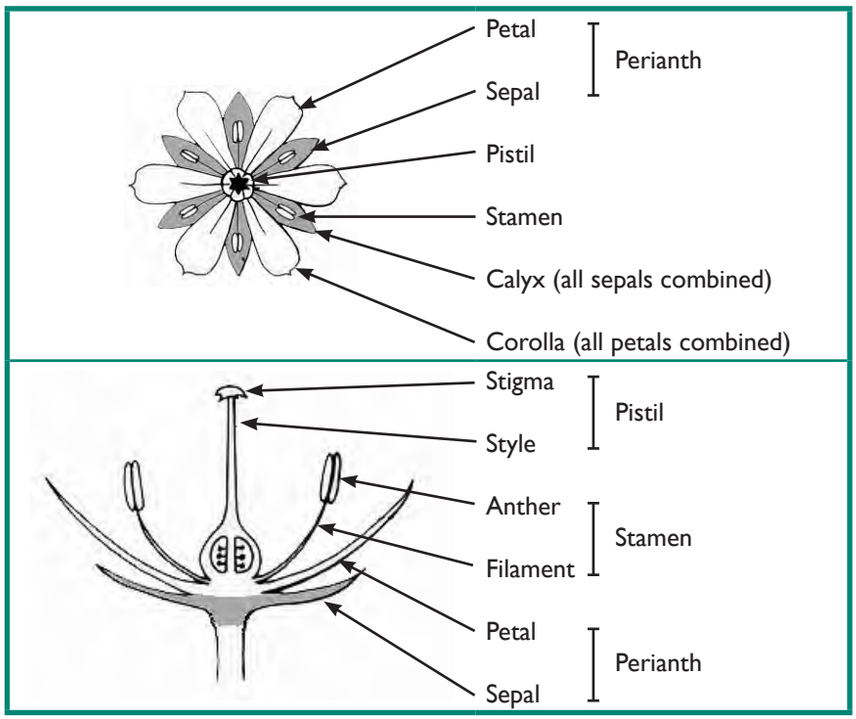


Figure 3-5 Types of inflorescence

	**Catkin** A soft spike or raceme, composed of small unisexual flowers. After flowering is finished the structure (catkin) normally falls away as one unit. Example: _____
	**Corymb** A racemose (see Raceme) inflorescence that is flat-topped or convex because the outer pedicels are progressively longer than the inner ones. Example: _____
	**Cyme** A class of determinate inflorescences characterized by the terminal flower blooming first. Example: _____
	**Head** A dense, indeterminate inflorescence of flowers crowded on a compound receptacle. Example: _____
	**Panicle** A branched, indeterminate inflorescence with pedicellate (having short floral stalks) flowers on the secondary branches. Example: _____
	**Raceme** An unbranched, indeterminate inflorescence with pedicellate (having short floral stalks) flowers along the axis. Example: _____

	**Scorpioid Cyme** A cyme which unfolds like a coil, the way a scorpions tall unfolds from under its body. Example: _____
	**Spadix** A stalk with flowers densely arranged around it, enclosed or accompanied by a spathe. Example: _____
	**Spike** An unbranched, indeterminate inflorescence with sessile flowers arranged along the axis. Example: _____
	**Umbel** A type of raceme with a short axis and multiple floral pedicels of equal length that appear to arise from a common point. Example: _____

Plant Growth Regulators

Plant growth regulators are chemicals that occur naturally in plants but are often synthetically created for the use of growers (primarily of floriculture or bedding plants). When applied to plants, they influence plant growth and development, and are employed to create uniform, compact crops. There are five classes of growth regulators, each responsible for various aspects of growth and maturation in plants.

Abscisic acid is primarily responsible for mediating a plant's response to stress. It enforces dormancy, plays a role in seed maturation, and it promotes abscission (drop of leaves or fruit) in fall or upon ripening.

Auxins produce different growth responses in plant tissue depending on their concentration. They cause **adventitious root** initiation—that is, roots that grow from stems or shoots rather than from parent roots—and this is why we are able to take cuttings and root them to begin new plants. It is logical then, that rooting powder contains indolebutyric acid (IBA), a synthetic auxin that enhances root growth. **Apical dominance** is caused by auxins produced in the leader. Auxins move down the stem and suppress the growth of lateral buds. This is why pinching to remove shoot tips encourages bushy growth.

Cytokinins are a group of compounds that primarily promote cell division and differentiation, but also are necessary for mitosis and chloroplast development. They also stimulate the release of lateral buds from the effect of apical dominance.

Ethylene is a gas which hastens ripening of fruits like bananas, melons and tomatoes, and de-greens citrus fruit rinds. At high levels, ethylene can cause leaf abscission (leaf-drop) and damage to flowers. Damage to plants trapped in enclosed environments can often be traced to those plants' response to ethylene produced by neighbouring plants. This is why one should never store fruit in a floral cooler, and why poinsettias should only be sleeved for transport and never closed in a bag.

Gibberellins trigger the germination of seed and breaking of bud dormancy, and they stimulate fruit development. Because they are produced in seeds, synthetic gibberellins are sprayed on seedless grapes to increase fruit size.

Basic Plant Needs

Chapter 4

Light

Without adequate light, plants are unable to sustain the necessary growth processes for proper cell and tissue function, and they begin to deteriorate. Symptoms of inadequate light exposure include **chlorosis** and stretching of stems (**etiolation**), decrease in leaf size and reduction in flower production. Excessive light exposure is equally destructive to plant tissues. Many plants are well-adapted to high light levels, but without proper **acclimatization**, the majority of green-house grown ornamentals will burn when placed in the hot sun.

Ornamental plants are often categorized as being adapted to, or tolerant of, low (filtered or indirect), moderate (bright indirect), high or very high (bright or direct) light levels. Some publications characterize light intensity in foot-candles (fc) or **lux** (one foot-candle is approximately 10.76 lux). A **foot-candle** is a measure of the amount of light emitted by a candle at a distance of one foot:

- Low-light plants require about 25 fc of light, but prefer 75 to 200
- Moderate light plants need 75 to 100 fc but prefer 200 to 500
- High light plants require 200 fc but will perform better at 500 fc or more.

Plants that tolerate low light usually have broad, dark green leaves and sinuous stems, such as philodendrons and other aroids. Plants requiring very high light are often those with modified surfaces, such as an opaque, waxy cuticle (e.g. many rosette-type succulents), or hairy or glandular leaves and stems (e.g. *Pelargonium* spp.). Plants adapted to very bright conditions often align their leaves so that only their edges are exposed (e.g. jade plant). Table 4-1 shows some common plants, and their preferred light conditions.

Table 4-1 Common houseplants and their preferred light levels

Low Light 75 – 200 fc	Moderate Light 200-500 fc	High Light 500 fc or brighter
Chinese Evergreen *Aglaonema* spp.	Bromeliads	Aloe Vera *Aloe barbadensis*
Cast-Iron Plant *Aspidistra elatior*	Spider Plant *Chlorophytum comosum*	Norfolk Island Pine *Araucaria heterophylla*
Parlour Palm *Chamaedorea elegans*	Weeping Fig *Ficus benjamina*	Ponytail Palm *Beaucarnea recurvata*
Pothos *Epipremnum aureum*	Boston Fern *Nephrolepsis exaltata*	Jade Plant *Crassula argentea*
Philodendron *Philodendron scandens*	African Violet *Saintpaulia* spp.	Chinese Hibiscus *Hibiscus rosa-sinensis*
Snake Plant *Sansevieria trifasciata*	Peace Lily *Spathiphyllum* spp.	Christmas Cactus *Schlumbergera* spp.

Light Quality and Photoperiodism

Plant growth and health depend not only upon light intensity, but also on its duration and spectral quality. The spectrum of light used by plants includes that visible to humans, as well as the shorter ultraviolet and longer far-red and infrared wavelengths. Most plants absorb and utilize light in the blue, red and far-red portions of the visible spectrum, and much (but not all) of the green light is reflected. Most plants appear green to us because of this. An absence of any one portion of the spectrum can have profound effects on the growth and development of a plant. For example, without red light the seeds of some plants such as lettuce and turf-grasses will not germinate, flowering will be inhibited in some, and normal tissue pigmentation will not occur in others. Most plant seeds do not require any light to germinate: only oxygen, proper temperature and water.

Many plants are known to be sensitive to the relative length of light and dark, responding to lengthening or shortening days by initiation of flower production. Those that react to decreasing night length are classed as **long-day** plants; response to increasing night length is classed as **short-day**, and plants not affected by changes in **photoperiod** are known as **day-neutral**. To induce flower production in short-day plants (e.g. chrysanthemums and poinsettias), plants are typically given less than 10 hours of light per day. Within this period of flower bud set (usually eight to ten weeks), if there is even short exposure to light during the night, plants will not flower. Growers can prevent flower initiation at this time by exposing these crops to short duration light during the period of natural darkness, thus postponing flowering. This is why poinsettias grown year-round in a living room won't produce red bracts at Christmas. Long-day

plants, such as azaleas, form flower buds in response to increasing day length (usually more than 12 hours), once chilling requirements are met. Careful manipulation of day or night length through the use of blackout curtains and supplemental lighting, allows growers to produce both short- and long-day plants throughout the year.

Temperature and Humidity

Most indoor plants can be categorized as preferring cool (14-18°C / 57-64°F), moderate (18-22°C / 64-72°F) or warm conditions (22-26°C / 72 -79°F), although a majority will grow well in the moderate range. Some plants require specific night-time temperatures for the initiation of flower buds (e.g. cool for gardenias, warm for geraniums), but in general, night temperatures should be about 5°C (41°F) lower than daytime temperatures. Most flowering plants will last longer in bloom under this temperature regime. Fluctuating temperatures caused by intermittent draughts of hot or cold air are often injurious to plants, causing, for example, premature leaf-drop in weeping fig (cold) and bud drop in azalea (heat). Table 4-2 below provides some tender ornamentals' preferred temperatures.

Table 4-2 Preferred temperatures for some tender ornamentals

Cool 14-18°C / 57-64°F	Moderate 18-22°C / 64-72°F	Warm 22-26°C / 72-79°F
Asparagus *Asparagus officinalis*	Chenille Plant *Acalypha hispida*	*Anthurium* spp.
Azalea *Azalea* spp.	Chinese Evergreen *Aglaonema* spp.	Citrus
Cacti	*Begonia* spp.	Pothos *Epipremnum* spp
Slipper Flower *Calceolaria* spp.	*Chrysanthemum* spp.	Prayer Plant *Marantha* spp.
Spider Plant *Chlorophytum comosum*	Coffee Plant *Coffea* spp.	Palms
Grape Ivy *Cissus* spp.	Dumbcane *Dieffenbachia* spp.	Moth Orchid *Phalaenopsis* spp.
Orchid *Cymbidium* spp.	*Dracaena* spp.	Lady Palm *Rhapis excelsea*
Cyclamen spp.	Poinsettia *Euphorbia* spp.	African Violet *Saintpaulia* spp.
English Ivy *Hedera helix*	Weeping Fig *Ficus benjamina*	Snake Plant *Sansevieria trifasciata*
Sword Fern *Nephrolepsis* sp.	*Hoya* spp.	Peace Lily *Spathiphyllum* spp.

Relative humidity, the amount of moisture in the air relative to the maximum quantity that the air can hold at that temperature, increases with rising temperature. Since the most common houseplants come from moist tropical regions, where both humidity and temperature are often high, the temperatures at which we grow indoor plants must necessarily be higher to provide adequate humidity.

Winter conditions in non-tropical areas are characterized by extremely low humidity. At such times, and in regions of low humidity, raising humidity by grouping plants together, relocating them to kitchens or bathrooms and away from draughts, and using humidifiers or water-filled pebble-trays is recommended. Misting plants provides only temporary relief and may encourage foliage diseases. In the garden centre, sufficient humidity is normally generated by the large numbers of transpiring plants grouped together and by regular watering.

Water and Watering

Water is one of the basic constituents of plant tissue, comprising as much as 90% of the total volume in some species. Water performs many important functions both in and around the plant. The transport of food and nutrients within the plant and the maintenance of **turgor** (the internal cell pressure that prevents leaves and stems from wilting) are dependent on an adequate water supply. Outside the plant, water is necessary for the movement of many nutrients from the soil to plant roots, and in the form of humidity, the protection of delicate tissues from desiccation.

Much of the water applied to a plant's roots is not used in any of the functions or processes mentioned above. Significant portions are lost as runoff or as water vapour, the latter evaporating from the soil surface or through pores in leaves and stems. Demand for water by plants is usually greatest in the spring when the most active growth takes place, and in summer when evaporation is high. During the rest of the year, many plants can get by on minimal water, especially if temperatures are kept low and humidity is high.

Growing media and container size also have profound effects on water use. Ease of wetting and water retention are greatly improved in media to which wetting agents have been added, and this may be an advantage during high water demand periods. Large pots require more water than small pots, but maintain a greater reservoir of moisture. However, small plants may suffer root suffocation as a result of a combination of over-watering and over-potting, particularly where soil media are fine textured.

The quality of water used for irrigating plants must be high. Dissolved mineral salts in hard water may accumulate in growing media, and affect the growth and appearance of some plants. Seedlings are particularly susceptible to damage. Household water softeners generally do not remove enough salts to be of use. **Deionized** or distilled water, or rainwater should be used in areas where water quality is questionable or known to be polluted. Fluorides in the water supply may also cause injury to susceptible plants, particularly **monocots** such as flowering bulbs, *Draceana* and spider plants. Where tap water is used it should be left to stand for at least 12 hours.

The temperature of irrigation water should be at or just below the ambient temperature around the plant. Most indoor plants are tropical, and cold water can damage their roots in the same way that cold air can damage their above-ground portions. Whether a watering can or a garden hose with a breaker is used to irrigate plants, the stream of water should be soft. Most fungal and bacterial diseases are spread by water, so reducing water splashing by not "fire-hosing" will limit their spread if they are present. Watering should be carried out in the morning, or under drying conditions, when water has time to evaporate from leaves before nightfall.

The Air and Plant Growth

Since oxygen makes up more than a fifth of our atmosphere, it is normally available to plants in sufficient quantities for growth (unless roots are suffocated by a saturated or excessively compacted growing medium). In contrast, during the day in relatively closed environments (such as improperly ventilated greenhouses), the relatively less abundant carbon dioxide can be quickly used up and plant growth restricted as a result. Not only is it important to prevent reductions in normal levels of carbon dioxide, but research shows that enriched levels of carbon dioxide in the atmosphere can significantly increase growth in most crops. Carbon dioxide generators are now routinely employed in most greenhouse operations, especially where weather conditions prohibit the introduction of outside air.

As mentioned previously, ethylene is a gas produced by all green plants and is the substance responsible for the ripening response in tomatoes, bananas, oranges and apples, and for premature aging and leaf drop in some foliage plants. Ethylene will effectively delay flowering in short-day plants, and induce flowering in some long-day plants (e.g. bromeliads). In addition to its natural production in plant tissues, ethylene may be produced by incomplete combustion of hydrocarbon fuels, also a source

of injurious carbon monoxide and ozone. Without adequate ventilation, concentrations of these gases may be high enough in some areas to damage or affect the growth of many plants.

Adequate ventilation and air circulation are important for the general health of most plants. Stagnant, humid air and overly moist conditions can contribute to foliage and flower disease problems, as well as physiological disorders such as edema (cell rupture) and localized mineral deficiencies.

Soil & Soil Nutrients

Chapter 5

Growing Media

Also referred to as potting soil, potting mix, or soilless mix, **growing media** is prepared for containerized plants. Regardless of whether it is blended for African violets, orchids, cacti, or as an all-purpose mix, a given medium must provide support, nutrition, water and air. The ideal all-purpose medium should be relatively uniform, easy to handle, adaptable to wide range of different plants, and have predictable water and nutrient holding capabilities. For this reason, most growing media are peat-based.

Peat, or peat moss, is a naturally occurring, partially decomposed material formed in bogs. Individual peat fibres are capable of absorbing a considerable quantity of water. Mixed with coarser materials such as **perlite** or **vermiculite** so that large air spaces are formed, it makes an ideal container media. Peat is unfortunately exceptionally hydrophobic (water-hating) when allowed to dry out, and re-wetting may be difficult if a wetting agent was not initially incorporated into the mix.

Soil

While growing media may be referred to as "potting soils", they are not truly "soil". True garden or top soils contain four necessary principal components to support plant life, including quantities of organic matter and minerals, in addition to water and air. A soil's base is comprised of soil solids—sand, silt and clay—and the relative quantities of each vary geographically.

Particle size is the primary difference between sand, silt and clay. A high percentage of silt or clay results in poor percolation of water through the soil, decreasing drainage ability. A high percentage of sand in mineral soils produces air pockets and improves drainage because it is the largest particle; however, sand is usually the smallest particle in growing media where it decreases air space and improves water retention.

Plant health is reliant on soil **tilth** to permit adequate aeration, retention of water and nutrients, and good root penetration.

Table 5-1 Soil solids and their roles

Soil Solid	Particle Size	Role in Soil Composition
Sand	0.05 mm - 2.0 mm	As the largest particle in mineral soils, sand increases air space and therefore improves water drainage. As the smallest particle in growing media, sand decreases air space, and because of surface tension causes water to flow less quickly; therefore, sand improves water retention.
Silt	0.002 mm - 0.05 mm	Silty soils are highly susceptible to water erosion, but their small particles contribute to the retention of nutrients. This is why the deltas of waterways tend to have rich soils.
Clay	0.002 mm or smaller	Clay soils tend to be sticky when wet, compacting and becoming lumpy as they dry. They generally contain few pore spaces and hold water in a soil mix. In a balanced mix, clays contribute to the anchoring of plant roots and nutrient retention.

Organic Matter

Organic matter (decayed plant material) is added to soil to improve its tilth, and to a lesser degree, to supply nutrients. Organic matter breaks down in the soil to form **humus**, which improves the aeration of a soil high in clay by binding particles into larger pieces. Humus also improves the water and nutrient-holding capacity of sandy soils. Well-rotted manures and composts are among the best organic materials for top-dressing lawns and gardens because they are usually rich in nutrients compared to peat moss, which has few available nutrients.

Compost

Compost is made by piling layers of kitchen waste (excluding meat), grass clippings, leaves, crop residue and other vegetable matter. A few shovels full of soil, a sprinkling of lime in acidic soils, and a nitrogen-rich fertilizer between each layer, speeds up decomposition. The material must be kept moist but not sodden. A pile contained in a bin or box will retain heat, resulting in quicker breakdown and temperatures and can kill weed seeds. Bins require good aeration. The heap should be turned every few weeks (or more often) to introduce air and to redistribute material. Mature

compost (dark and crumbly) can be screened for lawn and garden use. Screenings can go back to the pile to decompose further.

pH

Plants' roots absorb mineral nutrients such as nitrogen and iron when they are dissolved in water. If the **soil solution** is too acidic or alkaline, some nutrients will dissolve too slowly to meet plant requirements. A soil that has a pH ranging from 6.0 to 7.5 will have readily available nutrients. Below 6.0, some nutrients such as nitrogen, phosphorus, potassium and sulphur become less available. When pH exceeds 7.5, iron, manganese and phosphorus become less available. Soil acidity or alkalinity is measured and communicated using the pH scale, a logarithmic scale of the number of free hydrogen ions in the soil solution. Table 5-2 below shows a pH range, and the pH level of common household substances.

Table 5-2 The pH levels of common substances

pH	Description	Example
0	Extremely acid	Hydrochloric acid
1.0	Very strongly acid	Battery acid
2.0	Very strongly acid	Lemon juice
4.0	Strongly acid	Orange juice
5.0	Moderately acid	Unpolluted rain
6.0	Moderately acid	Cow's milk
7.0	Neutral	Distilled water
8.0	Moderately alkaline	Baking soda
10.0	Strongly alkaline	Milk of magnesia
11.0	Very strongly alkaline	Household ammonia
13.0	Very strongly alkaline	Lye
14.0	Extremely alkaline	Sodium hydroxide

Areas with light rainfall tend to be high in calcium carbonate (lime) resulting in an alkaline or high pH level. Slightly alkaline soils will accommodate many plant species but the pH can be lowered with an application of elemental sulphur; adding peat moss will also serve the purpose. Soils in high rainfall areas are subject to leaching of calcium carbonate from the surface levels, resulting in acidic or sour soil that restricts the growth of many plants. Ground limestone breaks down in the soil slowly and is best applied in the fall to allow time for it to alter the pH prior to the growing season. A good rule of thumb is that 0.25 kg / m will raise the pH by one unit. Where pH is low or acidic (less than 6.5) lawns, flower beds, and ornamental borders should receive 25 to 50 kg

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Home pH test kits are inexpensive and handy to have on hand for your garden centre customers.

/ 100 m before planting. After initial establishment, lime should be applied every few years at 12 to 25 kg / 100 m. Acid loving plants such as camellias, rhododendrons, and blueberries should not receive lime applications. Lime can be purchased as ground limestone, dolomite limestone, gypsum, or hydrated lime:

Ground Limestone or Dolomite Lime
Calcium carbonate ($CaCO_3$)
Finely ground limestone has more surface area and so it affects pH more quickly. Coarsely ground limestone dissolves more slowly but affects soil pH for a longer period of time.

Gypsum
Calcium sulphate ($CaSO_4$-$2H_2O$)
Gypsum has little effect on soil pH because it is a neutral substance. It is used to aid in leaching sodium (Na) from soils. When used on heavy clay soil, it breaks up the compaction allowing air and water movement. It can also be used to clear muddy ponds.

Hydrated Lime
Calcium hydroxide ($Ca(OH)_2$)
Also known as agricultural lime, hydrated lime should only be used on ground being prepared for planting as it can burn roots or other plant parts, and must not be used on lawns. Hydrated lime reacts immediately in soil, and changes pH more rapidly than other limes.

Fertilizers

Soluble fertilizers are inorganic nutrients that dissolve readily in the soil solution. They are normally diluted with water and applied directly to the soil surface where they can soak into the root zone. In most cases, these fertilizers contain "immediately available" forms of plant nutrients, such as nitrogen in the nitrate form. This makes solubles ideal for use in sterile media where the microbes responsible for nitrogen mineralization are absent. Unfortunately, solubles are also easily leached from most container media. Soluble fertilizers are applied sparingly, and only to pre-moistened soil; the concentration of fertilizer in the soil solution will otherwise damage roots. Complete soluble fertilizers (i.e. containing nitrogen, potassium, and phosphorous) formulated for use in peat-based media usually contain micronutrients such as iron, as these elements are usually lacking in such media.

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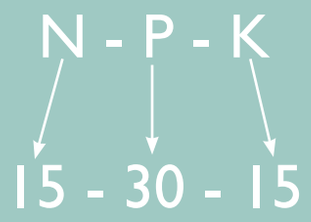
Always pre-moisten soil before applying soluble fertilizers.

What does N-P-K Stand for?

Plant growth and nutrition can be attributed to some sixteen essential nutrients, of which carbon, hydrogen, and oxygen account for 90-95% of a plant's weight. While carbon, hydrogen and oxygen are easily supplied to a plant through air and water, the remaining 13 ingredients to healthy growth must be sourced from soil.

Commercial fertilizers, both chemical and organic, exist to boost the levels of nitrogen (N), phosphorous (P) and potassium (K) in soil. Plants use these elements in relatively large quantities, and inadequately amended soils are often deficient. So what do nitrogen, phosphorous and potassium do?



Nitrogen promotes rich, lush growth and a healthy green colour and is primarily responsible for building plant proteins. Leafy green vegetables (lettuce, spinach) and lawn both require a plentiful supply to maintain growth.

Phosphorous promotes healthy root development, particularly in the case of storage roots (beets, carrots), and also helps in the production and maturity of seeds. Because flowers are the vehicles of seeds, fertilizers high in phosphorous are used to promote flowering.

Potassium promotes strong stems and roots, and assists in maintaining water balance in plants. It also helps in plants' disease resistance.

The numbers indicated on fertilizers express the percent in which each of these three nutrients are present. So what about the other ten soil-borne nutrients?

Nitrogen, phosphorous, and potassium are considered macronutrients. Calcium, magnesium and sulphur can also be added to this category. Micronutrients include boron, chlorine, copper, iron, manganese, molybedenum and zinc. These 10 remaining elements are seldom deficient in soils, however some garden centres may stock supplements for specific cases, and they are generally sold once soil tests have indicated specific problems. Some packaged fertilizers are formulated to contain N-P-K and also micronutrients.

Timed-release fertilizers are commonly resin- or plastic-coated soluble complete fertilizers. The individual **prills** are coated in such a way that the nutrients slowly diffuse in the presence of heat and moisture. Timed-release fertilizers can be either incorporated when the media is prepared, or added as a top-dressing subsequently. Top-dressing is usually avoided after mid-summer, as later applications may continue to release fertilizer beyond the time when bedding plants require feeding, or when indoor plants should be slowing down for the winter. These fertilizers are generally labelled according to their duration of release within a given temperature range (e.g. 2-14 months, at 20-25°C).

Nutrient Toxicity and Deficiency

Over or under application of fertilizer often results in poor growth characteristics and damage to plants. Over application of nitrogen, for instance, rarely induces toxicity symptoms but does cause rapid, weak growth, which invites pest and disease problems. Calcium and magnesium are common in water in some regions and are responsible for its alkalinity or 'hardness'. Both of these minerals can accumulate in soil as the white crust often seen on the soil surface, and can cause damage to cell structure in plants, resulting in curled leaf tips, stunted or black growth, failure of terminal bud, and chlorosis. Other nutrients cause necrotic symptoms in plants, even at low levels. Plants only require minute amounts micronutrients and they can easily be over applied.

Symptoms of abnormal, uncharacteristic growth are often signs of nutrient deficiencies. The location of the symptom (e.g. in old versus young leaves) is often an indicator of a particular nutrient deficiency. Deficiencies of nearly all elemental nutrients will cause chlorotic symptoms, and it may be possible to identify the deficiency based on the type of chlorosis, be it interveinal, marginal, or overall. However, because many ailments cause similar symptoms, it is advisable to undertake soil testing before treating a plant for micronutrient deficiencies.

Environmental Problems & Physiological Disorders

Environmental (**abiotic**) problems or physiological disorders refer to signs of distress in plants that are not caused by pest or disease organisms, but by nutritional or other cultural problems. Like those caused by organisms, abiotic problems are most common in plants growing in unsatisfactory environments (e.g. too hot, too dry, too moist, etc.). Table 5-3 below indicates some common abiotic problems and their symptoms in plants. Keep in mind that many of these symptoms

can be a result of a pest problem as well; when diagnosing a plant problem, thoroughly investigate both pest and environmental causes.

Table 5-3 Diagnosis of symptoms of environmental stress

Symptom	Possible Abiotic Problems
Brown leaf tips or edges	Insufficient water, poor humidity, potash deficiency, fluoride toxicity
Yellow or brown spotted leaves	Over-watering, water left on leaves in hot sun
Bronzed leaves, edges curling under, new leaves small and compact	Sun scald or too much light
Curled leaves	Ethylene damage
Older lower leaves chlorotic, new leaves small, stems stunted	Nitrogen deficiency
Purplish coloration, roots stunted	Phosphorus deficiency
Leaf drop	Salts in soil, improper watering, shock from changing environment, ethylene exposure
Malformed leaves	Micro-nutrient deficiency, insect damage
Yellowing of whole leaf	Salts in soil, improper watering, ethylene exposure
Yellowing between veins (interveinal chlorosis)	Iron, magnesium or manganese deficiency
Swellings on leaves, corky ridges, water spots that turn red or brown	Edema caused by warm, moist soil and cool, moist air
Slow growth	Low light in winter, underfeeding, improper watering during growing season
Pale, thin or weak growth	Low light, high heat, over-watering
Discoloured, soft or rotten stems	Over-watering, especially when cold and humid
Plant collapse	Extreme heat or cold, gas fumes, root rot from over-watering or poor drainage, shock from changing environment, calcium deficiency
Malformed stems or bud drop	Ethylene exposure or damage, over-watering, low humidity, exposure to cold
Few flowers but lush growth	Excess nitrogen
Failure to set flower buds	Low light, ethylene exposure, phosphate deficiency
White crust on soil	Over fertilizing, hard water deposits

It's usually best to avoid diagnosing plant problems over the telephone. Encourage customers to drop in with a sample so you can better analyse the symptoms, and have the opportunity to recommend a solution.

Repotting

Most repotting tasks in the garden centre are necessary because plants have not been sold at the appropriate time and have overgrown their pots. However, some garden centres are set up for repotting, and regularly buy liners to pot up and grow on for later sales. The time required for repotting is extensive, and is seldom cost-effective except with high value crops. When repotting is required, a few basic rules need to be applied:

1. Do not re-pot diseased or insect infested plants.

2. Make sure potting area is clean and dry.

3. Water plants before re-potting, and use only pasteurized or sterilized pre-moistened growing media that is similar to the original medium.

4. Cut off any dead, damaged or diseased roots, prune appropriately and loosen or cut off girdling roots.

5. Don't over-pot; use the next largest pot size only.

6. Keep the original soil level on the stem from one pot to the next, and pack the new growing media to the same firmness as the original root ball.

7. Leave sufficient space between the soil level and the pot rim for watering.

8. Water in to settle the plant and remove air pockets.

9. Use a "starter" fertilizer at the recommended rate to reduce transplant shock.

10. Keep growing media moist and shade plants from direct sun until new roots are active.

Retail Handling

Most garden centres buy the bulk of their plant stock for immediate resale. This material is generally shipped locally via truck, or long-distance via semi-trailer or container. Reputable suppliers ensure that plants are well-watered and in good health before loading. Depending on the packing method used and distance shipped, plants may need various levels of reconditioning before they are saleable. Plants that have been crushed in transit will

normally spring back within a day or two, whereas torn and broken plants are possible sources of disease, especially if the injuries sustained were in the course of a long journey. Published quality and size standards can be obtained from the Canadian Nursery Landscape Association (CNLA), which can be used with the following considerations for grading plant material upon receipt.

Unload and inventory shipment
Unload plants from trucks or containers carefully to ensure that damages incurred in transit are quickly identified and not worsened by further mishandling. Align plants in easy to count blocks by variety, and verify shipments are as stated on the accompanying packing slip which may be provided by the driver. If the shipment cave via a refrigerated truck, record the temperature at which the unit was set.

Inspect shipment
Remove sleeves and other packing material once outside the truck or trailer and inspect materials and plants for problems. Immediately set aside waterlogged, wilting, pest infested, diseased and damaged plants so that both the carrier and the supplier can be notified. If the driver is still present, you may be able to return badly damaged plants to the supplier on the truck; be sure to indicate how many were returned on your packing slip. If you don't return the plants with the driver, contact the supplier within 24 hours; you may be required to take photos of the damage to send to the grower.

Prepare shipment for sale
Space new stock to allow sufficient air circulation. Shade newly unloaded plants, particularly those that have been shipped long distances in refrigerated ("reefer") units, to acclimatize them to strong light and high temperatures. New plants should be carefully examined for signs of pest and disease problems. This includes the presence of insects, or sticky, yellowing, discoloured, distorted or partially eaten leaves. Also inspect for waterlogged and flagging plants. Immediately quarantine any plants that appear affected. Set aside any that are below quality standards. Water all plants, if needed, including those that may be returned to the supplier.

Prepare sale area
Most pests and can be discouraged using cultural controls, and good sanitation practices are the foundation of these methods. Remove all debris, dead plants, weeds, flats and

pots from holding and retail areas before introducing new stock. Diseased and pest infested plants (including weeds) are potential sources of problems for clean plants, and should be removed from areas adjacent to growing and holding areas.

Good watering practices (water in the morning, keep water from foliage), adequate plant spacing, air circulation and moderate temperatures will prevent the establishment of many pests and diseases. Frequent visual inspections of plants ensure that small problems can be identified and dealt with before they spread.

Chemical controls are seldom appropriate in retail situations (or in the consumer's home) since they demand considerable time, expertise and special equipment, and can potentially have toxic properties that are harmful to both people and the environment if improperly applied. Chemical residues and strong smells usually require removal of treated plants to holding areas. Such extra handling is seldom cost-effective, except with high value crops.

Follow up and problem solving
Any apparent problems including damaged, ailing, or incomplete shipments, should be reported to your supervisor or the supplier immediately.

Home and Yard Care

Good initial consultations with your clients will minimize product returns, the need to troubleshoot problems, and their association of your store with an unhappy experience. Always advise customers to purchase only healthy looking, established plants, and provide them with the tools they need (whether horticultural information, a box of bonemeal, or friendly encouragement) to be successful. The more successful that your customers become, the more likely they will continue to garden and shop at your store. Home care advice is like the plant material you sell: if it's poor, the customer may hold you and your garden centre responsible.

Most indoor plants (both foliage and flowering pot plants) have relatively short life spans. This is primarily a consequence of the unfavourable conditions plants encounter in the typical house. There, light is often poor, humidity is low, temperatures are high, watering is inconsistent, and spider mites are often already established. Unfortunately, the vast majority of these plants prefer cool, bright, humid and ventilated conditions. Watering should be performed according to the needs of the plant (more frequent when actively growing, when flowering or when temperatures

increase), rather than conforming to a set schedule. Concentrate the advice you give on optimizing conditions for the typical houseplant, and suggest ways in which the customer can improve the plant's environment, and remember to properly wrap or package them for the customer to avoid damage in transport.

Annual bedding plants pose fewer problems for the consumer. As long as potted annuals are planted in the ground or in planter boxes with a minimum of delay, they will generally survive the season. Do caution clients on planting too early (shipments often arrive at the garden centre before spring temperatures have stabilized). Once established, most bedding plants can get by with a minimum of water and fertilizer if situated appropriately. In sunny, warm summer regions, attention must be paid to the species' shade requirements. In these areas, many plants (e.g. impatiens, *Browallia* spp.) need sun protection to survive. In cooler areas, annuals that need sunshine and heat to perform at all should be pointed out to the customer (zinnia, marigold, zonal geranium).

Bedding plants in planter mixes or in sandy, infertile soil need regular applications of a balanced fertilizer, such as 20-20-20, to promote vigorous growth and flowers. Most garden soils are relatively fertile and require less frequent applications of fertilizer to satisfy the needs of bedding plants. Organic matter should be added to these soils on an annual basis.

Finally, your sale of nursery stock (trees and shrubs) should always include planting and placement advice—and a box of bonemeal! Planting to properly establish trees and shrubs in the landscape requires some important steps, and over-crowding can lead to long term ill-health. The chapter that follows addresses planting and design principles.

Planting & Design Principles

Chapter 6

Planting Procedures

Customers commonly ask for advice on the correct methods for planting trees, shrubs, perennials and annuals. A knowledge of planting procedures, based not only on personal experience but also on an accepted standard, will ensure that customers are given advice that is consistent with industry practices, and will contribute to successful establishment of trees and plants in the landscape.

You and your customers may be familiar with a traditional method of planting, whereby the gardener digs a deep hole, surrounds the tree or plant's root ball with fresh soil, manure or other amendment, then tightly packs it down. If drainage is reasonable, this method may appear successful at first: young roots grow through the new soil and the plant seems to thrive. However, once roots reach the hard-packed garden soil from which the gardener has created a basin, the roots may encircle the planting pit as if containerized in a clay pot, thereby creating a root-bound effect and limiting potential growth. If drainage is poor, the basin forms a bathtub. By digging a large hole in heavy or packed soil, and filling that hole with loose soil and amendments, excess surface water from rain or irrigation will collect between the old soil and the new, literally drowning the plant. Only a few marsh-loving trees (e.g. willows and poplars) will tolerate this sort of water retention.

Since most plants' roots need air just as much as they need water, the following method is recommended to establish healthier trees, and the same theory can be applied proportionately for other plants as well. This method is employed by professional landscapers and green space managers, and it is proven to contribute to longer plant or tree life. When selling trees especially, it is a good idea to ask you customer if he or she needs tips on planting; most customers will be pleased to receive the advice.

Selecting the plant
Always choose plants and trees from a reliable supplier, and ensure they are healthy and well branched.

Selecting the spot
Choose a location where your plant or tree will have sufficient room for both its roots and branches to grow without interference from adjacent buildings, overhead wires, or other trees or shrubs. Be sure you know the mature size of the plant so you can plan accordingly. Finally, call before

you dig: your municipality will help you ensure that your space is free from underground pipes or buried cables.

Prepare the planting area

For each tree, prepare a shallow planting area the same depth and about two to three times the diameter of the root ball or the spread of bare roots. As a general rule, trees should be planted no deeper than the soil in which they were originally grown. In areas where moist soils prevail, trees may be planted slightly less deep than their original soil, and bermmed up to prevent water from puddling.

Amend the planting hole minimally to improve drainage or lighten compacted soils, but be aware that adding too many amendments (compost, peat moss, manures) can actually limit root growth to the size and shape of your planting hole, preventing adequate stability in the long term.

Planting

1. After you have prepared the planting bed, dig a hole in the middle and set the root ball in; if planting a bare root tree or shrub, spread out the bare roots in the hole. Do not dig the planting hole too deeply: most trees and shrubs should not be planted more deeply than pot level. If the hole has been dug too deep, add more soil to the planting hole and compact it lightly to prevent the plant from sinking in as the soil settles. Scarify (roughen) the edge of the hole with a fork or the blade of your shovel to remove the glazed surface; 'glazing' occurs when the sides of the planting hole become smoothed and form a barrier, making it difficult for water to penetrate.

2. For **bound and burlapped (B&B)** root balls, remove the string (particularly if synthetic) and cut the burlap so that it may be folded back down the sides of the ball. The burlap need not be removed entirely. For trees in paper fibre pots, remove the pot if the plant is well-rooted; if the plant is not well rooted, remove the bottom of the pot, the rim, and make at least three cuts halfway up the sides of the pot. There is no need to remove the entire pot, as the paper fibre will readily decompose. For trees in plastic pots, carefully remove the pot, moistening the soil so that it will hold together. If the plant is rootbound, scarify or loosen the roots. This will help prevent girdling roots and promote new root growth. For bare root trees or shrubs,

note the slight difference in colour on the stem or trunk where the trunk emerged from the ground. This indication should be at ground, or slightly above ground level.

3. Lightly firm the soil in place around the tree. Do not pack the soil down hard with your feet.

Watering

Water to remove the air pockets in the soil half way through the backfilling process and again at completion. If air pockets are not removed, they may cause the roots to dry out, and the soil to sink when the pockets eventually collapse. If recommended for your region, build a water basin around the perimeter of the rootball to hold extra water during the establishment period or longer. Mulching will also help preserve soil moisture, but it should not directly touch the tree trunk.

Staking

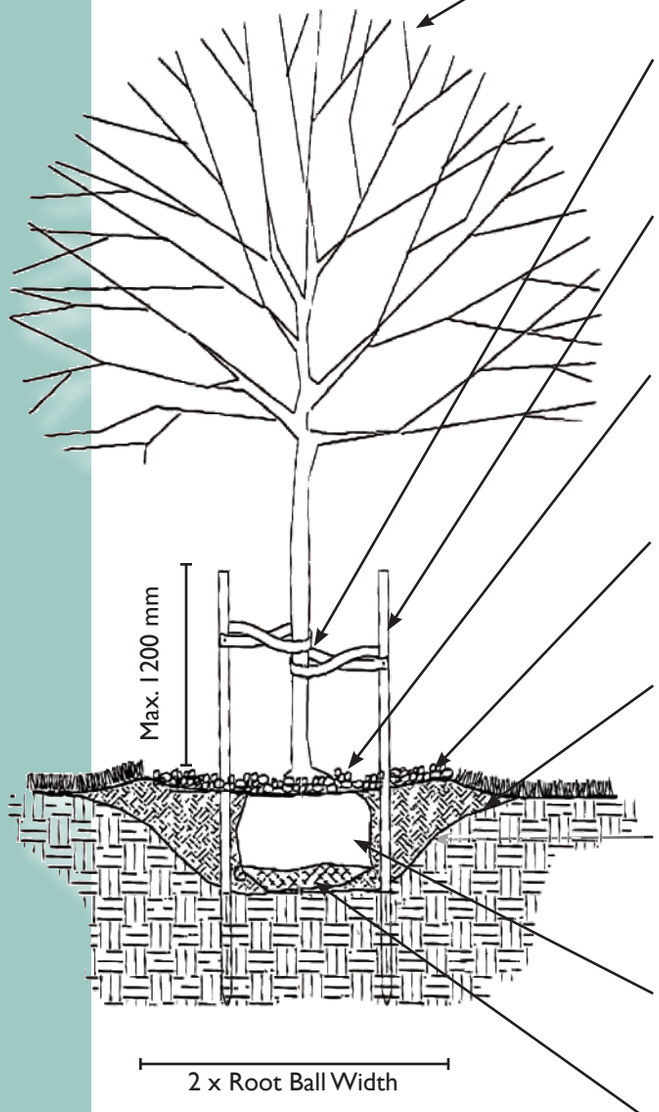
If the tree is unable to withstand anticipated winds, then staking may be required. Staking of trees is done to secure the rootball while the tree sets new roots, not to prevent the tree trunk and canopy from moving, which actually weakens the tree. Typically, two stakes placed parallel to prevailing winds are used for smaller trees (under 3 m or 10'), and three stakes or guys are used for taller trees. Do not drive stakes through the rootball of the tree. Use a tying material that will not damage the trunk as it increases in size, and which will disintegrate after a period of time. Remove the stake 12 to 18 months after planting.

Tree planting specifications vary by region, particularly when it comes to selecting appropriate amendments for use in the planting bed. Follow the above basic advice and learn your region's variations to ensure that the plant will thrive for many years.

Figure 6-1 Typical tree planting detail

Notes:

- Protect tree from damage during planting.
- Do not expose tree roots to sun or frost.
- Tree stakes to be aligned parallel to prevailing wind.
- Set tree plumb. Use two round stakes, 50 mm diameter, pressure treated wood, 1.2 m in length, each set fully vertical 1/3 height below grade.



Prune dead or damaged wood prior to planting. Do not cut leader.

Belt placed at no greater height than will support the tree vertically. Fabric belt / banding in figure-8 pattern, attached to stake with shingle nails.

Stakes do not penetrate or damage root ball.

1.2 m diameter x 80 mm deep well, formed in topsoil for first year watering. Bark mulch of 50 mm depth applied at minimum distance of 150 mm from trunk.

Finished grade of planting 25-50 mm above existing grade.

Planting hole edge has shallow angle. Scarify sides and bottom of tree pit prior to planting.

Growing medium to be compacted to 85% standard proctor density to remove air pockets.

Remove strapping, cut all binding material and fold burlap into bottom of hole prior to backfilling

Compact subgrade under rootball to prevent settling.

Planting Design and the Retail Environment

Complete landscape design and installation projects are best dealt with by a specialist—a landscape designer who possesses the knowledge, skill and experience, and opportunity to properly evaluate and the customer's site and requirements and properly fulfil the customer's needs. While some garden centres may have landscape divisions, those that do not should have access to their regional association's member list, or know of some landscape design companies that can be recommended to the customer.

However, having knowledge of the landscape design process and of the fundamental elements of planting design, the retail garden centre professional will be able to help customers solve minor landscape problems within the setting of the retail garden centre. Typical queries might include plant selection and placement for a bed along a driveway or boulevard, or on either side of an entrance, near a newly installed deck, or to solve planting issues on a difficult slope. Regardless of the application, it is important to properly assess your customer's site so that you can take these important points into consideration:

- Light levels and sun exposure
- Wind exposure, drainage and snow loads
- Soil conditions
- Existing plants and trees
- Overhead or underground utilities
- Existing features such as sidewalks, pathways or driveways
- Building locations and the position of their windows or doors
- Architectural style and colour of the residence.

If the site requires a recommendation that includes more than just a few plants, it will be helpful to have your customer bring in photos of the area, and make a sketch (roughly to scale) to help you determine plant spacing, quantities and other hardscape features. Then, you can assess your customer's needs and make suggestions appropriately.

What are the homeowners intended uses for the area, and what do they want the finished landscape to include? Ask your customer if the site should accommodate any of the following.

- Foot traffic in the area
- Space for children to play
- A dog run or other pet-friendly area
- Mature or replacement plantings
- Screening of undesirable views or enhancing desirable views
- Particular or favourite flower and foliage colours, seasons or plants
- Garden ornaments or accessories such as birdbaths, lighting, or furniture
- High or low level of maintenance
- A budget level and timeline.

Fundamental Planting Design Principles

After a clear idea of the site's characteristics and the customer's requirements are obtained, make planting recommendations. Consider the fundamental principles of planting design when choosing and placing plant materials and any other features.

Provide a focal point

A focal point is the dominant point or feature in the design. It is often created using a single interesting or dramatic plant that will attract and hold the attention of the viewer, and it should be emphasized by the plants surrounding it. A plant grouping or hard landscape feature can act as the focal point, and it may anchor a view within a garden bed itself, from a pathway or looking out a kitchen window.

Maintain unity within the design

Unity describes the quality of forming a 'whole' from separate parts. The design is unified if the materials used have a noticeable relationship to one another or share some characteristics. Unity can be achieved by using plants with similar forms, textures, or colours, or by repeating elements throughout the design. One

example would be the use of one specific groundcover throughout the planting, helping to tie otherwise different areas together.

Provide variety
Temper efforts to achieve unity with a need for variety. A variety of forms, textures, colours and materials will create interest in the planting.

Strive to achieve balance
Balance may be judged as the garden is viewed from different points. At each viewpoint a central position is identified. The overall effect and mass of the landscape on each side of this point should be balanced. If plants on one side create a large and bold body of vegetation, but the other side is diminutive, the scene is unbalanced. Similarly, if one side of the view offers strong interest but the other side is monotonous or mainly uninteresting, the scene is unbalanced.

Consider the scale of the area
Small areas or areas viewed from close range demand that plants be used in small groups and be of a smaller size. In small spaces, finely textured plants may be more appropriate than coarse plants. Contrasts in texture and form might be subtle. In a larger space, or a space viewed from afar, larger masses of plants can be accommodated, and strong contrasts in texture and form can be incorporated where subtle adjustments may be lost.

Consider Form
Form describes the total mass and outline of a plant or group of plants. Forms may be vertical, horizontal, columnar, weeping, oval, mounded, or round. Use contrasting forms to create interest and variety. Repetition of forms throughout the planting, or the use of plants with similar forms, helps provide unity. A strong form can serve to direct the viewer's eye: a strong vertical form will direct the eye upwards where a strong weeping form will direct the eye downwards; horizontal or spreading forms will direct the eye across the planting.

Consider Texture
Texture describes the appearance of the surface of a plant, and is usually determined by foliage. During the dormant season, the texture of deciduous plants is determined by their branching. Plants with many small leaves are considered finely textured, whereas coarsely textured plants have fewer, larger leaves (*Aesculus* spp.—Buckeye or Horse Chestnut—is an example). Use texture

contrasts to create interest; use the characteristic of texture as a basis to create unity. Gradual transitions in texture will help direct the eye and unify plant groupings. Use texture to help create illusion. Coarse textures will help to draw a distant area closer. Finer textures can help to make a small space seem larger.

Consider Colour

Colour is found in foliage, flowers, stems and fruit. Reds, oranges and yellows are considered warm colours, and they advance toward the viewer and draw the viewer's eye. They are used to make a distant area seem closer, and often are used to create a feeling of passion or energy in a space. Blues, greens and grays are considered cool colours, and recede from the viewer. They act to soften or provide stability in a planting, and can be a background for brighter colours. They are used to create a feeling of depth or distance, and serenity. Colour in the garden is dynamic: plants go in and out of bloom, foliage colours change, fruit develops, and through these changes, focal points may shift. Use similar shades throughout a planting to help achieve a unified design. Use contrasting colours to draw the viewer's eye and create dramatic interest.

Plant Placement & Spacing

The mature or ultimate size of plants should be considered when suggesting them for a landscape. Give plants enough space to develop to mature size without crowding or requiring severe pruning, but remember that massed plantings can be installed more closely than their mature size might indicate. In areas that seem bare, suggest groundcovers or seasonal plantings while waiting for shrubs to mature and fill in. Pay attention to variations in height, strive to identify aesthetically pleasing plant combinations—and don't be afraid to repeat them. Plants in groups should be placed to create a transition in height from high in the centre or back of a group to low at the front or edge of a group.

Pruning Methods & Techniques

Chapter 7

In general, the aim of pruning is to improve a plant's appearance and performance, its productivity, and its health and vigour. By pruning in the following situations, these objectives can be achieved:

To direct or control growth
When two or more branches are crossing and are likely to rub against one another, either as they grow or as they are blown about by wind, prune one or more of the offending branches. Select the healthiest and most aesthetically pleasing branch to remain. In doing so, the plant will grow into a more balanced shape. In addition, it will prevent the remaining branch from wound and disease that can settle in injured tissues.

Remove a branch where the **crotch angle** it makes with another branch is very narrow or very wide; this is an issue in fruit and shade trees, as wide or narrow crotch angles often lead to split or broken branches as the tree grows.

In grafted plants (e.g. grafted roses) or other suckering plants, remove any **suckers** at ground level as they appear. This will help maintain the shape of the shrub and prevent suckers from weakening the grafted variety. Likewise, remove **watersprouts**. Sucker and watersprout pruning should occur in summer, as dormant removal encourages further production of them; keep pruning to 15 to 30% by volume to discourage vigorous watersprout regrowth.

To correct damage
Remove broken branches resulting from wind or other damage; the **cambium** layer of a tree will heal over a clean cut quickly, whereas a ragged branch end will not heal over. In addition, decaying organisms and disease can enter the non-living inner wood and cause rot or infection.

Remove diseased or insect-infested branches, being careful to sterilize pruning tools between cuts.

To promote fruit and flower production
Several tree shaping methods applied to fruit trees can enhance yields. Fruit thinning—removal of some of the immature fruit—allows the remaining fruit to reach a greater size, and reduces the chance of branches breaking from excess weight. Be wary of pruning the fruit-producing spurs of some trees.

To find out if a branch is alive, do the scratch test: gently scrape the bark and look at the pith beneath; if it's green, it's living but black means it's dead.

The critical pruning season for flowering plants relates to the time of year when flower buds are developed by the plant. If the flower buds are formed a year prior to blooming (i.e. on **second year wood**) such as they are with lilacs and all other spring blooming plants, the right time prune is after flowering has finished and before the buds for next year's flowers have formed. If a plant flowers on the current season's growth, and does not produce significant winter interest, it can be pruned in autumn. Plants with showy winter features can be pruned in early spring. Since most plants that bloom on the current season's growth have a tendency to flower more prolifically if deadheaded, a good practice is to not simply **deadhead**, but to also remove a little of the older non-flowering wood in the process. This encourages the production of new flowering wood, and maintains a tidy and attractive form.

To enhance plant health

Thin a tree or shrub to allow light and air circulation to penetrate the inner portion of the plant. Air circulation allows foliage to dry quickly, therefore inhibiting the growth of mildew and other fungal diseases. Also prune dead wood to minimize sites for diseases to grow.

To create special plant shapes

Formal pruning is utilized to create special shapes or structures in the landscape, and includes the following methods:

Hedging: planting and pruning shrubs to serve as a screen, barrier, or formal landscape element

Topiary: shrubs, usually evergreen, are clipped to form ornamental shapes such as spirals or balls

Espalier: usually applied to fruit trees, espaliered plants are pruned and tied to create a fan or lattice-shape against a wall or fence. This assists in fruit harvesting and production

Pollarding: applied to certain street trees, all branches are removed annually to a simple branch framework to prevent outgrowing of an allotted space; this leads to large knobs at the ends of the main branches.

To rejuvenate a shrub or tree

Restore health and vigour to an overgrown, neglected plant by removing about one-third of the old stems to the ground, and cutting back the remaining stems to the lowest lateral

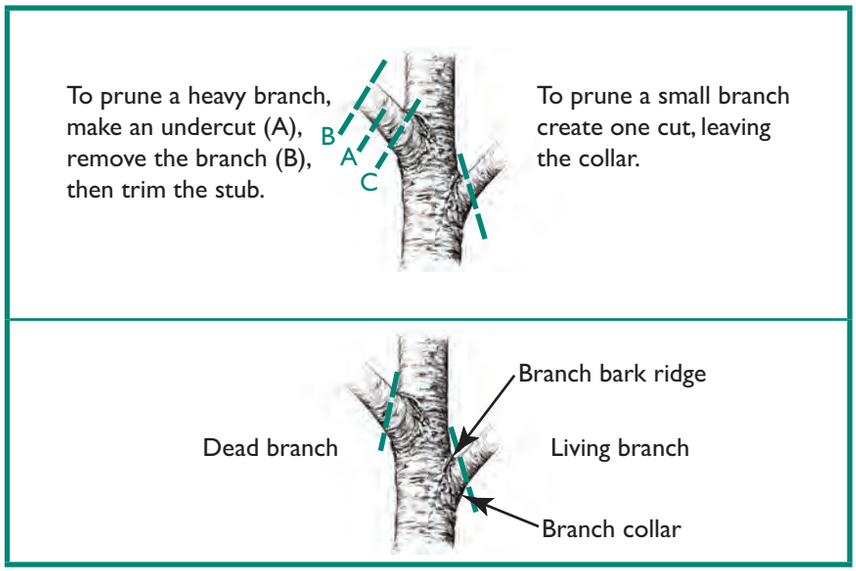
branch. This will force new growth of young wood, producing a large crop of suckers. Thin out suckers later in the season.

The following spring, remove another third of the remaining old branches to the ground, and a year later remove the last of the old branches. This will produce a shrub of all new shoots, which can be thinned and shaped to create an open, balanced shrub.

Making Pruning Cuts

Pruning cuts to shorten stems (**heading back**), should be made about 6 mm (1/4") above a lateral shoot, eye or bud, where actively growing; it is usually best to prune just above an outward-facing bud to encourage growth away from the centre of a plant. If made between shoots or buds, the stem will die back to the previous bud, and the dead tissue can invite decay or disease. Cuts should always be made at a slight angle to allow water to drain off.

Figure 7-1 Pruning cuts and correct pruning of a branch

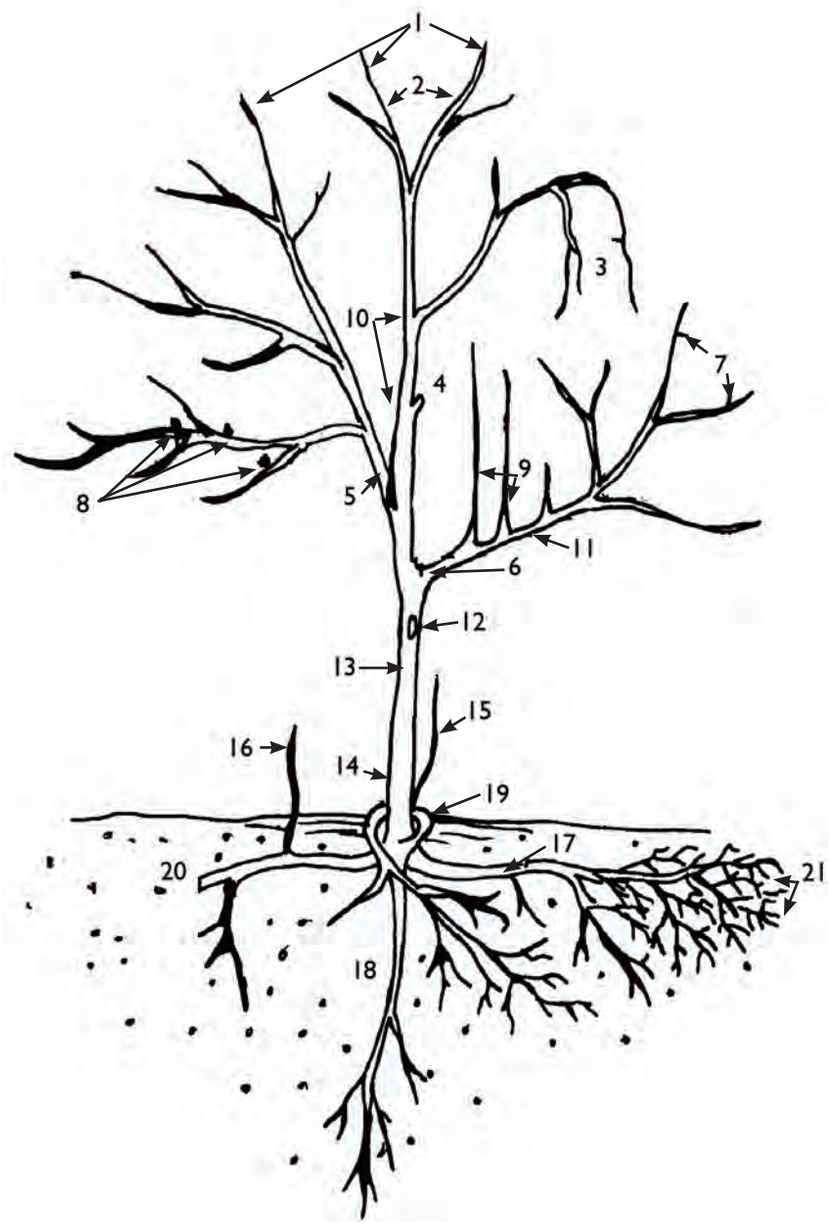


Pruning cuts to remove branches from a main trunk should be made at the top of the collar. Cutting at this narrower point, rather than flush with the tree trunk or main stem, leaves a smaller wound to **callus** and heal. Cuts made with **secateurs** and **loppers** should be made with the blade edge closest to the main trunk. Make a clean cut without damaging adjacent bark: a clean cut will heal over in one or two seasons on most plants. When pruning heavy branches, use a three-step cut. First, undercut the branch a few centimetres away from the trunk (a good rule of thumb is an equal distance away from the main trunk as the

diameter of the branch being cut). Then, cut from above slightly further out (6-15 cm or 2-6”), downward through the branch, which may fall before the cut is complete. This removes most of the branch and prevents the branch from breaking and tearing bark away from the tree. For the final cut, remove the stub left from the first two cuts, just outside the branch collar as suggested above. Do not pare or carve the wound down beyond the branch collar.

Regardless of what type of pruning is done, it is imperative that tools are sharp for the cleanest cuts, and that they be thoroughly cleaned between uses to prevent the spread of disease. Likewise, it is usually best to remove prunings from the garden, or burn or bury them, as they may spread fungal spores.

Figure 7-2 A pruning guide to the tree



1. Terminals
2. Double leader (weak crotch)
3. Hangers or droopers
4. Branch stub
5. Weak crotch (narrow angle)
6. Strong crotch (wide angle)
7. Laterals from primary and secondary branches
8. Fruiting spurs
9. Water sprouts
10. Scaffold or main branch structure
11. Injuries from child's swing cables
12. Healing wound from cut branch
13. Trunk
14. Base of trunk
15. Base sucker
16. Root sucker
17. Lateral root
18. Tap root
19. Girdling root that will choke tree
20. Roots improperly cut
21. Feeder roots

Pruning Conifers

Mostly evergreens, conifers form two groups of pruning methods: those with branches radiating from the trunk in whorls (e.g. pine and spruce), and those that have a random branching pattern (e.g. juniper, cedar, yew). Either can be pruned at any time.

For whorl-branched types:
Limit growth, induce branching, and encourage bushy, dense growth by pinching back the candles with your fingers by about half. Candles should be pinched as they elongate in spring.

For randomly branching types:
Follow general pruning techniques for most trees or flowering shrubs, shortening branches by no more than one-third in a season, and thinning out damaged, diseased, dead or interfering branches. Thin to maintain shape, and head to encourage dense growth.

When a leader is damaged:
If a central leader is damaged or removed, side shoots will compete to become a new central leader. This will reduce height and create a bushy top, but usually leads to narrow branch angles and splitting among competing leaders. To create a new leader, stake the next nearest branch vertically and limit the growth of nearby branches.

When shearing or shortening a branch of a conifer, do not prune past the level of green growth. Most species will not develop new growth from the remaining bare wood. Either leave some (at least 2 cm or 3/4") of the green growth, or prune the branch back to a main branch or trunk.

Pruning Roses

Most roses should be pruned in late winter or early spring, just as the buds begin to swell. The fundamental rules of pruning also apply to roses, however there are some specific needs of hybrid, floribunda, climbing, and miniature roses.

1. In early spring, cut back hybrid teas to two to four eyes, about 15 cm (6") above ground level. Most hybrid teas benefit from annual pruning or thinning. Very vigorous varieties should only be pruned lightly as hard pruning stimulates vigorous but non-flowering growth.

   Floribundas should be pruned moderately as harsh pruning can weaken them over time, and light pruning results in spindly growth; leave six to eight eyes per stem.

   Shrub or species roses can be left unpruned for the best floral display, or may be limited to light, basic pruning.

2. Throughout summer, deadhead all roses to promote more flowering.

3. In autumn, cut back inflorescences to a strong stem, just above an outward facing shoot or eye. Remove the complete inflorescence truss rather than leaving weak, spindly stems. In varieties that set showy hips, tidy the plant without completely removing its attractive fall colour

4. Because they flower best on canes that are two to three years old, only remove canes of climbing and rambling roses that are four years old or older. This will result in the removal of about one-third of the plant each year. It is generally best to prune climbers in early spring; in cold climates where a climber must be taken down for winter protection, however, fall pruning is more logical.

Lawn Installation & Maintenance

Chapter 8

The Alternatives

Lawns have been a cornerstone of landscapes since the 19th century in North America, and they date back to Tudor times in England where upperclassmen's manorial estates were nestled among them. Certainly, there is no finer surface for golf courses, outdoor games and picnics—and to underline their place in popular culture, many people who know nothing about gardening are experts at lawn care.

The dilemma we face with lawns today is that they require considerable maintenance, are showiest when heavily fed with fertilizers, are tremendous consumers of water, and can be plagued by difficult-to-rid pests like European Chafer. At a time when the trend in home gardening is to spend more time enjoying, and less toiling, lawns have become somewhat impractical. Environmental considerations also play a part: most municipalities impose water restrictions in summer, and many are moving towards bans on cosmetic pesticide use.

For low-traffic areas, there are many herbaceous and shrubby groundcovers available to plant in lieu of lawns. Many groundcovers have attractive, long-blooming periods, and only require occasional mowing and limited weeding once established. Familiarize yourself with options suitable for your climate zone.

Installing a Lawn

The first step in any new lawn construction is proper grading, taking into consideration visual appearance and proper drainage. Improper preparation of rough (sub) and final grades is the most difficult thing to put right. Grading, drainage and soil preparation is the same for all methods of planting a new lawn, whether seeding, **hydroseeding** or laying sod.

Consider the following grading and drainage points:

1. Surface drainage: Surface drainage is important but the runoff must have someplace to go. Work with existing ditches where possible. A slope ratio of 15 cm (6") to every 30 m (about 100') is recommended.

2. Drainage: Work from fixed elevations such as walks, drives, steps and the walls of buildings; always slope away from structures.

3. Testing the area: if any water remains after two to three hours, regrade and test again. Do this for both the rough (sub) grade and final grade. Sub surface drainage (i.e. drain tile) may be required if surface drainage is still not adequate.

4. Other considerations: if light exposure is poor, consider clearing or thinning trees and shrubs to allow more air and light. Weeds, rocks, and debris should be eliminated before planting new areas.

The next step is soil or seedbed preparation. Evaluating the soil and amending appropriately is as important as proper grading and drainage. Ninety percent of a grass plant is below ground, making this step critical. Not amending and preparing the soil to the proper depth will always result in a poorly performing lawn. The goal is to establish a uniform soil environment to a minimum depth of 20 to 30 cm (8-12"). The soil should be easily permeable by water and roots, well furnished with nutrients, and have the correct pH level (6.5-7).

To accurately determine and adjust the soil fertility and pH, a soil test is necessary. Once a sample is submitted, the lab will then provide a soil report telling you what amendments need to be added for turf-grass in your region. Governmental agriculture departments can be a good source of information and current recommendations.

When preparing the soil, also consider the following points:

1. Depending on the results of your soil sample, add any necessary amendments, lime or ammonium nitrate, and fertilizer (e.g. timed-release turf starter) into the entire 20 to 30 cm (8-12") of root zone. This is the only opportunity to get nutrients deep into the soil.

2. Finish grade of seeded lawns should be about 1.5 cm (1/2") below surfaces such as walks, and 3 cm (1") below in areas where you will be laying sod.

3. For drainage purposes, it is critical to avoid layering different soil types (e.g. tilling then spreading an inch or two of top soil on top). If sodding, it is important that sod has the same soil type as the new lawn area.

4. Rake the area with a wide rake to smooth and level low spots, then firm with a roller but do not overly compact soil.

5. If seeding, apply a thin layer of light mulch such as peat moss or sawdust to retain moisture.

When you have completed all these steps you are ready to establish your turf area. Consider the options listed in Table 8-1 below to determine which will work best for you.

Table 8-1 Turfgrass Options

Method	Application Time	Irrigation Needs	Usability	Cost
Seeding	Fall	High: frequent watering for first several weeks to keep moist	Intolerant of traffic for 2 to 4 months; normal to high use only after first year. Not immediately aesthetic	Low
Hydroseeding	Spring Fall	Moderate: less frequent watering than seeding as mulch holds moisture, but must not be allowed to dry excessively	Intolerant of traffic for 2 to 4 months; normal to high use only after first year. Not immediately aesthetic	Low to moderate
Sodding	Spring Fall Summer and winter if available and climate appropriate	Low: less frequent watering than other options, but must not be allowed to dry excessively	Low traffic immediately. High traffic within 2 to 3 weeks. Immediate coverage	High

Grass Species

Turf seed is usually a mix of grass varieties that collectively create a durable, aesthetic, and use-appropriate lawn, which is generally more pest resistant than a lawn made of any one variety on its own. There are numerous turf seed mixes, blended for a number of different purposes. Cool-season grasses are selected for areas that experience cold winters, but they may brown during hot, dry summers. Warm-season grasses may not withstand winter cold, but are more tolerant of heat and drought. Some common varieties and their traits are indicated below.

Regardless of which blend is planted, the relative concentrations of different lawn species will change over time: better-suited or more aggressive species overtake the more poorly suited or weaker ones.

Table 8-2 Grass varieties and their characteristics

Common Name - Trait	Kentucky Bluegrass	Creeping / Red Fescue	Chewings Fescue	Perennial Ryegrass	Fairway or Crested Wheat-grass
Shade	Dark	Medium	Medium	Light	Light
Texture	Medium	Very Fine	Fine	Medium	Medium
Density	Medium	High	High	Medium	Medium
Establishes	Slowly	Rapidly	Moderately	Rapidly	Rapidly
Habit	Low	Creeping	Bunch type	Bunch type	Bunch type
Colour Retention	Good	Moderate	Poor	Poor	Good
Cold Tolerance	Good	Moderate	Poor	Poor	Good
Drought Tolerance	Good	Excellent	Good	Fair	Excellent
Heat Tolerance	Poor	Moderate	Poor	Poor	Moderate
Shade Tolerance	Poor	Excellent	Good	Good	Poor
Wear Tolerance	Good	Moderate	Good	Good	Moderate
Recupera-tion	Good	Moderate	Fair	Fair	Good
Cutting Height	5-8 cm	4-6 cm	5-6 cm	5-8 cm	5-6 cm
Identifica-tion	Boat-like leaf tips	Reddish sheaths		Glossy leaves	Hairy leaves

Lawn Maintenance and Rejuvenation

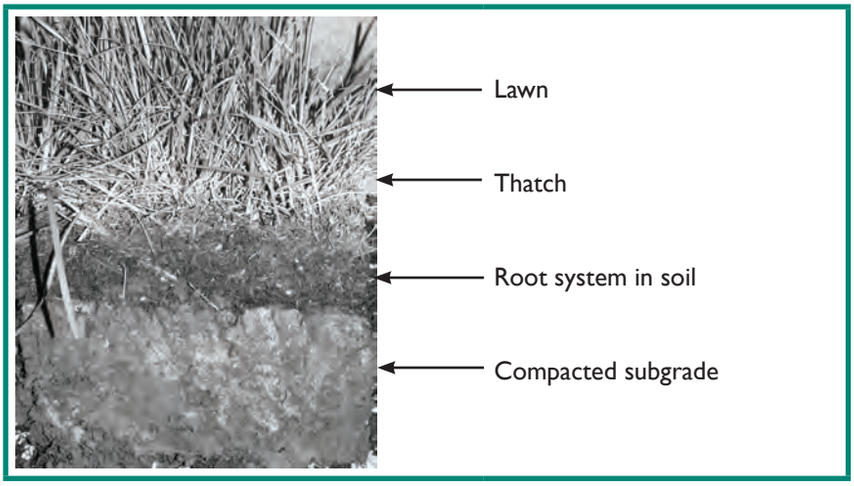
Once a lawn area has been properly installed, certain maintenance practices must be followed to ensure that the quality and appearance of the turf is maintained. Occasional rejuvenative techniques and practices must be used to rehabilitate lawn areas that have not been properly maintained. These include controlling weeds, pests, and diseases; controlling thatch and moss; regular fertilizing, overseeding, and aerating; adjusting pH levels; and proper mowing and irrigating. Symptoms of poor turf quality include:

- Light green or yellow discolouration of lawn
- Lawn areas drain poorly and are soggy when wet
- Lawn has a soft and spongy feel when walked upon
- Bare, weedy, or mossy patches have appeared
- Lawn turns brown quickly in summer

Thatch Control

Thatch is a tightly interwoven layer of undecomposed, partially decomposed and living tissue, located between the soil surface and green vegetation. It generally consists of stems, leaves, nodes and crowns of turf plants. These parts contain lignin, which is resistant or slow to decay, and its accumulation and compaction causes the crown of grasses to be raised above the soil level.

Figure 8-1 Excess thatch accumulation in lawn



An unhealthy lawn with above average mortality of grass plants is the leading contributor to thatch, which becomes harmful when accumulation reaches a thickness of 2 cm (3/4") or more. Thickly thatched lawns do not allow moisture, nutrients or pest control products to penetrate the soil, and therefore result in wasted maintenance efforts. Additionally, when crowns of grass become too highly raised above the soil, regular maintenance such as mowing can severely damage the living tissues, causing the lawn to be "scalped" from its roots. Grass clippings do not contribute to thatch accumulation.

Core Aeration

The root system of your lawn needs air just as much as it needs water and fertilizer, and one of the best things you can is to ensure it can breath well. In soils that are high in clay, there is insufficient air space for the lawn's roots. By core-aerating on an annual basis, you help to relieve compaction and thatch problems, and allow the roots to breathe. Aeration also allows the roots to move into the holes left by the aerator and the lawn, better able to absorb water and nutrients, will become thicker and healthier.

pH Adjustment

Soil pH for turfgrass areas should be 6.5-7 (neutral). If pH is too low, some nutrients become 'locked' and are not available to the grass plant. A pH test should always be done so you know how much lime or ammonium nitrate to apply. pH adjustments, while typically applied in spring, can be done at any time of the year.

Mowing

General considerations for mowing turfgrass areas include the following:

- Lawns should be cut when they reach about 7.5 cm (3")
- Never cut more than one third of the blade per mowing
- Mulching with a mulching mower is preferable to bagging
- Cut regularly and at a consistent height
- In the heat of summer, allow grass to grow taller and raise the mower's cutting height.

Irrigation

To water properly, wait until the top 5 cm (2") are dry, then water deeply. Shallow root growth, caused by light and frequent watering, leads to a lawn's susceptibility to drought, heat, and pest damage.

Fertilizing

A good lawn must be well fed, and implementing a balanced fertilizing program is an important factor in maintaining an attractive, healthy lawn. Timed-release fertilizers are preferable as they feed the lawn slowly over a longer period of time and help prevent—but do not eliminate the risk of—fertilizer burn. For this reason, it is important to know how to calibrate fertilizer spreaders, and to be able to advise your customers on proper fertilizing techniques.

Fertilizer spreaders, either broadcast (whirling disk) or drop style (gravity feed), are used to distribute granular fertilizer. Equipment output depends on the size of the adjustable hopper openings, and the size, weight and shape of the granules. Because spreaders are not standardized, it is important to calibrate a spreader so you know what amount of fertilizer will be applied. Granular fertilizer labels will tell you the maximum amount to apply in a given area. To calibrate a spreader requires a few steps and some basic mathematics; a detailed example has been provided.

A good practice when using a spreader for granular fertilizer is to make two complete passes of the area to be fertilized: the second pass at right angle to the first pass. This ensures a more even coverage of the area. If the fertilizer is to be applied with two passes, it is important to remember that the spreader calibration must be 50% of the required amount for a single pass. Other important points to consider when using a fertilizer spreader are to:

- Always test equipment prior to loading
- Always remove the spreader from the turfgrass area to fill
- Apply the product with even distribution
- Always start moving before opening the shutter, and close and reopen the shutter at each turn
- Follow all safety considerations when applying any chemical based product.

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In many regions of Canada, fall fertilizing with a high nitrogen feed is preferable to spring. The excess nitrogen gets locked away for use when the turf needs it most. Winter damage is minimal.

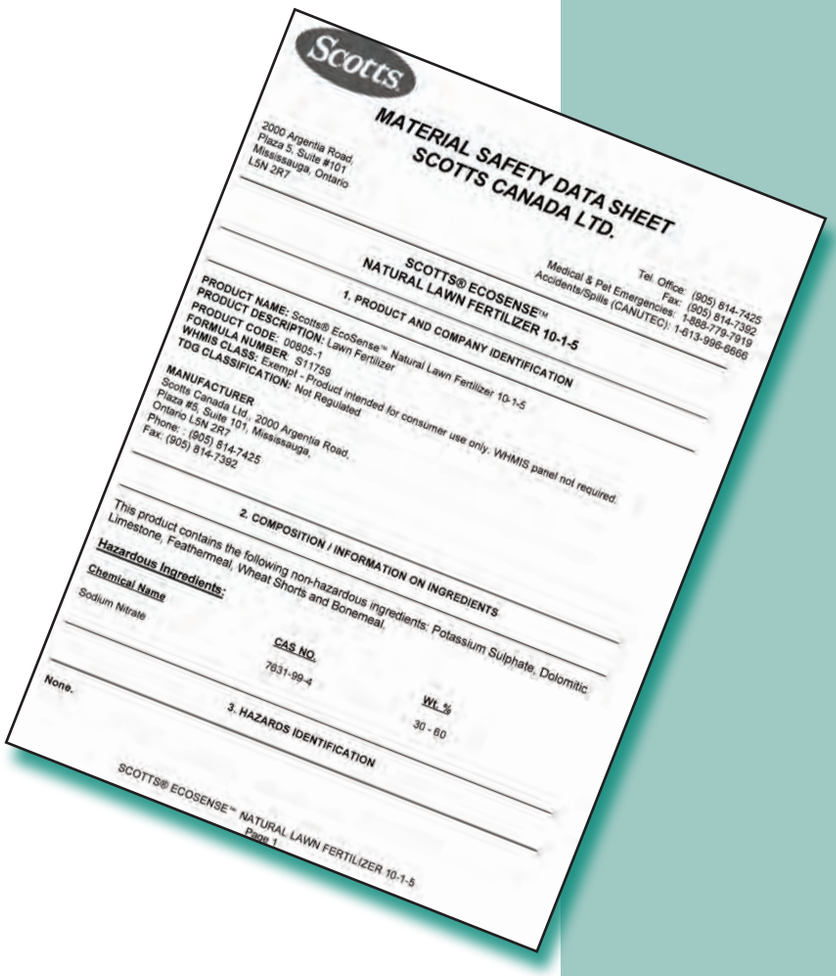
Fertilizer Spreader Calibration

A package of Scotts® Eco-Sense Natural Lawn Fertilizer directs users to apply it at a rate of 2.43 kg per 100 m^2 (4.95 lb per 1000 sq. ft.). If using a Scotts® brand spreader, the instructions indicate the spreader setting you should use. To calibrate a different spreader, follow these steps. We'll work through the example in metric and imperial measures:

1. Determine the amount of fertilizer to be applied in a given area of lawn. Let's assume the lawn area you wish to cover is 50 m^2 (about 538 ft^2).	
2.43 kg / 100 m^2 = 1.22 kg / 50 m^2	4.95 lb / 1000 ft^2 = 2.66 lb / 538 sq. ft.
2. Lay out a plastic sheet or tarp as a test space, and make note of its area. Let's say that our tarp is 3 m x 5 m (about 10' x 16.5')	
3 m x 5 m = 15 m^2	10' x 16.5' = 165 sq. ft.
3. Adjust the spreader's output shutter to a reasonably sized opening. Fill the hopper with a measured amount of fertilizer, then run the spreader over the test area, noting your walking speed.	
We'll use 1 kg	1 kg = about 2.2 lb
4. Measure the amount of fertilizer remaining in the hopper to determine how much fertilizer was used for the application. Let's assume about 0.75 kg (approximately 1.65 lb) is remaining in the spreader.	
1 kg - 0.75 kg = 0.25 kg 0.25 kg were used in the test area	2.2 lb - 1.65 lb = 0.55 lb 0.55 lb were used in the test area
5. Calculate the spreader calibration.	
If the test area was 15 m^2, and the amount of fertilizer applied in the test area was 0.25 kg, then: Calibration = 0.25 kg / 15 m^2	If the test area was 165 sq. ft., and the amount of fertilizer applied in the test area was 0.55 lb, then: Calibration = 0.55 lb / 165 sq. ft.
6. Compare the spreader's calibration to the desired application rate. In this example, the spreader was applying about 68% of the recommended rate. Open the output shutter 32% wider and re-calibrate the spreader.	
Calibration = 0.25 kg / 15 m^2 or 1.67 kg / 100 m^2 Desired rate = 2.43 kg / 100 m^2 1.67 / 2.43 = 68%	Calibration = 0.55 / 165 sq. ft or 3.33 lb / 1000 sq. ft. Desired rate = 4.95 lb / 1000 sq. ft. 3.33 / 4.95 = 67%

Safety Requirements

Safe work practices are especially important when working with chemical based products. Governments in most regions require that suppliers of these types of products supply **Material Safety Data Sheets** (MSDS), for all products sold. MSDS sheets provide all of the information required for safe handling of the product. This should be communicated to the customer at the time of the sale to ensure they are aware of the necessary precautions when using the product. Some regions require other training or certification, such as pesticide applicator, vendor or dispenser licenses. Workplace Hazardous Materials Information Systems (WHMIS) training may also be a requirement both for those applying and selling controlled products.



Scotts

MATERIAL SAFETY DATA SHEET
SCOTTS CANADA LTD.

2000 Argentia Road,
Plaza 5, Suite #101,
Mississauga, Ontario
L5N 2R7

Tel. Office: (905) 814-7425
Fax: (905) 814-7392
Medical & Pet Emergencies: 1-888-779-7919
Accidents/Spills (CANUTEC): 1-613-996-6666

SCOTTS® ECOSENSE™
NATURAL LAWN FERTILIZER 10-1-5

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Scotts® EcoSense™ Natural Lawn Fertilizer 10-1-5
PRODUCT DESCRIPTION: Lawn Fertilizer
PRODUCT CODE: 00805-1
FORMULA NUMBER: S11759
WHMIS CLASS: Exempt - Product intended for consumer use only; WHMIS panel not required.
TDG CLASSIFICATION: Not Regulated

MANUFACTURER
Scotts Canada Ltd., 2000 Argentia Road,
Plaza #5, Suite 101, Mississauga,
Ontario L5N 2R7
Phone: : (905) 814-7425
Fax: (905) 814-7392

2. COMPOSITION / INFORMATION ON INGREDIENTS

This product contains the following non-hazardous ingredients: Potassium Sulphate, Dolomitic Limestone, Feathermeal, Wheat Shorts and Bonemeal.

Hazardous Ingredients:

Chemical Name	CAS NO.	Wt. %
Sodium Nitrate	7631-99-4	30 - 60

3. HAZARDS IDENTIFICATION

None.

SCOTTS® ECOSENSE™ NATURAL LAWN FERTILIZER 10-1-5
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Pests & Diseases

Chapter 9

Integrated Pest Management

Integrated Pest Management, or IPM, is an approach to pest control aimed at suppressing damage to within acceptable economic levels, at a minimum effect on the environment. IPM programs follow a decision making process that begins with a number of preventative measures, then minimizes any arising pest or disease problems through a series of cultural, physical, mechanical, and biological methods, using chemicals as a final option only where others have not been sufficient. The principle of Integrated Pest Management has been developed because an over-reliance on chemical pesticides has led to undesirable effects, such as the development of chemical-resistant pests, the build-up of secondary pests, and the overexposure of our environment to toxic pesticides.

Below are some basic steps the gardener can take in order to prevent and control insect and disease problems. IPM measures are discussed in detail in other publications. Additional readings are extremely useful, and we recommend that you familiarize yourself with more extensive information on IPM by requesting complete manuals from your regional Ministry of Environment, Lands or Parks, or by contacting your local landscape and nursery association.

Insect and Disease Prevention & Control

A certain amount of insect and disease prevention and control can be achieved by following some of the basic premises of Integrated Pest Management:

1. Select healthy, disease resistant cultivars and those that attract beneficial insects.

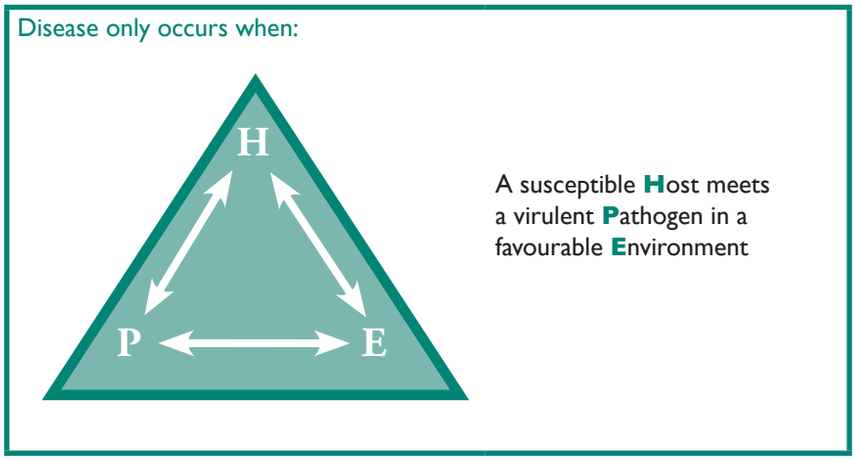
2. Maintain sanitary conditions in the growing area: destroy heavily infested plants, remove all weeds near the growing area, clean containers and tools thoroughly between uses.

3. Remember, healthy plants are less susceptible to pest attack: maintain proper growing conditions with regard to temperature, humidity and light; keep foliage dry and provide good air circulation: most fungi and bacteria need several hours of moisture for spores to germinate.

4. Isolate new plants from existing plants to prevent the introduction of new pests.

5. Know which insects and diseases are harmful and use the least toxic control method at vulnerable stages of the pest's life cycle.

Figure 9-1 Remember the disease triangle



Considering Customers' Pest Problems

It is important to approach your customers' plant pest and disease questions with the following facts in mind:

1. It is normal for garden plants to have some pest damage.

2. Healthy plants can withstand pest attack better than plants growing under stress.

3. Many garden problems are the result of poor growing conditions such as wrong soil acidity, inadequate or over watering or fertilizing, and too much or too little sun.

Always educate your customer on preventative and cultural measures, and suggest non-chemical controls wherever possible. Remember the principles of Integrated Pest Management, and help your customers assess how much damage can be tolerated before pesticides should be applied—or if damage is such that replacing the plant is the best and least toxic option.

When chemicals must be suggested as the last resort in solving a pest problem, it is imperative that you offer the correct advice in selecting, measuring and applying them; more importantly, you must be ensure the customer understands your advice, and knows what safety precautions to take.

Further, you need to know what sort of pest you are identifying and its stage of development. To be effective, most pest controls must be applied at a specific developmental stage of the pest. Controls applied at the wrong time may be ineffective. Some pests, such as root maggots, require preventive control measures long before the damage is evident. Other "pests" are not really pests at all. Most insects found in the garden are important pollinators or are predators of harmful insects: home gardeners commonly inquire about a black and orange elongated insect that horticultural experts know as the larval stage of the beneficial ladybug—so you can see the need to know your bugs.

Cultural Methods of Pest Control

Cultural methods of pest control work by interfering with the pest at a susceptible period in its life cycle. For instance, we know that fungi or bacteria cause most garden diseases, and that they can be transmitted by splashing water or by spread of infected plant debris. Most require moist conditions for survival in the initial stages of infection; therefore, important controls include watering at the base of a plant only and encouraging conditions that permit rapid drying of foliage. Fall cleanup of plant debris limits insect populations and disease inoculum in spring from over-wintered pests. For some diseases and pests, is better to burn or otherwise dispose of plant refuse, rather than compost it.

Table 9-1 following describes some common diseases and pests and potential controls. When a control must be used, select the least toxic option available and, if a chemical, apply at recommended label rates. Avoid the use of home remedies (e.g., dish soap, etc.) as their ingredients vary widely, some may be damaging, and their efficacy is not tested. Because the regulation of chemicals is controlled at various levels of government, a given pesticide may not be available in all regions, or indeed from one municipality to the next. For this reason, we recommend that you learn which pesticides are available to you and your customers. Make note of these chemicals and familiarize yourself with their positive and negative effects.

Identifying Unknown Pests

When you run across plant pests or diseases that neither you nor the gardener can identify, there are various agencies that can help. Governmental departments responsible for agriculture or the environment often have labs that will assess the problem. In addition, the spread of invasive alien species in various regions have led to the establishment of councils (usually not-for-profit) that help identify non-native insects, plants or diseases, and to track their spread.

To preserve samples to submit to such an agency, use these methods:

Moths & Butterflies
Press between two pieces of stiff paper and place in an envelope.

Caterpillars & Soft Bodied Insects
Send live samples in a jar with their natural food, or preserve in alcohol.

Other Insects
Submit love or dried specimens.

Leaves and Flowers
Press flat between paper towels and cardboard.

Fruit
Best sent fresh while showing symptoms; rotten samples are unacceptable. Wrap fruit, towel-dried of any moisture, in paper towel and place in a plastic bag.

Roots or Stems
Washed of soil, towel-dry and place in a plastic bag.

Disease or pest samples should include a note describing the variety of the plant and its growing conditions, a description of the disease, an indication of any pesticides applied and their rates, as well as any other pertinent information. Unidentified plant samples should be accompanied by details of the plant's growing conditions, its size and shape, and any other information that may be helpful.

Learn Online

BCMAL Plant Diagnostic Lab, Abbotsford, BC
www.agf.gov.bc.ca/cropprot/lab.htm

Crop Diagnostic Centre, Winnipeg, Manitoba
www.cropdiagnostic.ca

Pest Diagnostic Clinic, Guelph, Ontario
www.labservices.uoguelph.ca/units/pdc/

*For lab services in your province, contact the provincial ministry of agriculture.

Table 9-1 Common pests, diseases, and their controls

Pest or Disease	Affected Plant(s)	Description & Control
Aphids	Numerous species indoor and outdoor	Small, sap-sucking, soft-bodied insects of various colours from pinkish-white to green and black, found in colonies on stems and undersides of leaves. Aphids feeding on leaf buds cause forming leaves to curl and twist. Best controlled when colonies are small. Hose plants down with water. Encourage predators such as ladybugs and lacewings to maintain control. Do not spray with insecticide if beneficial insects are controlling the population.
Azalea Leaf Gall	Azalea Rhododendron	Leaves become thickened and develop into hard, brown, gall-like bodies. Avoid overhead watering to minimize leaf wetness. Improve air circulation around the plant. Prune out and dispose of galls that form.
Bacterial Canker or Gumming	Apricot Cherry Peach Plum	Blossom and twig killing occurs in spring, often accompanied by gumming. Gummy trunk and limb cankers may kill all or part of the young trees later in the season. Prune out as many cankers as possible well below the diseased area; disinfect pruning tools after each cut in one part disinfectant or bleach to 10 parts water.
Black Knot	Plum	Black wart-like growths appear on twigs and branches. Early growths are soft and greenish, enlarging and becoming black and hard as the tree grows. Warts can reach a diameter of 20 cm (8”). Prune out knots before early spring. If knots are present on major scaffold limbs or the trunk, remove by cutting away the diseased tissue down to healthy wood and out at least 7 cm (2.5”) beyond the edge of the knot.

Pest or Disease	Affected Plant(s)	Description & Control
Black Spot	Roses	Fungal-caused circular black spots on leaves and infecting stems if severe. Recommend varieties resistant to black spot. Remove infected leaves and dispose of, and clean up all debris and dropped leaves in fall. Improve air circulation surrounding plant. Thin out plants and mulch soil. Avoid overhead watering.
Blight	Numerous species	A plant disease or severe pest infestation causing withering and rapid death of plant parts. Treatments vary according to species. In those that are prone to blight, select disease resistant varieties, employ good cultural practices, ensure good sanitation, and for vegetable plants, practice crop rotation.
Botrytis	Numerous species	This fungal disease can develop on any above-ground part of the plant as a result of poor air circulation and high humidity. Dead leaves and flowers left on the plant encourage its growth. Symptoms generally appear as fuzzy gray patches. Remove old leaves and flowers regularly and increase ventilation. Discard severely affected plants.
Bruce Spanworm or Winter Moth	Fruit trees, notably apple, cherry, plum, pear, and ornamental cherry and plum. Maples Roses	Larvae feed on the leaves and buds in spring. Severe infestations lead to defoliation. Young worms are carried by the wind and can drift considerable distances on silken threads. Male moths are pale brownish-gray. The females are wingless. Adult worms are 2 cm long, bright green with three white stripes on their sides. Two sticky bands, applied around the tree trunk in fall will trap many of the females as they crawl upward to deposit eggs on the trunk and larger limbs. The lower band should be replaced as it becomes dry, congested, or as moths begin to become trapped on the upper band.

Pest or Disease	Affected Plant(s)	Description & Control
Caterpillar	Numerous species	Some types feed within rolled leaves, others skeletonize leaf surfaces or form webs. Damage may occur throughout the growing season. Watch for signs of damage. Small infestations may be hand-picked or pruned out and disposed of.
Colorado Potato Beetle	Petunias Potatoes Tomatoes	Adults are yellow-orange beetles with 10 black stripes on wing covers. Larvae are orange, hump-backed grubs with black spots along sides. Eggs are yellow ovals laid in upright clusters. All stages defoliate plants. Hand-pick beetles to control.
Cutworm	Numerous species	Fleshy, soft-bodied caterpillars, up to 4 cm (1.5") in length, that curl up when disturbed. These insects cut off and eat plant stems at or just below soil surface. Some feed on the foliage at night, returning to the soil in day. Check field grown plants. Drench with water to force cutworms to the soil surface, where they can be hand picked and destroyed. Discard severely infested plants.
Cypress Tip Moth	Cedar Cypress Juniper	Tips of branches become brown and drop off. Cocoons, 4 mm long, appear on affected twigs in April and May. Gray moths, 5 mm long are present in June and July. Improve plant health through feeding and watering during growth season, to improve tolerance to damage.
European Chafer Beetle	Turfgrass	Common in southern Ontario and BC. Larvae are white grubs that feed on grass roots, causing it to die out in patches. Skunks, racoons and crows tear turf to feed on grubs. Healthy lawns are least susceptible. Follow fertilizing and irrigation regimen. Replace turf with perennial groundcover where possible. Inspect garden plants before transplanting to prevent spread.

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Prevent the spread of pest and disease between plants by sterilizing your garden tools, particularly secateurs and loppers. Use one part bleach to 10 parts water, or one part Lysol to 9 parts water.

Pest or Disease	Affected Plant(s)	Description & Control
European Pine Shoot Moth	Pine	6 mm (1/4") long, brown caterpillars with black heads, which bore into terminal buds during mid-summer. Infested buds exude pitch. The following spring, new growth may be distorted or fail to develop. Prune damaged shoots.
Fairy Rings or Mushrooms	Turfgrass	Semi-circles or rings of dark green grass appear in the lawn. Growth within this ring is yellowish or dead. Mushrooms, toadstools and puffballs may grow within or around the ring. Application of nitrogen and ample irrigation during growing season may mask symptoms. Eradication often requires deep excavation and removal of soil and mycelium (fungal tissue which forms an impervious mat, preventing water and nutrients from reaching the roots).
Fungus Gnats	Numerous species, particularly houseplants	Gray flies about 3-6 mm (<1/4") long, resembling fruit flies. Young are white maggots that feed on soils high in organic matter, roots and crowns of plants. Foliage may drop and growth may appear stunted on affected plants. Plants potted in pots that are too large are highly susceptible. Decrease humidity and frequency of watering so that soil dries between watering. Topdress houseplants with 2.5 cm (1") of clean sand. Discard severely infested soil and wash roots, then repot in sterilized soil, or discard entire plants. Yellow sticky cards attract gnats at flying stage.
Japanese Beetle	Various species	Adults are metallic blue-green, 1 cm long (1/2"), with bronze wing covers. Larvae are fat, white grubs with brown heads. Adults defoliate and feed on flowers of many kinds of ornamentals. A serious pest in eastern U.S. and southern Ontario. Not yet present in BC and cannot survive Prairie winters. Shake or pick out beetles from plants.

Pest or Disease	Affected Plant(s)	Description & Control
Lawn Moths	Turfgrass	Irregular brown patches appear in lawn where grass roots or blades have been chewed off at ground level. The damage is caused by small white worms 1-2 cm (<1") long, which are usually hard to find. They develop into pale moths that are active at dusk and are attracted to light. Examine the lawn from March to April and from late August to early September. Do not chemically treat unless larvae are causing severe damage.
Leafminer	Numerous species including birch, lilac	Young leaves have blotchy brown areas, each containing a tiny worm, which feeds between the two leaf layers, appearing to skeletonize the leaves. Various types of leafminers exist, affecting different species of plants. Remove infested leaves, debris, and alternate weed hosts. Improve growing conditions. Use cover cloth on vegetable crops and practice crop rotation.
Mealy Bug	Numerous species, primarily houseplants	Closely related to scale. Insect is oval-shaped, white and fuzzy. All stages suck plant sap, causing stunting or death. Honeydew is excreted onto foliage, where sooty mold will often grow. Most often found in the crevices of a plant. Difficult to rid. Use a cotton swab dipped in rubbing alcohol, and apply to insects. Hose infested plants with water weekly. Remove plant from pot and thoroughly wash pot with one part bleach to 10 parts water, cleaning crevices and rims thoroughly.
Pearslug	Cherry Pear	A green to orange-black, slimy, slug-like larva up to 6 mm in length long, causing leaves to become skeletonized and brown. Damage in limited amounts is not necessarily injurious to plant health. Heavy infestation should be controlled using a jet of water.

Pest or Disease	Affected Plant(s)	Description & Control
P. ramorum	Commonly affects Oak and Camellia, but affects and is hosted by numerous other species.	Soil fungus that causes an array of symptoms in a wide variety of plants including leaf discolouration, tip dieback, and can ultimately lead to plant death. Currently problematic and / or present along the western seaboard, leading to the regulation of the disease in some areas, and inspection and certification of nurseries against it in other areas. Not known to survive cold temperatures, and not currently identified in southern Ontario. No known cure. Positive finds in nurseries are destroyed by deep burial. Retail garden centres should ensure that host material comes from a certified grower. Retailer / growers should become certified free of disease.
Powdery Mildew	Numerous species	Gray to white powdery growth, usually on the tops of leaves. Small black dots form and produce spores that are blown by wind to infect new plants. Thrives in poorly ventilated, humid conditions. Prune or remove infected leaves to improve air circulation. Water early in the day and avoid wetting foliage. Control nearby weeds, which may be hosts. Maintain ideal growing conditions, avoiding excess shade, dry soil, or lack of feeding.
Root Weevil	Azaleas, berries, rhododendrons, roses, viburnum, and other hosts.	Larvae are grubs that feed on roots, weakening plants or causing them to die. The snout-nosed beetle feeds on the edges of leaves giving them a notched appearance. There are several species from 3-10 mm (<1/2")long, gray to black in colour. Partial control of adults is possible by placing short pieces of boards among plants. Weevils hide under these and can be collected and destroyed every few days.

Pest or Disease	Affected Plant(s)	Description & Control
Scale	Numerous species	The adult females are noticeable as hard or soft, 2-5 mm (about 1/8"), apparently stationary bumps on stems, leaves, fruit; males are minute flying insects; larvae are tiny, soft and crawling. All stages suck plant sap. Plants yellow, drop leaves, and may die. Scale excretes honeydew where sooty mold will often grow. Prune out infested plant parts. If practical, scrub scales gently from twigs with soft brush and rinse well.
Slugs	Numerous species, most devastating to leafy plants like hostas, lettuce, etc.	Soft, unsegmented bodies exude a slimy mucus. Active throughout the year if temperature and humidity are suitable. They shelter in moist, dark places and feed at night. Surface tissues of plants are rasped and irregular holes are eaten leaving foliage tattered and slimy. Seedlings may be completely eaten. Remove trash, vegetation and other sheltering sites for slugs. Avoid late evening watering. Remove shade to increase air circulation. Consider choosing plants less susceptible to slug damage. If slugs are common, place pet-proof traps in area.
Snow Mould	Turfgrass	Fungal disease caused by two pathogens: pink and white snow moulds. Dead patches of grass appear under melting snow piles. Reduce watering and apply a nitrogen fertilizer in the late summer.

Pest or Disease	Affected Plant(s)	Description & Control
Spider Mite	Numerous species, particularly houseplants and Alberta Spruce	Most are too small to be seen without a magnifying glass. They are found on the undersides of leaves and in leaf axils where they spin fine webs, under which they feed and lay their eggs. Mites suck plant juices, causing a yellowish speckling of the leaves, and eventually leaf-drop. They are common on plants grown in hot, dry locations. Mites reproduce rapidly and must be controlled immediately. Hose down plants. Provide cooler temperatures, higher humidity and good air circulation.
Thrips	Numerous species	Small, slender pests, the adults being brown to black and the young much lighter in colour. Their feeding gives foliage and flowers a silvery, speckled appearance. Dots of frass (excrement) and small egg-laying scars are often seen on severely infested plants. Control thrips with methods recommended for aphids. Eradicate nearby weeds, which often harbour thrip populations.
Whitefly	Numerous species, particularly houseplants	Adults are about 1 mm (<1/16") long, and look like tiny white moths. Whiteflies congregate on the upper foliage of many plant species, feeding and laying eggs on the lower surfaces of leaves. Like many sucking insects, they excrete honeydew, which acts as a medium for the growth of sooty mould. Leaves of infested plants turn yellow and eventually fall off. Generally very difficult to control once established. Careful inspection of new stock and eradication of weeds (which are often infested) are necessary to prevent outbreaks. Some success may be achieved using methods recommended for aphid control or using yellow sticky cards.

Weed Control

Weeds are defined as any plants growing in undesirable locations. They compete with garden plants for water, nutrients, light and space, and may act as hosts for insects and disease. While some are native to our geographic areas, others are introduced or escaped garden plants: Purple Loosestrife (*Lythrum salicaria*), for example, was brought to North America from Europe in the 1800's as an ornamental; knapweed came through impure grain seed. The presence of other weeds can indicate poor growing conditions for desirable plants. In lawn, for instance, clover may be a sign of low nitrogen while buttercup invades lawns with overly compacted and moist soils and moss thrives where the pH level is low. The best way to eradicate these and many other weeds is to make the growing conditions less amenable to them, and to limit their spread before their seeds mature.

Many annual and biennial weeds are capable of producing 20,000 seeds per plant or more. Once dispersed, some of these may germinate immediately and some remain dormant for years before germinating, or may germinate when exposed to light after the soil has been disturbed. Perennial weeds will produce seed, but a good many are capable of reproducing by small vegetative cuttings. These must be removed from the garden manually or "mechanically" with attention paid to eliminating the whole plant.

Mechanical Controls

Hand weeding is the most effective control for weeds in the home garden because it is selective and safe. A gardener can remove problem weeds without risking possible injury to desirable garden plants, and without chemical application.

Hoeing is ideal for controlling annual and biennial weeds in large areas. A hoe should be used to slice or scrape just below the soil surface to sever annual weeds from their roots. Weeds with deep taproots must be excavated with a garden fork or spade. Perennial weeds with spreading rhizomes can actually be dispersed by cultivation: breaking up the rhizome and spreading its pieces in the garden can cause new weeds to establish themselves throughout. For this reason, once dislodged, weeds should be removed and composted. Weeds that have gone to seed should only be composted if the compost pile is kept hot (75°C / 167°F), otherwise the seeds may survive and germinate when the compost is spread in the garden.

Mulches of grass clippings, sawdust, plants or newspaper are often effective means of smother weeds. Mulches should

Invasive Alien Species

We don't often consider garden-variety weeds as 'noxious' or 'alien'—usually they are simply 'annoying'. But many weeds in our environments are considered to be Invasive Alien Species. Just as the spread of plant pests and diseases are tracked and catalogued, so are invasive weeds. In the publication, An Invasive Alien Species Strategy for Canada, the problem is noted as "affecting Canada's environment, economy, and society, including human health," and the study further notes that "current threats posed by existing and potential invasive alien species are significant and are growing at an alarming rate" (September 2004).

The potential damage is such that governmental agencies at all levels, as well as non-governmental organizations, have launched efforts to make the public more aware. The spread of invasive alien species in various regions have led to the establishment of councils (usually not-for-profit) that help identify non-native insects, plants or diseases, and to track their spread. In nurseries and garden centres, it is important to know which aggressive ornamentals need to be conscientiously contained.

An IAS in Canada: Brown Spruce Long-Horned Beetle
Natural Resources Canada • Klaus Bolte

Learn Online

CFIA Invasive Alien Species Resources (Plants > Pests > Invasive Plants)
www.inspection.gc.ca

Hinterland Who's Who (Issues & Topics > Invasive Alien Species)
www.hww.ca

Canadian Biodiversity Information Network: An Invasive Alien Species Strategy for Canada (Issues > Invasive Alien Species)
www.cbin.ec.gc.ca

*Most provinces have their own IAS councils: contact your provincial horticultural trade association to find out more about invasive alien species in your area.

be 5-7 cm (2-3") thick to prevent germination of weed seeds. Established perennial weeds should be cut to the ground, or dug out entirely before applying the mulch.

Chemical Controls

Integrated Pest Management practices should always be applied when considering the use of a chemical, whether for insect, disease, or weed control. Use least toxic measures first. In extreme cases, herbicides may be used to control weeds in lawns, on driveways, around ornamental plantings or along fence-lines. Used properly, herbicides can be very effective; used improperly, they can be ineffective or they can injure or kill desirable plants.

Table 9-2 Common weeds and their controls

Weed	Commonly Found	Description
Black Medic *Medicago lupulina*	Lawn Gardens Open soil	Annual; spreads by seed and roots. Alternate leaves compound with three leaflets. Flowers yellow, borne in globe-shaped clusters.
Canada Thistle *Cirsium arvense*	Gardens Open soil	Perennial; spreads by seed, horizontal roots. Separate male and female plants. Purple flower heads. Spiny leaves and stems.
Chickweed *Stellaria media*	Lawn Disturbed soil	Annual or winter annual; spreads by seed, leafy stems. Tiny, white star shaped flowers; opposite, oval leaves.
Smooth Crab Grass *Digitaria ischaemum*	Lawn Open soil	Annual; spreads by seed. Auricles absent, ligules present. Two to six finger-like terminal spikes. Purple coloured stems.
Creeping Buttercup *Ranunculus repens*	Damp soils	Perennial; spreads by seed and roots. Five shiny yellow petals; leaves three-part lobed and toothed.
Creeping Speedwell *Veronica filiformis*	Lawn	Perennial; spreads by seed, rhizome. Blue flower, low growing groundcover.
Dandelion *Taraxacum officinale*	Lawn	Perennial; spreads by seed Yellow daisy like flowers. Basal rosette of toothed leaves. Deep taproot. Milky juice in leafless, hollow flower stalks.
English Daisy *Bellis perennis*	Lawn Waste places	Perennial; spreads by seed. White to purplish ray florets; yellow disk florets.

Weed	Commonly Found	Description
Field Bindweed Syn.: Morning Glory *Convolvulus arvensis, Convolvulus sepium*	Gardens Open soil	Perennial; spread by seed, vegetative cutting, creeping root. Round or heart shaped flowers and arrowhead-shaped leaves. Growth habit is vining.
Field Horsetail *Equisetum arvense*	Gardens Open soil Disturbed soil	Perennial; spread by spore, deep rhizome. Leafless or fertile stems are light brown, about 30 cm (12") high with a spore bearing at the top. Sterile stems, to 60 cm (24"), produce whorls of green leaf-like branches, which form at the joints. Tenacious roots reproduce even when severed.
Foxtail Barley *Hordeum jubatum*	Open soil Disturbed soil	Perennial; spread by seed. Green barley-like seed heads. Linear leaves on round stems.
Common Groundsel *Senecio vulgaris*	Gardens	Annual, winter annual, biennial; spread by seed. Semi-succulent with yellow flower heads composed of disc florets. Stems hollow; stems, leaves, flowers are hairless.
Heal-all *Prunella vulgaris*	Lawn Waste places	Perennial; spread by seed, creeping stems. Leaves have a mealy texture; leaves and stems often have a purplish blotch. Dense clusters of purplish flowers at end of branches. Broad kidney-shaped bracts.
Lamb's-quarters *Chenopodium album*	Lawn Disturbed soil	Annual; spread by seed. Gray powdering on the leaves; small green flowers.
Moss	Lawn	Common in high rainfall areas, although it cannot compete with a vigorous, healthy lawn. Thrives under conditions of poor soil aeration, poor drainage, low fertility, high acidity and shade.
Redroot Pigweed *Amaranthus retroflexus*	Gardens Open soil	Annual; spread by seed. Dense flower clusters at end of branches. Plant has bristly rough texture and reddish-pink taproot. Distinctive red roots and stems; green flower spikes.
Narrow-leaved Plantain *Plantago lanceolata*	Lawn Open soil Roadsides	Perennial; spread by seed. Oval spike of tiny green flowers. Narrow leaves with prominent ribs.

Weed	Commonly Found	Description
Prostrate Knotweed *Polygonum aviculare*	Roadsides	Annual, occasionally perennial; spread by seed.Small inconspicuous flowers. Prostrate stems with small leaves. Deep taproot.
Quackgrass *Elytrigia repens*	Lawn Gardens Disturbed soil	Perennial; spread by seed, rhizomes. Auricles and ligules present. Sheath hairy at base and open with overlapping margin. Green flower spikes. Flat leaf blades on hollow stems. Troublesome perennial grass weed.
Russian Thistle *Salsola kali* subsp. *ruthenica*	Gardens Open soil	Annual; spread by seed. Slender ascending stems with red stripes; plants bristly at maturity and leaves spine-tipped.
Shepherds Purse *Capsella bursa-pastoris*	Gardens Open soil	Winter annual; spread by seed. Distinctive triangular pod and flat fruit. Small white flowers. Wavy basal leaves with deeply lobed margins.
Stinkweed *Thlaspi arvense*	Gardens Open soil	Annual or winter annual; spread by seed. White flowers. Narrow leaves. Heart-shaped seedpods; distinctive odour.
Wild Buckwheat *Polygonum convolvulus*	Gardens Open soil	Annual; spread by seed. Small green flowers. Twining stem. Heart-shaped leaves. Two stipules fused to an "ocrea" (sheath).

Pesticide Application & Handling

Being able to identify pests and recommend control measures is an important skill for retail garden centre professionals to master. Customers have many questions about problems they are experiencing in their garden: accurate identification and effective control suggestions will help guarantee your customers success in their garden, but more importantly will encourage them to act safely and ecologically responsibly. Always ensure that your consultation with the customer includes the following:

1. Advice to carefully read all labels before applying the product, and a summary of the label instructions so that any questions can be answered.

2. An alert to use protective safety equipment as per label directions, and precautions for keeping children and pets away from chemically treated areas according to product warnings.

3. Details about proper storage and disposal of the product and / or its empty container.

Most regions have licensing requirements for pesticides vendors and dispensers. Contact the local authority, industry association or governmental agency to learn what the requirements are in your area, and be sure you and your staff are adequately trained and certified. Also contact your municipality to educate yourself on any cosmetic pesticide bans in your area.

Pest Control in the Garden Centre

Given the nature of the retail garden centre environments, it is not unusual for plant sales areas to become infected with pests themselves. In addition to selling pesticides, herbicides, pressure sprayers, hose-end sprayers, and other related products, retail garden centre professionals should have the ability to identify and treat pest problems in their own space, using these products. Make sure you are capable of:

- Accurately calculating the amount of chemical required to mix in a pressure sprayer, according to label rates
- Explaining and demonstrating the use of a pressure sprayer
- Explaining and demonstrating the use of a hose-end sprayer
- Identifying / using safety equipment as indicated on MSDS sheets
- Taking necessary precautions when mixing and applying chemicals
- Properly storing and disposing of pesticides and containers
- Containing and cleaning up a chemical spill.

Proper Use of Spray Equipment

Familiarize yourself with the different types of pressurized and hose-end sprayers available. Learn about their operation, different nozzles and their uses, proper cleaning and their other functions. Are they adjustable? Do they come with different attachments? What are the benefits and drawbacks of each? Whether you are selling or employing these tools, you need to know all their features.

Consider the following points:

1. Different nozzles are used for different purposes: cone shaped spray patterns are commonly used for spraying shrubs or trees; fan shaped nozzles are often used for ground spraying.

2. Even the best equipment can be prone to leaks or damage, and spills are common. MSDS sheets list the safety equipment you or your customer should employ before applying a chemical. Know where to find chemical resistant gloves, safety glasses or goggles, full-face shields, respirators, rubber boots, and protective clothing or aprons—and use them!

3. Some pesticides may only be used under particular environmental conditions. Be conscious of these instructions and know when it is too wet or too dry to apply them. Be aware of wind direction to avoid drift on to other plants or yourself.

4. Proper clean up of equipment is essential, both to extend the life of your equipment and to guard against cross-contamination: wash your sprayer, inside and out, with soap and water. Run soapy water through the boom and nozzle, then rinse with clear water.

Improper disposal of containers or cleanup of spills can cause environmental and health hazards. Rinse containers thoroughly, and punch holes in them to prevent re-use for other purposes. If a spill occurs, contain the area and keep customers and staff away. Notify supervisors or an authority, and fill out appropriate reports. Absorb the chemical and dispose cleanup aides according to safety guidelines.

The Garden Centre Environment

Chapter 10

The Diversity of Garden Centres

The retail garden centre is host to a wide assortment of environments. In any given workday you may be asked to unload a truck with the forklift, help a customer select plants to purchase, explain how to repair damage to a lawn, prune a fruit tree, answer the phone, process an order through the till, deal with an unsatisfied customer, fix a broken irrigation line, and create a display for impulse sales. Because of the variety of tasks, your day will be challenging but filled with opportunities to learn new skills and increase you knowledge. Realize that an employee with diverse skills is invaluable to an employer: educate yourself by reading books and product labels, attend industry events, network with your peers, take courses, and most importantly, listen to the answers given by more experienced coworkers and share your knowledge with those who are less experienced. Finally, try it out! Plant a garden, be it a large yard, a few patio pots, or a collection of houseplants on a windowsill.

In any industry, people find their niches. Because the nursery business is so multifaceted, you will find that some of your peers will specialize in sales, trees, tropical, perennial, bedding or pond plants, while others will be capable in a broad range of avenues. An experienced nursery professional will be competent in all areas of the store's operations. Similarly, some nurseries specialize in one facet of the industry or another: your store may not have a forklift or sell pond plants, where others are of a size and scale such that they can offer services that span most aspects of the trade. Whatever your employment situation, this guide will be of use to you. Refresh your skills, or use this section to teach the basics in areas with which you may unfamiliar.

Workplace Safety

Workplace safety is an important function of today's businesses, and is of particular concern in a retail garden centre environment where a wide variety of equipment, chemicals, and physical activities are employed. It is essential that you possess a high awareness of the potential dangers in your workplace, and that you operate in a safe manner. Consider just a few of the many pieces of equipment that may be present in your store, and know the basic safety practices associated with them so that if you are called upon to operate them or around them, you will be able to do so in a way that is safe. Also consider the nature of a garden centre or nursery, and take special care to sign slippery or wet area, remove hoses and other tripping hazards from walkways, salt icy areas in winter, and perform other tasks that will help prevent customer and co-worker accidents.

There are numerous manuals and publications, warning stickers, posters and courses that are available in the pursuit of safety available from Worker's Compensation Board (WCB) and the local agriculture safety association. Many signs are now available via the Internet as well, so they can be printed and posted immediately; Figure 10-1 below provides some sample safety signage that you can retrieve from the WorksafeBC website, that province's worker's compensation board. Your municipality, province or state, or local industry association can provide you with additional resources, as well as certification bodies for standard first aid.

Figure 10-1 Safety signage examples available for the workplace

Equipment Safety Checklist

Forklift, tractor, skid steer operation

- ❑ Perform daily vehicle inspection prior to startup: check horn, fuel, fluids, brakes, lift function, condition, tires
- ❑ Demonstrate the ability to operate the machine
- ❑ Demonstrate safety considerations: smooth operation, awareness of surroundings, using shoulder checks, parking safely and securely, elevating and moving load safely
- ❑ Become familiar with attachments used on these machines such PTO (power take-off) devices, hydraulic spades and augers
- ❑ Wear appropriate safety gear when operating machinery.

Potting and seeding machinery

- ❑ Watch for moving parts that can pinch, bind or grab clothing or body parts
- ❑ Watch for compressed air powered parts; beware of airborne debris
- ❑ Know the location of kill switches in case of emergency
- ❑ Become familiar with operating procedures before using machine
- ❑ Wear personal protective equipment where appropriate
- ❑ Inspect machine before use for safety and soundness
- ❑ Wear appropriate safety gear when operating machinery.

Climate control systems (Ventilation systems, humidity, heating system, boiler, cooling systems, shading systems, CO_2)

- ❑ Be aware of sensor, thermostat locations, and how to adjust them
- ❑ Know safe and appropriate temperature range levels
- ❑ Know location of climate control machinery within the nursery
- ❑ Ensure regular maintenance and lubrication is carried out

Shop tools and machines

- ❑ Know the safe operating procedures for the commonly found machines and tools in your workplace, such as welding equipment, band saws, radial arm saws, circular saws, compressors and tools, hand drill, drill press, bench grinder, generators, sump pumps, pressure washers
- ❑ Wear appropriate safety gear when operating machinery.

Pruning tools

- ❑ Know your air, electric, manual or gas powered pruning tools
- ❑ With electric tools always be aware of the cord or battery condition
- ❑ With gas operated machinery be aware of the engine and fuel type: two stroke (mixed fuel) or four stroke (straight gas), and check lubricant levels on all machines prior to startup
- ❑ Check blade condition and wear appropriate protective equipment
- ❑ Know how to clean and sterilize tools
- ❑ Wear appropriate safety gear when operating equipment.

Heavy object tools

- ❑ Know how to safely use a pallet jack and handcart (dolly)
- ❑ Keep feet clear of heavy objects
- ❑ Push, pull and lift with your legs, not your back
- ❑ Wear appropriate safety gear when operating equipment, especially safety-toed boots.

Store fixtures

- ❑ Be aware of the daily hazards faced around the workplace from common objects such as flood and roller tables, racking systems, carts and shelving units, lighting and shading systems, ventilation systems, wet floors and chemical spills, weather hazards, floral coolers or storage areas
- ❑ Keep entrances and aisles clear, and know exit and emergency lighting locations
- ❑ Know how to stabilize ladders and recognize limitations
- ❑ Wear appropriate clothing and footwear for the work environment.

Computers and cash tills

- ❑ Be aware of how to operate computer systems and cash tills at your workplace, and learn the basics regardless of your position at the nursery
- ❑ Know procedures for making cash handling and drops to a safe
- ❑ Know security policies in case of robbery
- ❑ Learn register or point-of-sale software operation, how to change paper and ink ribbons, and how to operate credit and debit card machinery

Trucks and trailers

- ❑ Be properly licensed before operating the various vehicles at your workplace
- ❑ Use extreme caution when operating vehicles, and be aware of the numerous pedestrians and obstacles located in parking and shipping and receiving areas; also exercise extreme caution when making deliveries to clients' residences
- ❑ Wear appropriate safety gear when operating equipment.

Display & Merchandising

Merchandising refers to in-store product positioning as it relates to store layout and displays. For merchandising to be effective, it must be well planned and organized, presented to the right market at the right time, attractive, practical and accessible for shoppers and re-stocking, and should incorporate appropriate signage and advertising. Just as good landscape design is rooted in some basic design principles, there are guidelines for building and positioning displays in order to accomplish these goals.

Understanding how traffic flows through your store is critical in determining where displays should be built, and it is important to note that store lighting, use of colour, and attractive, well designed displays all influence and encourage customers to move through different sales areas. In today's retail environments, space is at a premium. Every foot of every shelf must produce sales and profit, so customers must be led through the store by design. When a customer finds herself at a display, every shelf's arrangement and positioning will come into play to further encourage her to pick up a product.

This section will discuss the theory behind effective merchandising and store layout. Most of the examples provided demonstrate the use of hard goods, particularly in examples of high-impact end-caps. Note, however, that there is no one recipe for arranging a given product, and the same principles will apply to displays of plant material as well.

Store Layout

Store layout is the most important factor in determining how customers shop your store. Often physical restrictions (structural impediments) prevent us the flexibility we would like, so optimizing the space available is essential.

You may have heard reference to your store's **racetrack**, which is quite simply defined as the path of least resistance between store entry and store exit. A strong racetrack will lead a customer through as much or the store as possible and allow ease of movement though several departments or sales areas. If the racetrack is too short, a customer's visit may be overly brief; if a racetrack is too long, it creates frustration to the customer who is forced to walk well out of his or her way, perhaps toting heavy purchases. If someone comes into your garden centre with the purpose of picking up some fertilizer, he wants to find it easily and leave. But if you have effectively laid out your store, he will find the fertilizer and be encouraged to pick up other items as well, creating additional sales. For this reason, many stores have an

entrance in one corner and the checkout area in another, forcing the customer to walk the entire store, directing traffic flow, and exposing shoppers to more items than they'd intended on purchasing.

Along the racetrack are selling **hot spots**, the areas by which customers most often pass, and which are frequently noticed and shopped. Recognizing where your store's hot spots are improves your opportunity for increased sales if you select and display product there wisely. Conversely, stores also have **cold spots**, which are furthest away from the racetrack. These areas can be enhanced using directional spotlights, creating interest and optical movement, or enhancing the space with an eye-catching colour, seasonal interest or special promotions. They might host necessities: consider why supermarkets place the milk along the back wall of the store, or why the pharmacy's dispensary is located at the rear of a drug store. Realize that not all areas in a store are either hot or cold. The remainder of the store surrounding the racetrack will be travelled and shopped, but to a lesser degree.

Following is a sample floor plan. You can see from the diagram that this store's racetrack is quite short, but you can still promote a good deal of sales if you set up your displays appropriately. Strong displays will give the impression of lengthening the racetrack. As you review the diagram and as you think of your store's layout, consider these important points:

- The first 2-3 m (10-15') inside the store entry are generally not good selling areas: customers need a transition area while they slow their pace from running through the parking lot, and their eyes adjust to different lighting and sights

- If given a choice, people generally tend to turn to the right

- Cash register and checkout areas, usually positioned near exit doors, provide many sales opportunities: all customers pass through this area, sometimes they will have a wait, and impulse sale items are easily shopped

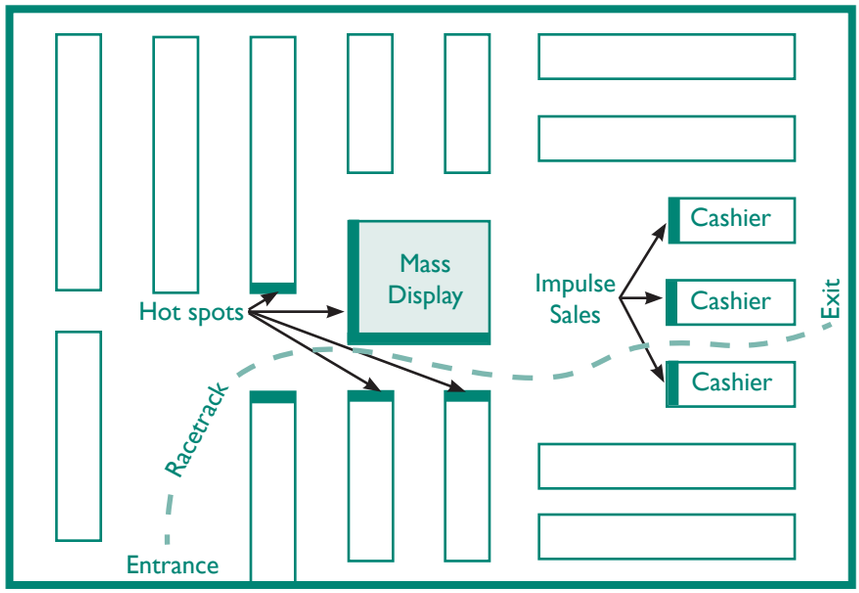
- Hot spots include converging walkways, entries to seasonal display areas or other departments, and large, open areas

- Cold spots are areas of least travel, usually at the ends of aisles away from main traffic areas; these areas generate lower sales and are commonly found at dead-end aisles, poorly lit areas, or along narrow pathways

- Hot spots can be created in traditional cold spots by creating emphasis on that area of the store, either through lighting, aisle arrangement, or the size of the display

- Main aisles must be sufficiently wide that they are not a deterrent to customers; a general rule is to create unimpeded aisles about two carts wide.

Figure 10-2 Typical store layout



Guidelines for Creating Displays

1. Remember the four P's of marketing: price, product, placement and promotion.

2. Create displays that are clean, organized and well spaced.

3. Product must be clean, in prime condition, and front faced; packaged goods should always have the primary language facing forward.

4. Eye level placement is the most effective: shelves that are at normal eye level sell the most product; the bottom shelf is the least productive space.

5. Plan displays with a specific purpose in mind, and change them appropriately to prevent them from getting stale or out-of-season.

6. Relate product thematically or by product.

7. Displays should always look full: pull products forward (front-face) or restock the display as needed.

8. Customers should be able to purchase product without feeling they have disrupted the display.

9. Limit the number of shelves you use: product should always be within reach, and you want to maximize space for product.

10. Build displays before or after regular store hours, or at least during times when you will not be obstructing normal customer traffic flow.

11. Have all your products, promotional items and signage available before setting up the display and remember that signage is critical.

12. Have sufficient product available to refill the display when necessary.

Building Displays

Now that you understand some of the basic principles of where traffic flows in your store and why, we can look at different types of displays that can be built to take advantage of customer traffic. Putting the right display in the right area is equally important as understanding how to build the display. For example, a price-point or high-volume display built in a cold spot would not be appropriate regardless of the timing: it simply will not be seen by enough people to generate high volume sales. Conversely, a theme display of many related items might not be as appropriate in a hot spot—this type of display might be beautiful, but it may be too complicated or make too quiet a statement to grab the attention of a shopper moving quickly along an aisle.

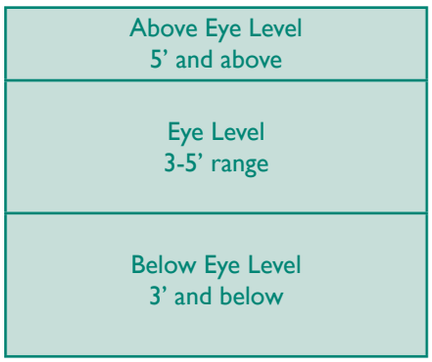
There are eight basic types of displays, each of which can be created as free-standing (or walk-around) units, or as end-caps.

Price-Point or High-Volume Displays

The goal of a good price-point or high-volume display is to increase the sales of a particular product or group of products. Typically, these displays are large and built in high traffic areas, or they are end-cap displays placed in a hot spot. Think of this type of display as the pyramid of Mandarin oranges you find in grocery stores during the holidays, or the wall of Tide® laundry detergent occupying the end of the household goods aisle at Wal-mart.

When building a substantial walk-around promotional display, a large group of items can be incorporated; however, on a typical end-cap that only spans 120cm (4'), you are more limited in the number of different items that can effectively be displayed. In either case, you should be able to get a high volume of sales without having to re-fill the display too often.

Figure 10-3 Vertical selling areas



Areas above eye-level are generally less effective selling spaces.

The eye-level range is considered to be the most effective sales space. Primary product is usually placed here.

Areas below eye-level are generally less effective selling spaces.

End-Caps

When working with an end-cap, no more than three items should be featured, and most merchandisers agree that the block method of display is more effective than either a vertical or horizontal linear method, as demonstrated in the diagram below. These products should be from the same product family or all used for a particular application, so you may have a display made up of all Miracle-Gro® brand items, or one of all boxed fertilizers.

One acceptable method of block merchandising an end-cap is to feature one main product that is your key selling item, a tie-in product for that extra sale, and a secondary or similar product such as a smaller or larger size of the key item. While it is not mandatory to have three items, it allows the merchandiser to highlight and market three different products. It is not wrong to have only one single product, but there is nearly always a missed opportunity for tie-in sales if only one item is presented. Recall that power end-cap of Tide® at Wal-mart: it likely featured the detergent in both liquid and powdered form, and provided fabric softener or stain-remover as a tie-in. An end-cap, however, ceases to create impact if it displays too many products, and it makes re-stocking more difficult and time consuming. Remember these key theories for planning end-cap displays:

1. When using the block method, the key selling item should be placed to the left: because people read from left to right, their eyes are automatically drawn there.

2. The key selling item should be placed at eye level and have impact: make it occupy at least two-thirds of the total end-cap display.

3. Place the tie in item immediately to the right of the key item; sometimes tie-in items are placed above or below the key item, but since those placements locate the tie-in out of eye-level range, they tend to be less successful.

4. The tie-in item requires sufficient quantity to be effective—it shouldn't be a suggestion, it should be a sale.

5. Lower shelves placed below eye level can be used for a secondary product, such as a different size, a concentrate, or a related item, but make sure your secondary product does not detract from the key-selling item.

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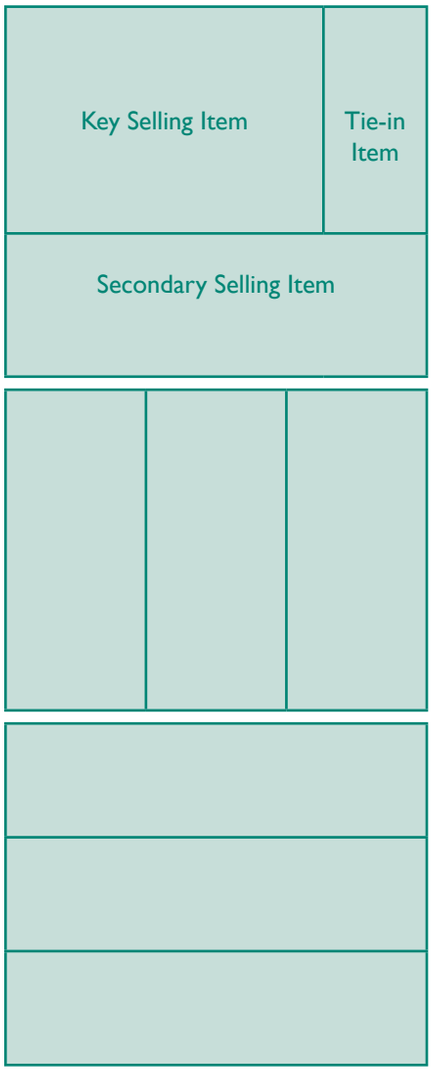
Customers recognize the price of known-value-items (KVIs). In supermarkets, milk and bread are considered KVIs. In garden centres, 1201 packs and seed geraniums are KVIs. Retailers generally price KVIs competitively while pricing for improved margins on non-KVI items.

Figure 10-4 End-cap construction for high volume displays



Block Method

The block method of display is generally considered the most effective for creating high-volume or price-point displays.

Vertical Linear Method

Horizontal Linear Method

Walk around or Promotional Displays

Freestanding or walk-around displays are product groupings that are placed on the floor and positioned in main traffic flow areas where customers must walk around them in order to move through the area. They are used to attract a large number of people to a particular product or area. This is best accomplished by mass displays or dump bins of product. If your store is running a sale on a particular potting soil, pallets of soil bags might be placed in a high traffic area to create a walk-around feature. A garden centre might use a large promotional display to showcase seasonal products. We typically see bins of spring-flowering bulbs placed as walk-around displays during the fall. Consider these key theories for planning walk-around or promotional displays:

1. Promotional displays are built to sell large quantities, so logically they should present large quantities of the same item and create visual impact.

2. Promotional displays are most commonly located in high traffic areas or hot spots.

3. Customers must be able to shop all of the display easily, so stack product in a way that will not cause tipping or spills, or be too far out of a shopper's reach.

What better tie-in product for tortilla chips than salsa? This high-volume, horizontally arranged end-cap is filled with rows of chips. Large jars of salsa appear at eye-level to grab the shopper's attention. This display accomplishes the added function of attracting consumers to an impulse item that doesn't regularly make it to the grocery list with the milk and toilet paper.

This grocery store walk-around display is located directly in front of the store's main entrance, which guarantees a high volume of traffic. The sale-priced summer produce is the feature item, but tie-in products are also present in large quantities: salad dressing and boxes of croutons are placed along each end.

Theme Displays & Creative Displays

Theme or creative displays help to create ambience in a store. They generally communicate an idea to a customer rather than drive high-volume sales. A Thanksgiving themed display, for instance, might include hay bales, cornstalks, and wooden crates filled with gourds, but feature harvest-coloured pot mums in groupings on and around the bales. Keeping in mind that the primary product should always be prominent, the mums would be your key selling item, and the gourds a tie-in. The display as a whole would encourage a shopper to buy what they need to decorate their home or yard for the season.

Let's try another example. Suppose you wanted to convey gardening as a way to create a summer relaxation space, and encourage a customer to shop for decorative pottery and perhaps patio furniture. You might start with a pair of attractive patio chairs, and toss a cushion or two on them to imply comfort. A tall, tropical-looking tree or houseplant might give the impression of shade in a summery space, and would provide vertical interest. To showcase a line of pottery, you might plant up a pair of large containers, then display the line's differently sized pots in heaps around them. Showing items complete or in-use help customers visualize them in their own garden spaces.

When planning theme or creative displays, consider these points:

1. If you are planning to sell from a creative display make it saleable: there should be sufficient quantity of product and it should be easily accessible to the customer.

2. Use of certain fabrics and 'props' can emulate a feeling through the use of texture, but creative accessories should be used to enhance the display, not over take it; look at your display and assess if the non-sale items you have used conflict with or complement the product.

3. Consider colour carefully: remember, creative displays must be attractive so be sure that the colours of both product, fixtures, and non-sale items are balanced and do not clash.

4. Avoid making the display too busy: maintain the theme and limit the quantity of different items included

Seasonal Displays

Timing can have the single biggest effect on the amount of products that will be sold from a display. You must tailor the display to the immediate needs of the customer. If those needs are not evident, the display can demonstrate that need. An example would be a display of rhododendron and azalea food as a featured item on an end-cap just before they begin to bloom. It is important to remember that just throwing a number of seasonally important but unrelated items together on one display is probably not effective. All other general rules for displays still apply.

This display concentrates on a harvest theme for an October sale event. Old wooden crates, apple baskets, hay bales, burlap fabric, and a rustic ladder are used as accessories. Because these accessories maintain a neutral colour scheme, they support rather than compete with the key item. Bright yellow and white potted mums are complementary accents. The quantity of casually heaped pumpkins and gourds are easy for customers to shop. Also consider that children are often responsible for selecting their own Jack-o'-lanterns: while floor merchandising can be awkward for most shoppers, low displays attract the attention of these demanding young consumers!

This seasonal display is designed for high volume sales, returning optimal dollars per square foot. Bins of hyacinth bulbs figure prominently. A tie-in product, bulb food, is also displayed to remind customers of what they need for the best growing success. Since bulbs themselves are not eye-catching, signage showcases photos of the hyacinth varieties in bloom.

Tie-In Product Displays
Appropriately located tie-in displays will trigger a need in the customer's mind. For example, putting tomato fertilizer or tomato cages next to an end-cap of tomato plants will remind a customer of these additional and supporting needs. Tie-in items do not need to be displayed in large numbers, but should be sufficient to sell.

Impulse Displays
Up to 70% of garden centre sales are made on impulse, so using impulse displays to persuade customers of additional needs or wants can dramatically increase the store's average sale value. Impulse sales may not necessarily relate to the primary purchase. These products are usually inexpensive, have high gross profits, and are items that most customers can use. Just as supermarkets place chewing gum, breath mints and magazines near the checkout, garden centres might feature garden gloves, gardening magazines, and hand cultivators near the cashier. In a garden centre, an impulse display might also be packets of timed-release fertilizer or bone meal; if a cashier is trained to prompt a customer—"What a lovely rose you've selected; do you need some bone meal to help establish it?"—these items can also add significantly to the sale.

Regular Aisle Merchandising
Stores are not entirely made up of showy end-cap, free-standing, or thematic displays. Every aisle in the store needs to contribute to an effective sale. When merchandising store fixtures or gondolas, the general considerations of creating effective displays still apply. Whether your aisle is created of plant tables or in-line shelving, the area should be front-faced, tidy, logically organized and well signed. One difference is that regular aisle merchandising may feature a greater range of product, be it several different sizes of rose food, or a grass seed mixes for a number of different applications. To assist in sorting out the organization of these items, manufacturers may provide planograms to indicate how to best arrange their product, and they may work with you on promotions or with special pricing. A vendor's sales person may come to the store to merchandise new displays for you.

Tie-in displays can be designed for high-volume sales as with the chips and salsa display pictured above. They can also be peppered throughout an area as "reminders" to customers. Look closely at this seasonal colour display: a small shelving unit placed in the walk around display contains Miracle-Gro and appropriate signage. In this store, these small shelving units also appeared on aisle tables.

Impulse displays are often placed near cash registers. This end-cap has been created for high-volume impulse sales. The all-purpose plant food is a likely need of most garden centre customers, and can easily be suggested as an add-on sale by the cashier. This particular display was created in conjunction with an in-store contest, which further suggests the product to consumers. Note the large signage and volume of product presented.

This aisle display contains a garden centre's selection of plant foods and fertilizers. A number of brands, sizes and types are displayed, but all are logically arranged by application method (i.e. granular, time-release, liquid). Notice that there are at least two facings of each item, with three or more facings of top sellers. The aisle is well-stocked and uniformly front-faced for easy shopping. Out-of-reach top shelves contain extra stock of items at eye-level, while the bottom shelf holds lower sales-volume items. Products from the same brand family are vertically arranged. It is likely that this display was created from a planogram.

Signage

One of the best methods of promotion within your store is your signage. Signs are silent salespeople, and are often the only communication you have with your customer during the selling process. Each garden centre will have its own policy on signage, but regardless of the signage look, style, or method used by your store, some general considerations apply:

1. Signs should always be clean and in excellent condition: faded, stained or cracked signs will detract from the product display and present an inferior image of your store.

2. All outdoor signs should be made with appropriate, weather and UV proof materials.

3. The lettering, whether hand written or computer generated, must be consistent and legible; too many different styles of lettering will appear unprofessional and reduce effectiveness.

4. Correct spelling and grammar are imperative to communicate credibility and professionalism.

5. Prices noted on signs must be accurate; if the sign communicates a promotional price or special, you may want to indicate the regular price or show what the customer's savings will be.

6. Signs should be placed close or within the display, at eye level wherever possible, and should be visible from all sides of the display.

Many different types of signs may be used within a retail environment, and the size, placement and wording used will vary according to the sign type and its purpose.

Price Signs

Price signs generally have eye-catching headings to draw attention and generate interest. You are probably already familiar with such signs that read "Special" or "Now Only" or "Great Savings". Price signs should provide a brief description of the product, mainly used to indicate exactly which item is being advertised, and it always includes the price. If the item is promoted at a special rate, you might also include the regular retail price or

a phrase indicating what the savings are; doing so will demonstrate to the customer that the item is actually a 'good deal'.

Selling Signs

A selling sign is usually more descriptive than a price sign. It includes comments about the featured product's benefits, providing customers with a reason to buy. For example, a selling sign placed near a promotional display of *Echinacea purpurea* might indicate that this perennial attracts butterflies and provides a long-blooming display of magenta to purple flowers all summer long. It might add that it is also a good cut flower. A selling sign should also include a price.

Your store will have policies in place regarding store pricing. Often in retail garden centres, mark-up margins are set for a given department and all regular pricing within that department is based on that mark-up. Policies may also include always ending the price with 0.99 or 0.97 as whole numbers tend to create mental barriers of perceived expense; hence, it is more common to find an item priced $5.99 than $6.00. Some retailers use odd prices ($2.44 or $3.83) to increase margins without increasing the perceived price. Special or sale prices may or may not be based on margin at all. Low priced specials or loss leaders are not necessarily priced for margin, but rather for attracting people to the store or creating interest in a particular display. These are usually common items for which customers will have a specific price reference.

Informational Signs

An informational sign is used to assist the customer with his or her purchase. It might give advice on performing a particular task such as over-seeding a lawn. It might provide a list of fragrant perennials, or indicate which shrubs are resistant to deer and rodent damage. Or, an informational sign might advertise an upcoming seminar or event that will be held in your store—a display of basket stuffers might include a sign giving details of a Hanging Basket Building Workshop happening soon. The most common informational signs seen in a garden centre, however, are basic plant info signs that provide details on height, spread, bloom time, and other important details. Plant information signs are sometimes called 'bench cards' or 'picture cards'.

Plant Information Signs

It is common knowledge that flowers sell plants. But how do we overcome the fact that not all plants are in bloom when

they are available for sale in the garden centre? The use of colour pictures on signs and labels has proliferated in efforts to sell items outside of their normal bloom time. The technology for acquiring and displaying large photographs of plants and flowers is improving and is becoming less expensive. Use photography and colour signage when it is available to you, but be careful not to plaster too much signage and photos in an area, as it will distract from the products themselves.

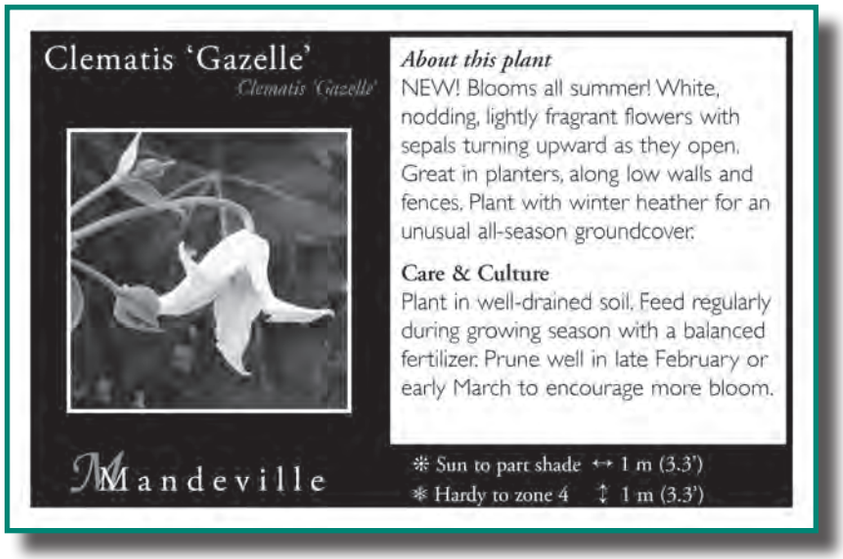
Directional Signs

Directional signs highlight groups or amenities within the nursery. You may have directional signs that read, simply "Rhododendrons & Azaleas" or "Fruit Trees" or "Information Booth". Usually, these signs are substantial in size and are not produced at the garden centre itself. Most stores have them custom-made of wood, chorplast, vinyled sintra, or they may have banners made; some garden centre / horticultural signage companies have off-the-shelf directional signs available too. When selecting directional signage, consistency is key in presenting an overall store "look". Select colours that allow lettering to be read from a distance, ensure that the signs are an appropriate scale for their placement, and consider incorporating your store brand or logo in any custom signage.

Figure 10-5 Types of retail signage

Price signs usually specify the exact product on sale, its price, and if offered at a discount, its regular price. Be careful to indicate the precise size of sale items so there is no confusion for customers or staff.

Selling signs contain key product features (professional formula, time-release fertilizer, wetting agent), their benefits (unbeatable blooms), and the product price and size. Since 45 litre bags of soil are generally displayed on pallets, the accompanying sign should be appropriately sized—this one is a letter-sized sheet of paper.



This plant information sign includes selling points about the plant (fragrant flowers, great in planters), tie-in suggestions (plant with winter heather for an all-season groundcover; feed regularly with a balanced fertilizer), care and culture requirements (plant in well drained soil), and a colour photos for items not in bloom. Outdoor signage tends to weather badly—be prepared to replace signage frequently to maintain a clean and tidy display.

Directional signage hangs along the main aisles of this garden centre in Spain, leading shoppers to the side-aisles where specific items (garden furniture, garden tools) are located. Its prominent size ensures its visibility, and the bilingual text caters to both the Spanish residents and British vacationers who comprise the store's clientele.

Merchandising Plant Material

Displaying Plant Material for Ease of Maintenance
When you first receive new plants to display, follow the Retail Handling Guidelines discussed in a previous section of this guide to ensure that your product is healthy and saleable. Proper displays can direct and inform the customer, present the products, and enhance the image of the garden centre—all without personal sales attention. For this reason, it is essential that the product is in good shape before you begin merchandising.

While methods of displaying plant material may vary considerably from garden centre to garden centre, the goals are essentially the same. In addition to accomplishing the goals discussed above for hard goods displays, plant material displays must also extend the shelf-life of the plants and nursery stock, and they should suggest appropriate plant combinations. Further, they should make general maintenance as efficient as possible.

Maximizing Shelf Life
Shelf-life differs widely depending on the plant, its soil or soil-less media, and its environment. Plants with a short shelf-life—notably plants in flower or bud—are usually ordered and re-ordered as frequently as possible to avoid carrying product past its prime but still maintaining well-stocked displays. Plants should be well spaced, not only making limited inventory appear more expansive and impressive to customers, but also providing air circulation and light to maintain plant health. Since the opportunity to space plants is limited by the amount of sales space and labour available, your garden centre may not always do so; if plants are left unspaced, monitor them closely for health and etiolation.

Shelf-life is also extended by judicious deadheading. The removal of dead foliage and spent flowers is vital to improving the appearance of inventory, and preventing the spread of diseases. Customers are drawn to flowering plants, and deadheading encourages re-bloom of many plants; further, it limits the appearance that the flower show is approaching its end.

Maintaining Displays
Maintaining presentable displays is easiest when like items are grouped together. Where possible, place high water-users collectively, and group low water-users in another area. This will allow appropriate hand-watering. While overhead watering is labour-saving, it often provides unequal distribution so some

hand or wand-watering is usually unavoidable; creating displays with irrigation needs in mind will make the effort more practical.

Encouraging Product Turns

No retailer wants to be stuck with old product. While some stale items are inevitable, in the green industry, 'stale' plants add to maintenance issues. Plants that are root-bound require much more water because the medium in the pot has become displaced, reducing its water-holding capacity. Plants that remain unsold for a long period may require fertilizing to replenish soil nutrients, but not to encourage excessive growth, so feed carefully making sure to water beforehand and avoid getting fertilizer on foliage which can cause spotting and burn. To minimize these efforts, place older product where customers can access it first: stock new plants to the back of the table or display; front-face boxed product and place new items at the rear.

Putting on the Shine

Remember that customers notice more than a pretty display when they wander through your store. Take a moment to step back from your displays. Are they aisles and parking lots free of trash? Are the plants and display areas free of weeds? Just as litter will find its way into your sales spaces, weed seeds can blow in from neighbouring areas or arrive in contaminated nursery stock. But, in a place that promotes the sale of healthy plants, weedy areas are simply unacceptable. Use a mulch to help keep weeds at bay, and control weeds that grow in cracks and crevices, along greenhouse walls, or beneath benches. If it becomes necessary to use a spray, it is recommended that you do so outside of business hours as many people can have chemical sensitivities.

Displaying Plant Material for Optimal Sales

Big box retailers are referred to as "mass merchandisers" for a simple reason: they arrange large quantities of a given product in shop-able displays to promote high volume sales. Garden centres often emulate these practices in their hard goods displays, but often we forget that plants can displayed using the same method. Creating powerful plant displays follows the same basic principles of creating powerful end-cap displays. Re-read the section on end-caps above, and this time imagine a display made up entirely of plants. Apply these three main points:

- Select a key selling item and ensure it occupies two-thirds of the display space

- Select a tie-in item and include enough of the item to make a strong sale

- An additional, but related item can be used to round out the display.

Let's suppose that a fresh shipment of #1 potted holly in full berry has arrived at your store. You have a number of wooden crates and plan to create a display a short distance in and to the right of your nursery yard entrance. To create a strong selling display, you might arrange the crates so that you have varying heights on which to place plants, thereby creating tiers and vertical interest. You fill upper display platforms with the holly. A good tie-in product—1 kg pails of bone meal—is available, and you arrange the pails on one of the tiers to the right of the holly. There is some wintergreen in the store already. Since it is also a plant with winter berries, it makes a good secondary item, so you use several to surround the display and occupy lower tiers. If you have used sufficient numbers of plants, and created a substantially sized display, it will allow for a high volume of impulse sales, with the central theme of 'winter interest'.

There are many combinations for creating plant displays, limited only by the materials at hand and one's time and inventiveness. You might arrange plants that are shade tolerant in a display, or pick perennials with complementary flowers; seasonally important plants, plants that are in colour, or fragrant plants might also create effective displays. Other considerations for constructing effective displays include the following points:

1. Choose structural props, such as pallets, milk crates, or pottery, that do not deter from the display; they should be unobtrusive, clean and tidy, appropriate in size, and as simple as possible.

2. Choose plant material that is appropriate, seasonal, and well-located; do not use too many different plant varieties (three is usually the maximum), and ensure plants are cleaned and deadheaded with labels facing front.

3. Select tie-in or associated sales appropriately; they should occupy no more than 30% of the display and are usually displayed to the right of the key selling item.

4. Pick ornamental props appropriately (e.g. sundials, birdbaths or gazing globes), and use them tastefully; do not overwhelm a display with accessories.

5. Consider the overall appearance: it should be aesthetically pleasing, of shopable height and quantity, and easily maintained.

Remember that the primary goal of plant displays is to sell plants. Obviously, plants that are too high, or too far within a bench will not generate further investigation by customers. They must be able to touch a plant or product, and be able to read its label information if they are to seriously consider its purchase. More subtly, plants and products that are on the ground cannot be touched or investigated without bending, which some customers cannot do and many will mildly resist, certainly enough to impede sales. As much as possible, products should be lifted off the ground and displayed on tables.

Displaying Plant Material for Shopping Ease

Organizing your store so that products are easy to find requires particular thought to store layout, pathway and bed design and especially effective and attractive signage. Product layout tends to vary depending on the product type. For example, annuals are usually displayed en masse, because there is a wide diversity of colour and varieties. Those that are shade tolerant are usually kept together in a shaded area to enhance shelf life and to guide customers who need shade tolerant material. Perennials and nursery stock, with their many genera and hundreds of species and varieties, require considerable thought. There are several methods of organization, each with their own benefits and drawbacks.

Plants For...

Grouping plants by their cultural requirements (for sun, shade, or wet or dry gardens) accomplishes the goal of minimizing maintenance since it makes watering regimes easier to administer. Additionally, customers can easily locate the items that are most appropriate for a particular space. However, not all plants fit neatly into these groups. Items that tolerate both sun and shade, for instance, may be located in either or both sections, so searching for a specific plant may be frustrating to a customer, let alone the merchandiser that needs to decide where to put them.

Alphabet Soup

Organizing plants alphabetically works well, particularly if plants are alphabetized within their cultural requirement groups. It does, however, take considerable labour, particularly when trying to squeeze in new stock as it arrives. Then there's the eternal debate over Latin versus common names. Most customers are unfamiliar with Latin names. Common names are so variable that several may exist, causing a quandary over

which to choose. Then there are the plants more commonly known by their Latin names than any common name: does one organize it by the lesser or familiar name? Regardless of what method you use, it's best to come up with a solution and stick with it. Use your bookings to create a list, if you need to. Alternately, simplify the method by placing plants on benches grouped according to a portion of the alphabet (i.e. A to E, F to O, P to Z). Finally, alphabetize only when appropriate. This method implies that you are sorting a big group of similarly sized plants (e.g. tables of 9 cm or 4" perennials) in a sufficiently large area that searching for a specific plant is truly difficult.

Centralizing Efforts: Communication & Appearance

Merchandising does not communicate everything we'd like customers to know or have access to. For this reason, stores will often set up an information kiosk where customers can consult staff. Some stores also have kiosks for container garden planting or display gardens. Both serve multiple purposes with planting kiosks providing a service, generating value-added product, and demonstrating methods to customers; display gardens show planting schemes to inspire customers and help create ambience. Seminars, slide shows and hands-on workshops are also used to communicate with customers, and if carefully planned, they will generate traffic to the store as well as encourage purchases afterward. No matter which of these 'extras' you employ in your store, remember that their placement is as critical as placement of displays—these 'destinations' often work well to draw traffic into store cold spots.

Whenever you plan a display, remember that it needs to enhance the appearance of the garden centre. A visit to a garden centre creates a set of memories for customers, whether they make a purchase or not. Of the displayed products, customers will remember the creative touches they saw, any problems they had in finding or learning about an item. They may have been interested in buying something, but couldn't find a price, so they put it down. They will have noticed how clean and straight the aisles were. They will notice tipped pots, bare benches, and faded or warped signs. They will certainly remember any unattractive or dying plants they saw. To analyze your garden centre areas, don't be afraid to ask your customers their impressions. Coax criticism out of them. Thank them and give them a gift certificate or small gift. Put yourself in their shoes. Empathize. People make most of their buying decisions within the garden centre, but their choice of where to shop next time will be strongly influenced by the memories the store layout and displays instilled in them.

Customer Service & Etiquette

Chapter 11

To be a retail garden centre professional, a trained horticulturist or experienced gardener must supplement knowledge of horticulture with a mastery of customer service skills. The retail garden centre professional will be called upon to act as a cashier, answer and use the telephone frequently, advise customers on plant and product purchases, accept plant returns, deal with complaints and provide horticultural knowledge. The importance of providing a consistent, appropriate level of customer service, as defined by each specific retailer, cannot be underestimated. The sole source of income for the retailer is customers, without the customer there would be no nursery or garden centre! Develop your customer service skills by first learning these basic principles, and then put them into practice.

Cashier Skills

Retail garden centre settings vary considerably. In a large garden centre, department or home improvement store, an employee's duties may be quite specialized. Floor staff may not act as a cashier at all. Conversely, in a small, independent garden centre with only a few staff members, nearly everyone is trained to perform a multitude of duties including cashiering. As a retail garden centre professional, you are expected to have skills pertaining to all aspects of the business, and having a very good understanding of cash handling principles is important.

The cashier is quite often the only person a customer meets in a store, so his or her behaviour and competency often represents the store as a whole. Basic cashier skills include cash handling, operation of a cash register, and opening and closing procedures. Although specific training will be required at different stores, using different equipment, this section will acquaint you with some general procedures.

Opening Procedures

Opening procedures are followed at the beginning of each business day, or when a cash register is used for the first time. Although these steps may have been completed at closing the day before, they should at least be reviewed each morning as well.

1. Be sure that the register has been "cleared". This ensures that sales information from the previous day is totalled off, and will not be added to the new day's sales information. The same is normally done to any online credit/debit card machine.

2. Count the float. Make sure the correct amount of money is in the register drawer at the start of the day.

3. Be sure that there are enough coin and low denomination bills in the float. If not, a change order may need to be completed. A float can be balanced (correct amount of money) but unusable because of an improper denomination mix.

4. Ensure that cash desk supplies are adequate for the day. Supplies may include cash register tapes, credit card receipts, bags, packing flats, pens, staples, etc.

5. Become familiar with any price changes, sale prices, or special promotions. It also helps a cashier to take a quick walk around the store to see if anything has changed or is newly arrived—often the cash desk is the first place a customer will seek assistance, knowing it is always staffed.

6. Tidy the check-out counter so that is clean and presentable.

Closing Procedures

Clearing the till and online credit/debit card machine, and counting the float are most often done at closing; but several other duties should accompany these:

1. Check around the register area and till drawer for any loose or misplaced cheques, cash, coupons or gift certificates.

2. Balance the day's sales receipts, recording sales and other information on the cash sheet. Prepare the cheques and cash for bank deposit.

3. Remove the register drawer complete with float from the till and store in a safe, or in an other secure, designated place.

4. Leave the register drawer open so that it is obvious that there is no cash in the register.

5. Tidy around the register and check-out desk so that it is ready for business the next day.

Figure 11-1 Sample cash sheet or sales summary

Green Gingko Garden Centre

Daily Sales Summary

Date: 04-june-2007	Cashier: michelle
Til Number: T3	

	Register tape	Actual	Difference
Total cash	1202.76	1402.78	0.02
Debit cards	464.49	464.49	–
Visa	290.01	290.01	–
Mastercard	319.68	319.68	–
Amex	98.25	98.25	–
Total cards	1172.43	1172.43	–
Cheques	–	–	–
Gift certificates	25.00	25.00	–
Credit notes	5.50	5.50	–
Coupons	2.00	2.00	–
Total other	32.50	32.50	–
Subtotal	2407.69	2607.71	
Less Daily Float		(200.00)	
Grand total	2407.69	2407.71	0.02 over

Today's Weather: rainy a.m., sunny p.m.
Customer Count: 82

Cash Area Etiquette

Courteous and friendly treatment of the customer at the cash desk is vitally important. The best rule is the golden rule… Treat customers the way you expect to be treated. When serving customers as a cashier remember the following points:

1. Greet each customer, and make eye contact. Avoid falling into the habit of keeping your head down and eyes on the till. Learn to use your eyes and body language to acknowledge the customer silently if already dealing with a customer.

2. Be alert and aware of the activity around you. If a line up forms, you may have the option of calling another cashier or a packer to help reduce the line up.

3. Speak clearly and courteously to the customer. Compliment the customer on their purchase. It is rude to chat or banter with fellow staff members when customers are present: give the customer your immediate and undivided attention.

4. Be friendly and pleasant, but avoid being drawn into conversation with a customer during busy times as other customers are waiting for service.

5. Thank each customer when the sale is complete, and if it is available, offer the customer carryout service.

Telephone Skills

The telephone is an important tool for retail nurseries and garden centres. It is a vital link between the garden centre and its customers. It provides the opportunity to make a good first impression and to win over a new customer. It allows you to make a sale to a potential customer who is 'shopping' over the phone, and to service established customers who often rely on their local nursery to provide gardening advice over the phone as well as in person. The retail garden centre professional should possess both knowledge of the telephone system and how to use it, and a courteous phone manner. Consider these points:

- Become acquainted with the telephone system and its functions

- Know how to answer a specific line on a multi-line system

- Be able to properly put a customer on 'hold' and to transfer a call or page without dropping the line (i.e. losing the customer)

- Be aware of any other functions the phone system may offer that can help you serve the customer most efficiently

- When speaking to customers on the telephone, be polite and use a friendly tone. If a customer mentions their name, you may want to use it later in the conversation; if you are taking a message, the recipient needs to know whose call they are returning.

Answering the Telephone
Answer the telephone with a greeting, the name of the store or specific department, and your name:

Hello? Green Gingko Garden Centre, John speaking.
or
Good afternoon, Tropicals Department. This is Jane.

By identifying the business, confusion is avoided over whom the customer has phoned—he or she may be phoning several nurseries, looking for a specific item. By using your name, the call immediately becomes more personal. A customer is more likely to remember your name if you mention it last (e.g. "John speaking," as opposed to, "This is John").

Answering Inquiries
Many telephone calls are made to obtain an answer to a question. Where are you located? What time do you close? Sometimes, a customer is trying to locate a certain product, obtain prices, or may have a gardening question to ask. Each phone call can be considered a sales opportunity, and every effort should be made to answer the customer's questions honestly and accurately.

When answering a customer inquiry avoid the temptation to guess or take a chance with the answer. A customer may be making a special trip, and if they phoned ahead but find your store sold out of the item they were looking for upon arrival, they certainly won't be happy.

Always mention a benefit, and if the product is not in stock, offer an alternate solution:

Yes, we do have pansies in stock. There is a wide assortment of colours, and they happen to be on sale right now.

or

I'm sorry, we're all sold out of 'Nikko Blue' hydrangea, but we do have 'Endless Summer' which grows about the same size and blooms much longer.

If you are unsure if a particular product is in stock, or if you don't know the answer to his or her gardening question, give the customer a choice of being put on hold while you get the answer. Or, offer to return their call after you check on the details, and return the call promptly:

You know, I should check on that to make sure. Would you like to hold, or may I call you back in a moment after I find out?

If the customer is checking to see if your nursery has a certain item in stock, offer to put the item aside if quantities are limited to avoid disappointing. Not only does this ensure that the item will still be available when the customer gets to the store, but it may also encourage the customer to visit since you have made an additional effort on his or her behalf.

We have just a few bags of grass seed left for shaded areas. Can I take your name and set one aside for you?

At the completion of a stock inquiry call, ask if the customer requires directions to the store, mention the store hours, and point out any sales or promotions that are taking place.

Great! You can retrieve your grass seed at the information booth.

Yes, it's a good time to drop in because we have turf-starter fertilizer on sale this week too.

We're open until six o'clock tonight. Do you know how to find us? … That's right, we're just beyond the park on the left-hand side.

Thanks for calling Gingko, Mr. Jardine.

Handling the Telephone During Busy Times

If a customer phones during a busy time, and his or her call cannot be handled quickly, offer to call back as soon as you have

an opportunity. This skill can take some thought and practice. While it may be a frantic moment at the store, it is important not to put the customer off with an impersonal remark such as, "I'm too busy right now, give me your name and I'll phone you back later." It is much better to explain to the customer:

You have a good question there, and I'd like to be able to answer it properly for you. May I return your call when it is a bit quieter here, say in about half an hour?

Be sure to call the customer back with the answer, as promised, and they will be impressed and grateful.

Making the Sale

Chapter 12

The Selling Process

A successful retail garden centre professional is one who can link their knowledge of horticulture with retail sales skills. Customers depend on the salesperson to help them choose both plants and other nursery products from the bewildering selection offered at most garden centres. Their gardening success is dependent on the quality of the service and the accuracy of the information they receive. By understanding the selling process and practicing sales skills, the retail garden centre professional can contribute to both the success of their customers and the success of the retail nursery or garden centre.

The sales process involves building a relationship with the customer so that the salesperson can quickly determine the customer's needs and recommend the products that will fully meet or exceed those needs.

The process can be broken down into the following steps:

- Greeting the customer and offering assistance
- Listening to the customer and determining needs
- Making the sale
- Closing The Sale

Greeting The Customer & Offering Assistance

Have you ever been to a store where you were either completely ignored or jumped on by an unrelenting sales force the moment you walked in the door? How did it make you feel? Uncomfortable? Annoyed? Helpless? Not keen on returning? The purpose of greeting customers is to make initial contact, acknowledge their presence, make them feel welcome, and let them know you are available to help when they require it.

1. Make eye contact: don't just say "Hello", without looking up because you've heard a door open or see a customer out of the corner of your eye.

2. Smile and use a friendly greeting. Be sincere and use a greeting that matches your personality. Do not use a close-ended greeting such as 'Can I help you?' This elicits one response—usually no!

3. Read the response. The customer's reaction will give you a clue as to their intentions. If they say "Hi" and avert their eyes or keep moving, it is likely that they do not want any help yet. If they slow down or stop, ask a question or start a conversation, they are ready for some assistance.

Recognize that some customers will want help immediately. They might be in a hurry or have a definite purpose in mind. Make yourself available to help or direct them. Recognize also that other customers will require help but will want an opportunity to get comfortable with the store, the staff, and the product. Give these customers a chance to browse, but remain aware of them and be ready to assist when the customer decides it is time.

Be sure not to greet the same person more than once—this is another reason eye contact is important. It is embarrassing to comment on the beautiful sunny day twice to the same customer. Also be able to greet a customer silently if you are already busy with a customer. Make eye contact and nod, or give a short wave to indicate you see they are in queue for assistance. It is important to recognize the signals that indicate a customer would appreciate some help:

- They are trying to establish eye contact
- They are looking around as if looking for something
- They are studying a product, then looking up
- They are asking questions of other customers
- They are studying a label or sign.

When you approach customers, speak to them in way that helps you to determine if they are indeed ready. A gentleman gazing about with a potted petunia in his hand may simply be looking for his wife, so don't launch into a sales pitch immediately; let the situation dictate your approach. Use open-ended questions that cannot be answered with a simple yes or no. You may want to make a comment about the weather or about the product they are showing interest in. If they are receptive, follow up and begin to assist them. If they seem unreceptive or defensive, if they cross their arms, turn away or avert their eyes, they probably do not want any help. It's best to give them their space. Remember to check with them again.

Once you have made contact and a customer is comfortable with you (this often takes only a few moments, but occasionally takes longer), begin to determine his or her needs.

Listening and Determining Customer Needs
What makes the retail garden centre so unique is the sheer number and diversity of products that are carried. Many consumers require some guidance when making even minor purchases. An ability to listen is essential in determining customers' needs quickly. Listening skills can be developed through practice and by keeping in mind some key points:

1. When customers explain their situation or problem, listen for, and mentally record key points which you will use to determine the ideal solution. Take note when they give indicators like 'shady area', 'easy care', 'durable', 'young children', 'pruners always seem to break' etc.

2. Filter the unnecessary details of the story. The customer will likely include details that are not required to solve the problem or situation. Don't get sidetracked by unrelated anecdotes. A customer may go off on a tangent that has little to do with the situation at hand. Gently guide the customer back on course by repeating the last key point made, or by asking a pertinent question.

3. Ask concise pertinent questions to discover key points. Use what you have learned about the situation already to ask questions that will help you to narrow down possible solutions or alternatives.

4. Show interest by nodding, making eye contact and encouraging the speaker. Give feedback. Repeat the essence of what was said (this is key); confirm the key points; state the problem or situation paraphrasing his or her words.

5. Recognize barriers to effective listening and do your best to overcome them. Many just require a little extra patience on your part. Examples of barriers to effective listening include fatigue, noisy environments, interruptions made by staff, telephone calls or overhead paging systems, or a customer's unfamiliar accent. Both your attitude, impatience, indifference, or the custom-

Being an Effective Listener

When giving customer service or making a sale, try to avoid jumping to conclusions. It's not easy to steer clear of making assumptions, particularly when you feel rushed or busy, or when a customer's story is less than to-the-point.

Consider the following example, and try to remember to stay focused on the conversation at hand. Filter out distractions and anecdotes, and ask relevant, thoughtful questions.

> Dave has been giving advice on pest control all week; he's had people bring in samples of damaged plants and samples of moths, cutworms, you name it! One afternoon a young fellow presents a small box with many tiny flies in it to Dave.
>
> "Could you tell me what these are?" he asks.
>
> Dave recognizes the insects as fungus gnats.
> "Where did you get them?" asks Dave.
>
> The fellow shrugs, "They've been flying around my mom's houseplant."
>
> "Well, they're definitely fungus gnats. You'll want to get rid of them. Try using thi…"
>
> "Oh no!" says the young lad. "I want to know if I can feed them to my Venus Fly Trap!"

Effective listening will enable you to understand the customer's needs and help you to identify a few alternatives that will satisfy those needs. It is then important to make the sale—that is, to present the product that is the best choice, in a way that the customer will understand.

ers' can also create a barrier to listening. Check your attitude and carry yourself professionally at all times.

Making The Sale

Once you have determined the customers' needs, the opportunity is open to make the sale. This is your chance to offer a little bit extra by relationship and suggestion selling. Relationship and suggestion selling allows you to advise other necessary or complimentary products. You might suggest seasonal, sale or promotional, new, impulse or unique items, or persuade the customer to upgrade his or her choice. Consider these tips for successful selling:

1. Offer the choice you feel best meets the customer's needs. Avoid giving the customer several suggestions, one after the other, and asking them to choose; instead, limit the number of choices to two or three so as not to overwhelm or confuse.

2. List the benefits of the suggestion and make reference to the key needs identified earlier. If the suggestion is a good one, show your enthusiasm for that choice, but be sincere. If more than one of the particular item is required to properly solve the problem, recommend the quantity at the same time:

I recommend a grouping of five of these Astilbe. Those ones have pink flowers in the summer, and will tolerate your wet soil conditions. The attractive foliage will do a good job of masking that foundation wall you mentioned earlier, and they live for years and years. Would you like me to pick out a few nice ones for you?

The above suggestion identifies the benefits in terms of the key points determined earlier, is phrased simply, recommends a quantity, shows enthusiasm for the choice, and asks the customer what they think of the suggestion.

Refrain from using industry jargon: jargon includes any words used in the nursery or horticulture profession that are not commonly understood. Some botanical names for plants, technical terms, and industry terms might be considered jargon. Instead of saying a leggy plant is experiencing etiolation, comment that it is stretching to seek

light, and suggest plants that would perform better in a shady area. Think of a better alternative to this response.

These Vaccinium vitis idea minus will be perfect! They are a wonderful ericaceous evergreen subshrub bearing small pendulous white flowers in late summer!

This suggestion, although enthusiastic, is filled with jargon, does not list the benefits or refer to the key points, and does not ask the customer what they think.

Ask the customer if the choice seems suitable, and answer any questions. If the customer is not satisfied with the suggestion, don't continue to pursue it. Instead, offer an alternative.

No matter how good a job you have done making the sale, part of the selling process involves allowing the customer time to consider the choices and make a buying decision on their own. Most people enjoy shopping: give them that opportunity. But be prepared for the customers who want you to make the right suggestion, and will take it and go!

Offering a Little Bit Extra

Understanding and mastering the selling process ensures that you will become a competent sales person. Developing the ability to offer a little bit extra can turn a competent salesperson into an excellent salesperson. New customers are hard to attract, and doing so is often outside of your immediate control. Therefore, the key in selling is to sell more to the customers we already have. Nothing else will build and increase sales faster.

As mentioned earlier, offering a little bit extra includes relationship selling, suggestion selling and upgrading. The goal is to make sure that customers leave the garden centre with everything they need to enjoy and be successful in their gardening endeavours. This will benefit both the customer and the retailer.

Relationship Selling

Relationship selling offers the customer products that are in some way related to the item he or she originally came to purchase. They often make the original item more effective or easier to use, or are necessary or complimentary to the original product.

Let's consider an example:

Mr. Lincoln greets you at the nursery one morning, stating "I'm finally ready to put in that rose garden I've been talking about! Lead me to your ten best varieties." After selling Mr. Lincoln on the Explorer Rose Series and loading the plants on his cart, Mr. Lincoln is ready to go. Do you now bid him farewell? Or do you offer a little bit extra? What related products would you suggest Mr. Lincoln purchase?

Related product possibilities can easily be broken down into two groups: necessary, and complimentary products. Consider the following suggestions for Mr. Lincoln's roses:

Necessary Products	Complimentary Products
Bone meal	A book on roses and rose care
Transplant fertilizer	Companion plants for the bed
Trellis or support for climbers	Secateurs or pruners
Rose food	Gardening gloves
Compost or manure	Accessories (gazing globes, etc.)

Necessary products are those that Mr. Lincoln really can't do without if he is to be successful. He may already have some of these products, or he may not be aware he needs them. It is up to the salesperson to offer these products, and explain how they can contribute to the success of the venture.

Complimentary products are those that are not necessary, but may give the customer a higher level of satisfaction or enjoyment. Mr. Lincoln is obviously interested in roses. He may fall in love with a particular book, or he may want to add the classy look that the 'Rose Garden' sign will give to his garden. Offer these products and the customer (not to mention the boss) may be ecstatic. This is an area of unlimited sales potential. Often customers will visit a garden centre with the intention of buying a plant to improve the appearance of their yard. They've seen how great the neighbour's place looks, and want their home to look just as good. Instead of selling just the one plant, show how a grouping of complimentary plants makes a much greater impact. If they've come to purchase an indoor plant to decorate a room, introduce them to a decorative pot that will complete the picture.

It is important not to overload the customer. Put yourself in the customers' shoes and think about what you would need to do the job. Make friendly, helpful suggestions. Don't get too concerned with cost. Customers come to the nursery and want to buy. It is important that they get the opportunity to purchase all the items they need to successfully complete the job. They will appreciate your advice and will make up their mind how much they should spend. There is no point in letting a customer get all the way home, out in the yard planting, before they realize they should have bought some peat moss! Likely they'll pop down to the nearest supermarket or hardware store garden yard to pick some up, resulting in a lost sale for your garden centre. Or they may not realize that adding some peat moss will improve their chances for success, and perhaps they'll return in six months with a struggling plant.

Suggestion Selling

Suggestion selling informs customers about the availability of products that they might enjoy or require, but may not have been aware of, or may have forgotten about. The suggested product will not be related to the product that the customer originally intended to purchase, but will be an item that the salesperson feels will appeal to that specific customer. Remember that up to 70% of plant sales are made on impulse.

Suggestion selling can be quite easy—almost a natural tendency—if the salesperson has spent a few moments building a relationship with the customer and is aware of their situation and interests.

Use your knowledge of the customer to help you decide if there are particular products that your customer might be interested in. Certain groups of products may be ideal for suggestion sales:

- Seasonal items: those that should be purchased, planted, or used now.

Gardening is seasonal by nature, and many products carried in garden centres and nurseries are seasonally available. An item may only be available for a short time, selection may be best at the beginning of an item's season of availability, or an item might need to be used or planted at a certain

time. A few of the many seasonal items include seeds, roses, dormant sprays, fall rye, bulbs, tomato seedlings and fruit set, bare-root plants, lawn care products, and Christmas trees.

When assisting a customer, take advantage of the opportunity to suggest seasonal items you think may be of interest. Spring flowering bulbs are an excellent example. Many customers wait until late in the fall season to shop for their tulip and daffodil bulbs, and may be disappointed by a poor selection of novelty varieties. If your customer is shopping in early September, a suggestion such as "By the way, our fall bulbs have just arrived. We've got an absolutely super selection right now!" may provide a reminder to a regular customer who intends to buy some bulbs anyway.

- Sale items and promotions

Help customers make good buying decisions by pointing out promotions or sales. Have you ever come home shopping only to discover that the store you just visited had an item on sale that you had been thinking about buying?

- New items

Take the time to point out new and interesting items. You might approach a customer who has selected a couple of clematis for a fence line and comment, "You're quite keen about clematis aren't you? Look at this new variety we've just received. What a beauty!"

- Impulse items

Plants that are in bloom, fragrant plants, and novelty items are great for suggestive selling. You might ask a customer, "Can you smell that fragrance? It's coming from this rock daphne. It would do so well in your rock garden!"

- Items that have been mentioned in recent gardening columns or articles

Often, the demand for an item will increase when it has received publicity, and a customer may be disappointed to find the nursery sold out. Keep informed and make suggestions to those customers who may have an interest in a particular item.

- Rare or specialty items that have just arrived

Buyers put a lot of time and energy in sourcing new and unusual product. Don't be afraid to point them out to customers: "Aren't these alpines interesting? We're quite proud of our selection. You don't find these just anywhere!"

Strive to make well thought out, sincere suggestions in a friendly and enthusiastic manner.

Up-Selling

Upselling, also known as upgrading offers customers a larger size or better quality choice for an item that they are interested in.

Many experienced gardeners and horticulturists have difficulty selling a larger size of plant, especially perennials or groundcovers, because from experience they know that with the proper care and attention, a smaller plant will establish successfully and grow vigorously. Remember that the average customer is not a horticulturist. Novice or unenthusiastic gardens may not adequately care for young plants to allow them to establish quickly. And even skilled gardeners may not be patient enough to wait a season or more to achieve a dramatic or mature effect. In these cases, a larger plant would almost certainly have a better chance of survival and of providing customer satisfaction.

Offering customers higher quality tools or gardening paraphernalia should be easy to justify. Although initial cost may be higher than that of the low quality item, there is greater value in a product that performs its task with ease, and lasts much longer than a low price alternative.

The relationship you have built with your customers will help you determine if a larger plant or better quality product is their best alternative. Consider their gardening experience, the frequency with which they intend to use the product, and the specific landscape situation in which item will be used. Is it an established site, an ill-maintained site, a high traffic area, an exposed area, an area susceptible to theft? Most of all, take note of their expectations. Do not make assumptions or judgments about their income level. Offer

the larger size or better quality first; if it is too expensive, customers will ask if there are other alternatives. When you are unsure if a larger size will appeal to your customers, show off the larger size. It will be a better representation of the mature appearance of the plant. Mention that the plant is available in "other" sizes. This allows customers a comfortable way of choosing a lower price option. When selling the higher quality item to customers, mention how the choice meets or exceeds their needs and expectations. Remember that retailers stock large plants and top quality products because there is a demand for them. Don't sell your customer short by neglecting to offer these products.

Relationship selling, suggestion selling and upgrading all involve offering your customers that little bit extra, to make sure that they leave your store with everything they need to enjoy and be successful in their garden. Now you are ready to close the sale.

Closing the Sale

Closing the sale is the culmination of the relationship that you have built with the customer. By working together, you have come up with the selections that meet the customer's needs. All that remains is for the customer to say "Yes, I'll take them!" Many salespeople have a difficult time completing a sale. They have a fear of being thought of as pushy or of being rejected. Closing a sale can be easy if you remember the following points:

1. Learn to recognize signs that indicate the customer is ready to buy. They include questions such as:

    - Do you have any smaller/larger ones?
    - Does it need any fertilizer?
    - How do I plant this?
    - What would look good with this?
    - Tell me about its characteristics one more time?
    - Do you think I would need more than one?
    - I wonder if my wife/husband would like it?
    - It does seem to work well, doesn't it?

    Many other questions could also signify that the customer is ready to buy. Most of the questions indicate that the customer is looking past the product to its use in the garden or how it should be planted—that the customer has already 'purchased' the product in their

mind. Also be conscious of when the customer agrees with you, nods his or her head or talks about how and where he or she plans use the product. The customer may smile, look at you more, or seem impatient.

2. Keep the conversation focused on the product, and the customer's needs.

3. Make it easy for the customer to buy. Make sure a shopping cart or wagon is available, or that the he or she has flat(s) to put plants in.

4. Give the customer time and space to make a decision if you sense that it is needed.

5. If you know the product to be an excellent one, give it your personal endorsement, to help reassure the customer:

   The two I've got do marvellously, and
   I'm rarely able to give them any attention.
   or
   Several customers have raved about how well
   these have done in their gardens!

6. Ask for the sale. This gives the customer an opportunity to make the final decision. Timing is important! You should have recognized that the customer seems ready to buy so that by now they shouldn't feel pressured. Ask in a friendly way: Can I put that on a wagon for you? Can I help you to the till with those? Will these two fill your space, or do you think you might like one more? Do you think these will do the trick?

7. When the sale is complete, applaud their choice, thank them, help or direct them to the till or another part of the store.

Accepting Plant Returns

All retail nurseries experience some rate of return of plant material, for reasons ranging from the plant not being true to its tag (often indicated by colour of bloom or wrong fruit) to the death of the plant. Each nursery has its own return and guarantee policies, and it is the responsibility of the employee to know and follow these policies. Most nurseries offer at least a limited guarantee

on plant material, and a retail garden centre professional must be equipped to deal with returns in a courteous and helpful manner.

Returns of Dead Plants

The return of a plant that has died after purchase can create an uncomfortable situation. The customer may be angry, embarrassed, disappointed, defensive or apologetic. Use following guidelines help deal with these situations more smoothly:

1. Do not attempt to assign blame for the death of the plant.

2. Smile and genuinely thank the customer for returning the plant; they are giving your garden centre another chance.

3. Empathize with the customer; show understanding for his or her feelings. Assure the customer that you will do your best to rectify the problem; if your nursery has an unconditional return policy, let he customer know that the plant will be replaced.

4. Explain to the customer that it is always worthwhile to try and determine the cause of death so that a decision can be made as to whether the same plant would be a suitable replacement, or if action could be taken to avoid the death of another plant.

5. Inspect the plant for any evidence of a pest or disease problem or physiological disorder which may have caused the death of the plant; ask open ended questions to gather information about cultural conditions and maintenance of the plant.

6. Be sure not to infer that the customer 'killed' the plant.

7. If the cause of death is determined, explain the cause to the customer. If the plant has died due to incorrect planting procedures, neglect after planting, being planted or placed in an unsuitable location, or due to incorrect cultural treatment (over-fertilizing, over-watering, etc.) gently suggest your diagnosis, being careful to use wording that does not blame the customer. For instance, if the customer planted a hosta in an arid area with southern exposure, who might be to blame? Did they receive correct, simple cultural information from your nursery when they purchased the hosta? Review the correct planting and maintenance procedures for the plant and make sure that plant is suitable for the

conditions where the customer intends to plant it. If not, suggest that there may be a more suitable plant choice.

8. If the plant has died due to a pest or disease problem, advise the customer of this and, if applicable, inform him or her of actions that can be taken to prevent infestation in the future. Inform the customer how to recognize early signs of an infestation and to contact the nursery for advice on control. If the plant is particularly susceptible to that pest or disease problem, inform the customer and ask if they would prefer a different plant as a replacement. If it is determined that the plant has died due to a soil borne disease, explain this and suggest alternatives that are resistant to the disease.

9. If the cause of death cannot be determined with certainty, inform the customer. Review correct cultural conditions and planting and maintenance procedures with the customer if replacing the plant.

10. After the plant is replaced or the customer has been taken care of, thank him or her again for returning the plant and offer a vote of confidence:

I'm sure this one will establish nicely.
not
There. You can't possibly kill two in a row.

Dealing with Complaints & Solving Customer Problems

Not all plant returns are made because they are dead or dying. We have already mentioned that a plant might be mistagged only to show its true colours later. Another reason for return might be an exhibition of characteristics that the customer didn't expect: its flowers might have a smell the customer can't bear or perhaps they thought it would remain a particular size or retain its leaves in winter. The policy of the nursery will help determine what solutions might be offered. These situations can be considered "complaints" and we will outline a strategy for dealing with complaints below.

Dealing with complaints and solving problems offers a special challenge in the nursery industry. In addition to the types of complaints common to any retail shop, the business of selling living plants creates the potential for many problem situations to arise. Variability in the characteristics and attributes of many plants due to genetic, environmental and cultural differences, means that plants may not grow as rapidly as expected, may turn out to have different coloured

blooms than expected, or perhaps different fruit. Because plants are living and dynamic, often what you see is not what you get. Plants change with each season, and as they mature, they sometimes result in the unveiling of an unexpected or unwanted characteristic.

Products such as fertilizers and pesticides must be used properly to be effective, and improper use may result in plant damage. Many problem situations are avoided by paying strict attention to detail in signing and labelling of plant material, and by ensuring that customers receive accurate, appropriate information about products before purchasing.

Effective and frequent communication between nursery staff also helps to reduce complaints related to customer service. Customers deserve prompt deliveries, to receive the product they've asked to have put on hold, and to have special requests filled whenever possible. Communication to accomplish these tasks is key—you might not track down special orders, but if asked for one, you need to ensure the appropriate person knows about it and has followed through.

The importance of resolving customer complaints cannot be overestimated. Each customer is a valuable asset, and a complaint should be viewed as an opportunity to save the garden centre from lost sales. It has been said that a customer whose complaint has been resolved to their satisfaction may in fact become the most loyal of all customers. Unsatisfied customers will often publicize their displeasure to friends and family. It is prudent to develop a strategy to effectively deal with customer complaints to the satisfaction of both the customer and the garden centre.

1. Be aware of the nursery's policies regarding guarantees, complaints and dealing with aggressive customers.

2. Recognize that customers with complaints will often be emotionally charged and they may be upset and angry or annoyed. Avoid argument and don't allow the situation to get 'personal'. Customers may be rude and difficult, even if you are not personally at the root of their problem; try not to feel insulted or take objectionable treatment to heart.

3. If the complaint is related to a specific staff member's actions, take a neutral position. Follow through to resolve the complaint but avoid either being defensive of the staff member or admonishing the staff member publicly. Show compassion for both the customer and the staff member. If

the staff member is in error, take them aside later and review the situation with him or her; to do so in front of others is humiliating to your coworker and embarrassing to witness.

4. Listen to the complaint without interrupting. Use body language and facial expressions (nodding, eye contact, hand gestures) to show that you are listening. Allow the customer to fully voice their dissatisfaction, and vent their emotions.

5. Empathize. Show that you understand their emotion and summarize the complaint and the emotion they may be feeling. Use the phrase "I understand":

   I understand you are disappointed that those petunias turned out to be red. They certainly don't fit into an all-white garden.

6. Apologize for any inconvenience that has resulted from this situation.

7. Do not attempt to assign blame or make excuses for the problem; rather focus on determining the best way to solve the problem. Work with the customer toward a solution and let the customer know that you want to satisfy his or her concern. Ask how you can best resolve the situation for him or her. If possible, offer the solution that has been requested. If the customer is not sure how the problem can be solved, use your knowledge of the garden centre's products, services and policies to determine possible solutions. Offer the solution that you judge to be the best one. If the solution that the customer suggests is unrealistic, discuss it with the customer and ask him or her to consider the best alternative solution that you have to offer.

Learn to recognize complaints or problems that are best passed on to a higher level. If you are certain it will be difficult to solve the problem given your level of responsibility or empowerment don't waste the customer's time. Introduce the customer to the staff member who is able to help. Do not leave the customer waiting alone, possibly feeling abandoned. Continue to empathize with him or her while waiting for qualified help.

In the extreme case that the complaint is such that you are not able to resolve it, and there is no one available to solve the problem immediately, become the customer's advocate. Explain to them that you will follow up for them and make sure that their complaint is resolved.

Give them your name and the name of the person who will be able to solve their problem. Get their name and information on how to contact them. Make sure that they are comfortable with this approach. Dealing with a complaint like this should be a top priority. Follow up as soon as possible, and keep the customer informed of your progress.

When the customer's concerns have been satisfied, remind them of how much their business is appreciated. Volunteer your name and encourage them to ask for you anytime they require help at the nursery.

Providing Horticultural Information

A unique aspect of the nursery business is customers' reliance on their local nursery to provide them with a full range of horticultural and gardening advice. Some nurseries have even developed and instituted special gardening information "hotlines" to meet this demand for information. The retail garden centre professional will be required to provide advice on a regular basis, in conjunction with the sale of plants and products and as a service in itself. Information provided to customers should be always accurate, up-to-date, appropriate to the region, easy to understand, and easy to remember or provided in written form.

It is important that the retail garden centre professional keep informed as new information becomes available. Make your best effort at answering odd or difficult gardening questions. Customers appreciate the extra effort made to help. Customers are rarely impatient when you are seeking an answer to their questions, and are often quite pleased to know that their question is a bit of a stumper. During busy times, you may need to delay a response until a less busy time, when an opportunity to follow up arises.

Locate alternate sources of horticultural information. They may include other experienced staff members, reference books, vendors, college or university horticulture departments, professionally produced handouts, government agriculture specialists, customers and the internet. Although one can expect a share of challenging gardening questions, most advice relates to the plants and products that the nursery carries. A general knowledge of planting procedures and of commonly sold nursery products and their uses will leave the retail garden centre professional well prepared to answer most questions.

Glossary

Appendix A

Abiotic Referring to non-living (environmental) elements that affect plant growth. Abiotic factors include but are not limited to light, temperature, atmospheric gasses, and geological composition of soil.

Abscisic Acid Primarily responsible for mediating a plant's response to stress. It enforces dormancy, plays a role in seed maturation and can inhibit germination, and it promotes abscission (drop of leaves or fruit) in fall or upon ripening. It also stimulates stomatal closure in order to reduce water lost by transpiration.

Acclimatization The physiological adaptation of a plant to changes in climate or temperature. Acclimatizing plants is done by gradually introducing them to a new environment so as not to shock them.

Adventitious Root Adventitious roots are those that grow from stems or shoots rather than from a parent root. In some plants, adventitious roots grow from the aerial stem to provide support (e.g. Banyan tree). In others, they occur to develop new plants (e.g. roots developing from strawberry runners or tropical spider plant).

Angiosperm Most basically defined, angiosperms are flowering plants. They are the most diverse and highly evolved category of plants, and their seeds are enclosed in sporophylls, which form one or more carpels in the ovary of the plant. See also **gymnosperm**.

Annual A plant that completes its life cycle from seed, to producing seeds, to dying naturally, in one year. Many plants are treated as and called annuals when they are killed by winter cold, even though they are perennial in their native tropical climates (e.g. *Osteospermum* spp.). See also **biennial**, **perennial**.

Anther — The terminal, pollen-bearing part of a **stamen**.

Apical Dominance — The apex (very tip) of a plant's stem has an actively growing apical bud. In some plants, the growth of the lateral buds (buds growing along the length of the stem) is inhibited by the growth hormones—auxins—produced by the apical bud. This is called apical dominance, and it explains why pinching the centre of some plants can cause them to bush out.

Auxin — Auxins are plant hormones that promote cell elongation, and therefore stem and root growth. They are an active ingredient in synthetic rooting hormones used when growers take cuttings of plants. They also promote uniform flowering, fruit set, and prevent premature fruit drop.

Axil — The upper angle formed by a leaf or a branch and a plant's stem. In flowering plants, buds generally develop in the axil.

Balled & Burlapped — "B & B" refers to plants that are dug from the nursery and root-wrapped in burlap with firm, natural balls of earth. These root balls must be of sufficient diameter and depth to encompass the fibrous and feeding root system, in order for the plant to withstand transplant shock. The burlap wrapping protects the root system during transport, and allows the plant to survive for a period of time prior to being replanted.

Basal — At the lowest part of a plant, hence basal growth, basal shoots and basal leaves.

Biennial — A plant that completes its life cycle in two years. Typically, the plant forms a rosette of foliage during the first year, then bolts, flowers, sets seed and dies the second year (e.g. *Digitalis* spp.). See also **annual**, **perennial**.

Bracts Modified leaves that grow just below a flower or flower cluster in some species. Bracts are usually green, but sometimes are conspicuously coloured, appearing to be the 'flowers' of a plant (e.g. poinsettia, dogwood, bougainvillea).

Bud The embryo shoot, flower or flower cluster, hence growth bud, flower bud.

Budding The practice of attaching a growth bud of one kind of plant to the stem of a closely related plant. This is common with roses and fruit trees to serve a number of purposes: to change varieties, to optimize pollination, to take advantage of the characteristics of a particular rootstock, or to perpetuate clones. See also **grafting**.

Bulb Any plant that grows from a thickened underground structure is often referred to as a 'bulb' even though it may be a **corm**, **rhizome** or **tuber**. True bulbs, however, are composed of fleshy scales, which are actually modified leaves (e.g. lilies, onions). They gather all the nutrient required to feed a plant from their roots and leaves, and store it until it is the appropriate time to grow and flower.

Callus The growth of corky tissue which naturally forms over a wound in the trunk or branches of a woody plant.

Calyx The outer whorl of flower parts. It consists of **sepals**, that are green. The sepals may be free from each other in the same flowers of some plants or fused to form a cup in flowers of other plants. The calyx encloses and protects the inner whorls in the bud stage, and since the sepals contain chlorophyll, they can also synthesize food.

Cambium — The thin layer of actively growing tissue between the **xylem** and **phloem**. In woody plants, this can also be described as the growing tissue layer between the bark and the wood.

Candles — New shoots or growing tips on pines and other conifers.

Catkin — A slender, spike-like flower cluster. Catkins are either male or female. In some species the male and female catkins occur on separate plants, while others bear both male and female catkins on the same plant. Some trees that produce catkins include willow and birch.

Central Leader — The central, vertical, dominant stem of a tree.

Chlorosis — Yellowing of leaves, generally due to unsuitable growing conditions or nutrient deficiencies.

Cold Spots — In merchandising, the area of a store away from the racetrack and therefore from the main traffic flow. Cold spots have the lowest sales volume in the store, but can be improved using colour, optical movement or other attention-grabbing methods to draw customers closer. See also **Hot Spots**.

Collar — The portion of a tree branch where it joins the trunk, forming a ridge. If left undamaged, the collar will heal a pruning cut quickly.

Conifer — A species of plant that produces cones (e.g. pine, spruce, larch).

Coppicing — The practice of pruning a tree or shrub close to ground level, resulting in production of numerous vigorous basal shoots; this may be done to rejuvenate old, leggy shrubs such as honeysuckle.

Cordate — Heart-shaped. Generally used to describe a leaf shape.

Corolla The second whorl of flower parts. Individually, these are known as **petals**; normally they are the highly-coloured parts of the flower.

Corm A thickened underground stem that serves as food storage in some plants including crocus, gladiolus, and cyclamen. The main distinguishing trait between **bulbs** and corms is the method of storing food. In corms, most of the food is stored in an enlarged basal plate rather than the meaty scales, which in corms are much smaller. Corms generally tend to be flatter in shape than round, true bulbs.

Crotch Angle The angle formed by two connecting branches. Branches forming excessively narrow or wide crotch angles be subject to damage.

Crown Cleaning The removal of dead, dying, diseased, crowded, weakly attached and low-vigour branches from the crown of a tree.

Crown Raising The removal of the lower branches from a tree in order to provide clearance for buildings, vehicles, pedestrians and vistas.

Crown Reduction Reducing the size of a tree, often for clearance for utility lines. Reducing the height or spread of a tree is best accomplished by pruning back the leaders and branch terminals to lateral branches that are large enough to assume the terminal roles (at least one-third the diameter of the cut stem). Compared to topping, this helps maintain the form and structural integrity of the tree.

Crown thinning The selective removal of branches to increase light penetration and air movement through the crown. Thinning opens the foliage of a tree, reduces weight on heavy limbs, and helps retain the tree's natural shape.

Cultivar — A cultivated variety as distinguished from a botanical variety.

Cytokinins — A class of plant hormones that promote cell division, cell growth, and generally promote shoot development while inhibiting root growth. They also play a key role in photosynthesis, chlorophyll production and leaf unrolling.

Day Neutral Plants — A plant in which blooming is not affected by **photoperiod** (the length of day or night). These plants generally flower after attaining an overall development stage, or in response to environmental stimuli. See also **long-day** and **short-day plants**.

Dead-heading — Pruning the spent flowers or unripe seed-pods from a plant. Deadheading is usually done by hand, or by using **secateurs**.

Deciduous — A plant that sheds all of its leaves at one time, usually in the autumn (e.g. maple).

Defoliation — The unnatural loss of a plant's leaves.

Deionized — Deionized or demineralized water is that which has had ions removed using an ion exchange process, leaving it free of sodium, calcium, chloride, bromide and other contaminants. Non-ionic compounds may still remain; these are only removed by distilling.

Determinate — Plants genetically predetermined to grow to a particular size and shape. See also **indeterminate**.

Dicot — A category of flowering plants having two cotyledons in their embryos, flower parts in multiples of four or five, reticulated leaf veins, and producing secondary growth to expand their girth (i.e. wood). See also **monocot**.

Dormant Buds Buds that are formed at the leaf-bases (leaf **axils**) but which do not grow unless the shoot or branch they are on is shortened (removing the **auxins** that cause **apical dominance**).

Edema Cell rupture caused by overly moist conditions.

End-cap The shelving unit or display at the end of an aisle that is perpendicular to the main gondola or aisle display. An end-cap is often used to feature a special, introduce a new product or answer a seasonal need. It is generally most effective if built in a **hot spot**.

Espalier A method of pruning or **grafting** a tree to create a two-dimensional pattern. This allows trees to be grown flat against a wall, or in rows, generally by orchardists to aid with fruit picking.

Etiolation Paling and stretching of shaded foliage toward light.

Ethylene A gas that acts as a plant hormone, stimulating and regulating the ripening of fruit, the opening of flowers, and the abscission of leaves. Some plants emit ethylene, and for that reason should not be enclosed in bags or sleeves, or left in confined spaces; poinsettia, for example, will lose their leaves if kept covered.

Evergreen A plant that sheds leaves slowly throughout the year, not all at once. Evergreens can be needleleaf or broadleaf (e.g. pine, evergreen magnolia).

Family In **taxonomy**, a group of plants sharing certain broad characteristics, which may not be immediately evident. The family, 'Rosaceae,' for instance, includes but is not limited to, roses, spiraea, apples, cherries, and plums.

Feathers The lateral growth on a year-old (maiden) tree.

Filament The part of a **stamen** which holds the **anther** aloft.

Foot-candle A measure of light intensity defined as the amount of illumination the inside surface an imaginary 1-foot radius sphere would be receiving if there were a uniform point source of one candela in the exact centre of the sphere. See also **lux**.

Formal Pruning Methods of pruning that produce particular unnatural shapes as in topiary, hedging, and bonsai.

Framework The main branches of a tree or shrub.

Generic epithet In binomial (two-part) **nomenclature**, the first word, which indicates the organism's genus. See also **specific epithet**.

Genus (pl. Genera) In **taxonomy**, organisms are divided into closely related groups called genera. The genus forms the first word in a plant's botanical name.

Gibberellins Plant hormones responsible for stem elongation, and controlling the bolting and flowering responses in plants, and the breaking of seed dormancy.

Gondola Wall or free-standing shelving units, usually metal, used to merchandise commercial products. Gondolas have adjustable shelves, and often are positioned with an end-cap shelf so that all sides of the display can hold product.

Grafting The practice in propagation of uniting a shoot (called a scion here) to the stem-and-roots of another, closely related plant (called the rootstock).

Growing Media A soil-less mix (normally peat based) used for potted plants. Most sterile, bagged potting "soils" are considered growing media and are distinct from topsoils or garden mixes.

Gymnosperm A group of seed-bearing plants with ovules on the edge or blade of a naked sporophyll; the sporophylls usually arranged in cone-like structures. See also **angiosperm**.

Hardiness A plant's resistance to both cold and climate. Hardiness is measured using a range of environmental indicators, and hardiness zones are used to match plants to the geographical locations where they will survive various weather extremes and traits.

Heading Back Pruning cuts made to shorten stems or branches.

Hedging Tightly spaced plants (usually woody) installed to form a wall, define boundaries, or create a backdrop for other plantings.

Hot spots In merchandising, an area along the store's racetrack that receives frequent customer traffic due to a high volume of passers-by. Displays created to move large volumes of product are most effective when placed in a merchandising hot spot. See also **cold spot**.

Humus The brown or black matter produced at the final stage of plant or animal decomposition, which will not break down further. In horticulture, the term is often used to describe matured compost.

Hybrid A distinct plant resulting from a cross between two species, subspecies, varieties, cultivars or strains. Hybrids are generally bred to further a given desirable trait.

Hydrophilic Water-loving.

Hydrophobic Water-hating.

Hydroseeding A spray-on method of lawn seeding. Grass seed, fertilizer, and wood mulch are combined to create a slurry that holds the right amount of water and encourages germination. Hydroseeding is particularly effective for installing lawns in hard to reach areas, on steep slopes, or in vast areas where hand-seeding or sodding would be costly or inefficient.

Indeterminate In pruning, a growth habit with no dominant central leader. In botany, plants with no genetically predetermined height; many tomato varieties are indeterminate. See also **determinate**.

Inflorescence An arrangement of flowers in a cluster. Inflorescences may include spikes, **catkins**, **umbels** or **panicles** of flowers.

Informal Pruning Informal pruning involves making selective cuts to gently shape a plant, or clean it of diseased or damaged branches.

Internode The region of a stem between two nodes.

Invasive Alien Species Organisms, not native to a given region and usually introduced by humans, that have taken over their new habitat, causing harm to the natural environment, its populations, the economy, or human health.

Lateral A side growth which develops away from the main stem or trunk.

Long-day Plants Plants that require less than a certain number of hours of darkness in order to induce flowering. See also **day-neutral** and **short-day** plants.

Loppers A large type of manual cutting tool, usually operated with two hands, used for pruning substantial branches, hedge-shearing, etc.

Loss Leader A product that is priced at a low margin. Loss leaders are generally advertised to attract customers to a store and compel them to make a purchase; once customers are in the store, they can be encouraged to purchase other items on impulse.

Lux A measure of light intensity equal to 10.764 **foot-candles**.

Macronutrients In soils, nitrogen, phosphorous, potassium, calcium, magnesium and sulphur. See also **micronutrients**.

Material Safety Data Sheet A technical bulletin that provides specific hazard information, safe handling information, and emergency procedures for a controlled product. An MSDS sheet is available for every chemical and most fertilizers sold in a garden centre, and they should be kept on-hand for emergency reference, and to answer handling questions.

Micronutrients In soils, boron, chlorine, copper, iron, manganese, molybedenum and zinc. See also **macronutrients**.

Monocot A category of flowering plants where the embryo contains one cotyledon, flower parts occur in multiples of three, major leaf veins run parallel, and they do not increase their diameter through secondary growth (i.e., are not woody). See also **dicot**.

Morphology The study of the structure of plants. The morphology of a plant assists in its identification and taxonomic classification.

Nitrogen The **macronutrient** required to produce the above-ground vegetative growth of plants. See also **phosphorus** and **potassium**.

Node The region of a stem where a leaf, leaves, or a bud arises.

Nomenclature The naming of organisms. See also **taxonomy**.

Ovary The female reproductive organ of the flower, which holds the ovule(s) and is located above, below, or at the point of connection with the base of the **petals** and **sepals**.

Panicle A type of loose, much-branched **inflorescence**.

Perennial A plant that returns year after year, growing in size until maturity (e.g. *Rudbeckia* spp., *Coreopsis* spp.). Perennials vary in terms of their length of life. See also **annual**, **biennial**.

Perlite A generic term for natural silicious rock (volcanic glass), which, when heated to as certain level, expands greatly into white puffy granules. Used as an additive in growing media or in which to root cuttings, perlite creates air pockets, and so improve aeration. It does not absorb water. See also **vermiculite**.

Petal The inner bracts of many flowers, usually brightly coloured to attract pollinating insects. Collectively, they are called the **corolla**. In some **families** and **genera**, the petals are fused together to form a tube (e.g. petunia, *Penstemon* spp.).

Phloem The vascular tissue through which plant nutrients are moved within the plant. For example, sugars manufactured through photosynthesis are moved from the leaves through the phloem to the roots. See also **xylem**, **cambium**.

Phosphorous A **macronutrient** important in the germination and growth of seeds, the production of flowers and fruit, and the growth of roots. See also **nitrogen**, **potassium**.

Photoperiodism The physiological reaction of organisms to the length of day or night. See also **day-neutral plants**, **long-day plants**, **short day plants**.

Pinching The removal of the shoot tips of a plant by cutting or nipping out with fingers to encourage lateral growth and branching.

Pistil The female portion of a flower, usually located in the centre. It is made up of the pollen-receiving tip or **stigma**, a narrow tube or **style**, and the **ovary** or ovaries where seeds are formed and mature.

Planogram A product placement map created by product manufacturers or distributors to indicate the best arrangement of a family of products on store shelves.

Pollarding The pruning of a tree or shrub back to a basic framework or the main trunk.

Potassium The **macronutrient** required to maintain disease resistance in plants, promotes general vigour and sturdy growth. See also **nitrogen**, **potassium**.

Prill A small aggregate of a material, most often a dry pellet, usually formed from a liquid. In the garden centre, fertilizers or dolomite lime may come in a prilled form for ease of distribution.

Racetrack The path of least resistance that most consumers will take between entering a store and exiting the store. The most effective racetracks compel customers to tour the largest proportion of the store. IKEA is one example of a store with a complex and thorough racetrack.

Relative Humidity The term used to describe the quantity of water vapour that exists in a gaseous mixture of air and water.

Rhizome Thickened, underground, horizontally growing stem, which may be long and thin (e.g. crabgrass) or thick and fleshy (e.g. bearded iris). See also **bulb**, **corm**, **tuber**.

Runner — A slender stem sent out from the bases of some **perennial** species, at the end of which an offset (young complete plant) develops. Strawberry plants are examples of plants producing runners.

Secateurs — Hand-pruners or shears. See also **loppers**.

Second-Year Wood — Growth or shoots which were produced the previous season; most shrubs flower on second year wood.

Sepal — The outer bracts of many flowers; usually these are green, but in some genera they are brightly coloured. Collectively, they are called the **calyx**. Plants with pronounced sepals include fuchsia and iris.

Short-Day Plants — A plant that cannot flower under the long days of summer. Short day plants typically flower in the fall of the year (e.g. *Chrysanthemum* spp.). See also **photoperiodism**, **day-neutral plants**, **long-day plants**.

Shrub — A woody plant that branches from the base and is generally under four metres tall.

Soil Solution — The mixture of water and nutrients in the soil

Species — A group of plants, usually interbreeding freely and having many characteristics in common. Natural crosses between species within a **genus** are uncommon, and crosses, natural or manipulated, between genera are very uncommon.

Specific epithet — In binomial (two-part) **nomenclature**, the second word, which indicates the organism's species. See also **generic epithet**.

Spermatophyte — Plants that produce seeds.

Spur — A slow-growing, short, shoot-like branch where flowers and fruit usually arise.

Stamens The male portion of a flower. The stamens are comprised of pollen-producing **anthers**, each held aloft by a stem or **filament**.

Standard A tree or shrub grown with 1-2 m (3-6') of clear single stem or trunk. Roses are commonly **grafted** on a rootstock stripped of its branches to form a **top-worked** standard. Other shrubs may be pruned in this way. See also **topiary**.

Stigma In flowers, he terminal end of the **style** which accepts pollen.

Stomate Small openings in leaves and stems, surrounded by guard cells, through which gases including water vapour pass. Plural: stomata.

Strain A group of plants with similar (but not identical) appearance and/or properties. Usually these plants are part of the same species or hybrid, but are variable in some way (flower colour, for example).

Style A stalk connecting the **stigma** with the ovary, which facilitates the growth of the pollen tube and hence the movement of the male gamete to the **ovary**.

Subspecies Usually a geographical or other variant of a species. In botanical **nomenclature**, subspecies are denoted with a ternary (third) name following the abbreviation subsp. or ssp.

Sucker A basal shoot arising from the root system of a tree or shrub.

Summer annual **Annual** plants in which the development cycle is completed in one growing season, and generally referred to simply as annuals. The term summer annual is used to differentiate a plant's growth habit from that of a **winter annual**.

Taxonomy The practice and science of classifying living things. See also **nomenclature**.

Thinning Annual pruning to remove weak or spindly stems.

Tilth The general suitability of soil to support root growth. A soil with good tilth has large pore spaces for adequate aeration and water percolation. It also holds a reasonable supply of water and nutrients, and has an amenable soil texture, structure, and amount of organic content.

Topiary The shearing of shrubs or trees into ornamental shapes. See also **standard**.

Top-worked A **standard** tree or shrub that has been **grafted** or **budded** 1-2 m (3-6') up the stem of a rootstock.

Transpiration Loss of water vapour through the **stomata** of leaves.

Tree Single trunk woody plant over 5m.

Tuber Short, fat underground stem, either flattened, rounded, or irregular, and usually knobby with growth buds or eyes (e.g. tuberous begonia, *Ranunculus* spp.). Each eye has a scale-like leaf with a bud in its **axil**. See also **bulb**, **corm**, **rhizome**.

Tuberous Roots Actually roots—not stems—with thickened food storage structures. They do not bear growth buds as do **tubers**, but can be divided as long as part of the stem base remains with the division; growth buds are in the old stem.

Turgor In biology, the pressure of the cell contents against the cell wall, and determined in plants by the water content of the vacuole, resulting from osmotic pressure. Turgid plant cells contain more water than flaccid cells and exert a greater osmotic pressure on its cell walls.

Umbel An **inflorescence** which consists of a number of short flower stalks, which are equal in length and spread from a common point, somewhat like umbrella ribs. Dill flowers are one example.

Variety In botanical **nomenclature**, a rank below that of species; as such, it gets a ternary name preceded by the abbreviation var. A variety will have an appearance distinct from other varieties, but will hybridize freely with those other varieties. See also **subspecies**.

Vermiculite A type of mica (mineral) that puffs up when heated. In this state it absorbs and holds water, and is used in growing media for water retention. Due to its tendency to compact, it shouldn't make up more than 25% of a growing media. See also **perlite**.

Vine Climbing plant by means of twining stems or tendrils.

Water sprouts Vigorous non-flowering (and usually unwanted) shoots that arise from buds on old wood on vigorous, severely pruned or damaged trees.

Whorl An arrangement of leaves or other plant organs in which three or more arise at the same node.

Winter annual — **Annual** plants in which the seed germinates in the autumn and a mat of leaves called a rosette is formed at the ground level. The plant grows through fall and spring, and produces seeds in late spring or summer. In climate zones where early germination is permitted, winter annuals may perform like **summer annuals**.

Xylem — The vascular tissue through which water and nutrients are moved from the roots of a plant, up through the stems, to the leaves and flowers. Water is drawn up to the leaves from the roots, primarily by the negative pressure created by transpiration from the leaves. Both xylem and **phloem** are located between the bark and the dead wood. See also **cambium**.

Regional Plant Lists

Appendix B

Plants of British Columbia

Broadleaf Trees

Acer griseum
Acer palmatum
Acer platanoides 'Crimson King'
Acer rubrum
Betula jacquemontii
Betula papyrifera
Cercidiphyllum japonicum
Cornus 'Eddies White Wonder'
Cornus florida 'Rubra'
Cornus kousa
Cornus nuttalii
Fagus sylvatica
Ginkgo biloba
Gleditsia triacanthos
Liquidambar styraciflua
Liriodendron tulipifera
Magnolia kobus
Populus tremuloides
Prunus 'Shirofugen'
Prunus 'Shirotae'
Prunus subhirtella 'Pendula'
Quercus palustrus
Quercus robur
Quercus rubra
Rhus typhina
Robinia pseudoacacia 'Frisia'
Sorbus aucuparia
Tilia cordata

Coniferous Trees

Metasequoia glyptostroboides
Picea abies
Picea breweriana
Picea glauca
Picea omorika
Picea pungens 'Glauca'
Pinus nigra

	Pinus sylvestris
	Pseudotsuga menziesii
	Thuja plicata
Ferns	*Athyrium felix-femina*
	Matteuccia struthiopteris
Groundcovers	*Arctostaphylos uva-ursi*
	Ajuga reptans 'Bronze Beauty'
	Aegopodium podagraria 'Variegatum'
	Cotoneaster dammeri
	Euonymus fortunei 'Emerald-n-Gold'
	Gaultheria procumbens
	Genista pilosa 'Vancouver Gold'
	Hedera helix
	Vinca minor
Ornamental Grasses	*Festuca ovina glauca*
	Miscanthus sinensis 'Gracillimus'
Perennials	*Artemisia* 'Silver Mound'
	Aquilegia x 'Blue Star'
	Aster alpinus 'Dark Beauty'
	Astilbe x *arendsii*
	Aubrieta x *cultorum*
	Bergenia cordifolia
	Campanula persicifolia
	Centaurea montana
	Coreopsis verticillata
	Dianthus deltoides
	Dicentra spectabilis
	Geranium x 'Johnson's Blue'
	Helleborus orientalis
	Hemerocallis lilio-asphodelus
	Hosta sieboldiana 'Elegans'
	Iberis sempervirens
	Iris sibricia
	Lithodora diffusa

Lupinus 'Russell Hybrids'
Nymphaea odorata
Paeonia latifolia
Papaver orientale
Penstemon fruitcosus 'Purple Haze'
Phlox paniculata
Phlox subulata
Rudbeckia fulgida 'Goldstrum'
Saxifraga x *arendsii*
Trollius x *cultorum*

Shrubs

Acer ginnala
Andromeda polifolia
Aucuba japonica 'Variegata'
Berberis verruculosa
Buxus microphylla
Camellia japonica
Cornus alba 'Elegantissima'
Cornus sericea
Daphne cneorum
Enkianthus campanulatus
Erica carnea
Forsythia x *intermedia*
Hibiscus syriacus
Hydrangea macrophylla
Ilex crenata 'Convexa'
Kalmia latifolia
Mahonia aquifolium
Photinia x *fraseri*
Pieris japonica
Pinus mugo mughus
Potentilla fruitcosa
Prunus laurocerasus 'Reynvaanii'
Pyracantha coccinea 'Orange Glow'
Rhodo japonicum 'Blue Danube'
Rhododendron 'Hino Crimson'
Rhododendron 'Nova Zembla'

Rhododendron 'Unique'
Ribes sanguineum
Rosa rugosa
Spirea x *vanhouttei*
Taxus x *media* 'Hicksii'
Thuja occidentalis 'Brandon'
Thuja occidentalis 'Smaragd'
Yucca filmentosa

Climbers / Vines
Clematis armandi
Lonicera x 'Dropmore Scarlet'

Plants of the Prairie Provinces

Broadleaf Trees
Acer negundo
Acer saccharinum
Aesculus glabra
Betula pendula
Betula papyrifera
Betula fontinalis
Crataegus x *mordenensis* 'Toba'
Elaeaganus angustifolia
Fraxinus mandshurica
Fraxinus pennsylvanica lanceolata
Malus x *adstringens* cvs
Populus tremuloides
Populus tremula 'Erecta'
Prunus padus var *commutata*
Prunus virginiana 'Schubert'
Quercus macrocarpa
Salix pentandra
Sorbus aucuparia
Syringa reticulata
Tilia cordata
Ulmus americana 'Brandon'

Coniferous Trees
Larix sibirica
Picea abies

Picea glauca
Picea pungens var 'Glauca'
Pinus cembra
Pinus contorta latifolia
Pinus flexilis
Pinus ponderosa
Pinus sylvestris
Pseudotsuga menziesii

Evergreen Shrubs

Juniperus chinensis 'Gold Coast'
Juniperus horizontalis
Juniperus sabina
Juniperus scopulorum
Juniperus squamata 'Blue Star'
Pinus mugo cvs
Thuja occidentalis 'Brandon'

Deciduous Shrubs

Amelanchier alnifolia
Caragana arborescens 'Lorbergii'
Caragana frutex 'Globosa'
Cornus alba 'Sibirica'
Cornus sericea 'Flaviramea'
Cotoneaster acutifolia
Daphne cneorum
Euonymus alata 'Compactus'
Forsythia ovata x 'Northern Gold'
Hippophae rhamnoides
Hydrangea arborescens 'Annabelle'
Lonicera tatarica 'Arnold Red'
Mahonia aquifolium
Philadelphus lewisii 'Waterton'
Physocarpus opulifolius 'Luteus'
Potentilla fruticosa
Prunus x *cistena*
Prunus tomentosa
Prunus triloba 'Multiplex'
Rhododendron x PJM

Rhus glabra
Ribes alpinum
Rosa species & hybrids
Salix discolor
Salix purpurea nana
Sambucus racemosa 'Plumosa Aurea'
Shepherdia argentea
Spiraea x *bumalda* 'Anthony Waterer'
Spiraea trilobata
Symphoricarpos albus
Syringa villosa
Syringa vulgaris
Viburnum lantana
Viburnum opulus 'Nanum'
Viburnum trilobum

Perennials

Achillea millifolium
Aconitum napellus
Alchemilla mollis
Anemone sylvestris
Antennaria rosea
Aquilegia species
Arabis caucasica
Armeria maritima
Artemesia schmidtiana
Aster novi-belgii
Astilbe x *arendsii*
Bergenia cordifolia
Campanula carpatica
Convallaria majalis
Coreopsis verticillata
Delphinium x *elatum*
Dianthus deltoides
Dicentra spectabilis
Echinacea purpurea
Gaillardia aristata
Geranium sanguineum
Hemerocallis x *hybrida*

Heuchera x *sanguinea*
Hosta species
Iris x *germanica*
Lamium maculatum
Liatris spicata
Ligularia dentata
Linum perenne
Monarda fistulosa
Paeonia sp
Phlox subulata
Pulmonaria montana
Salvia x *superba*
Sedum species
Sempervivum sp
Stachys byzantina
Trollius x *cultorum*
Veronica spicata

Annuals

Antirrhinum majus
Begonia hybrids
Centaurea cineraria
Cosmos bipinnatus
Impatiens wallerana
Lobelia erinus
Lobularia maritima
Pelargonium species
Petunia hybrids
Tagetes patula
Viola wittrockiana

Ornamental Grasses

Festuca ovina 'Glauca'
Helictotrichon sempervirens
Pennisetum alopecuroides
Phalaris arundinacea var *picta*

Groundcovers

Aegopodium podograria
Ajuga reptans
Arctostaphylos uva-ursi

Cerastium tomentosum
Pachysandra terminalis
Paxistima canbyii
Polygonum reynowtria
Thymus serpyllum
Vinca minor

Climbers / Vines
Clematis 'Jackmanii'
Humulus lupulus
Lonicera x *brownii* 'Dropmore Scarlet'
Parthenocissus quinquefolia var *engelmannii*
Vitus cvs

Ferns
Matteuccia struthiopteris

Aquatic Plants
Caltha palustrus
Iris pseudacorus
Nymphaea hybrids
Typha minima

Bulbs & Corms
Allium giganteum
Crocus sp
Gladiolus sp
Lilium species
Muscari armeniacum
Narcissus sp
Scilla sibirica
Tulipa sp

Plants of the Atlantic Provinces

Shrubs
Acer ginnala
Andromeda polifolia
Amelanchier canadensis
Aronia melanocarpa
Buddleia davidii
Baxus microphylla
Calluna vulgaris

Caragana arborescens
Chamaecyparis pisifera 'Filifera'
Chamaecyparis pisifera 'Squarrosa'
Clethra alnifolia
Cornus alba
Cornus mas
Corylus avellana 'Contorta'
Cotinus coggygria 'Royal'
Daphne cneorum
Deutzia gracillius
Erica carnea
Euonymus alatus
Forsythia ovata 'Northern Gold'
Hamamelis virginiana
Hydrangea paniculata 'Grandiflora'
Ilex meservae
Juniperus chinensis
Juniperus horizontalis
Kalmia latifolia
Lavandula angustifolia
Lonicera tatarica
Magnolia stellata
Mahonia aquifolium
Philadelphus x *virginalis*
Pieris japonica
Pinus mugo mughus
Potentilla fruiticosa
Rhododendron hybrids
Rosa species and hybrids
Salix discolor
Spirea x *bumalda*
Symphoricarpos albus
Syringa vulgaris
Taxus x *media* 'Hicksii'
Thuja occidentalis
Viburnum x *burkwoodii*

Trees

Gingko biloba
Larix decidua
Metasequoia glyptostroboides
Picea abies
Picea omorika
Picea pungens 'Glauca'
Pinus nigra
Pinus sylvestris
Tsuga canadensis
Acer palmatum
Acer rubrum
Aesculus hippocastanum
Betula papyrifera
Betula pendula
Catalpa speciosa
Cercidiphyllum japonicum
Cornus kousa
Fagus sylvatica
Fraxinus pennsylvanica
Gleditsia triacanthos
Laburnum x *watererei*
Liriodendron tulipifera
Malus floribunda
Populus tremuloides
Quercus palustrus
Quercus rubra
Rhus typhina
Salix babylonica (synonym: *Salix* x *chrysocoma*)
Sorbus aucuparia
Tilia cordata

Groundcovers

Arctostaphylos uva-ursi
Cotoneaster dammeri
Euonymus fortunei
Genista tinctora 'Lydia'
Hedera helix
Pachysandra terminalis
Thymus pseudolanuginosus

Vaccinium vitis-idaea
Vinca minor

Climbers / Vines

Actinidia kolomicta
Clematis 'Nelly Moser'
Hydrangea petiolaris
Lonicera x *brownii* 'Dropmore Scarlet'
Parthenocissus tricuspidata

Perennials

Achillea millifolium
Aconitum napellus
Aegopodium podagraria
Ajuga reptans
Alyssum saxatile
Antennaria dioica 'Rosea'
Arabis caucasica
Artemisia schmidiana 'Silver Mound'
Aster novi-belgii
Astilbe x *arendsii*
Bergenia cordifolia
Campanula carpatica
Leucanthemum maximum
Coreopsis verticillata
Delphinium x *elatum*
Dianthus gratianapolitanus 'Tiny Rubies'
Dicentra spectabilis
Echinacea purpurea
Geranium sanguineum
Hemerocallis x *hybrida*
Hosta species
Iris x *germanica*
Lamium maculatum
Liatris spicata
Papaver orientale
Phlox paniculata
Phlox subulata
Primula denticulata
Pulsatilla vulgaris

	Rudbeckia fulgida 'Goldstrum'
	Salvia x *superba*
	Sedum species
	Stachys byzantina
	Veronica spicata
Grasses	*Chasmanthium latifolium*
	Elymus racemosus
	Festuca ovina 'Glauca'
	Helictotrichon sempervirens
	Miscanthus sinensis
	Pennisetum alopecuroides
	Phalaris arundinacea 'Picta'
Ferns	*Athyrium felix-femina*
	Matteucia struthiopteris
Annuals	*Begonia* hybrids
	Brassica oleracea
	Cosmos bipinnatus
	Impatiens wallerana
	Lobularia maritima
	Nicotiana alata
	Pelargonium species
	Petunia hybrids
	Tagetes patula
	Viola wittrockiana
Bulbs & Corms	*Allium giganteum*
	Crocus vernus
	Lilium x Asiatic hybrids
	Narcissus 'King Alfred'
	Tulipa x Darwin hybrids
Aquatic Plants	*Caltha palustrus*
	Iris pseudacorus
	Lemna minor
	Nymphaea hybrids

Typha minima

Plants of Ontario

Trees

Abies concolor
Acer platanoides var
Acer rubrum var
Acer saccharum
Betula jaquemontii
Betula pendula
Caragana arborescens 'Pendula'
Carpinus betulus 'Fastigiata'
Catalpa bungei
Chamaecyparis nootkatensis pendula
Chamaecyparis obtusa var
Cornus alternifolia
Cornus kousa
Cotinus coggygria
Crataegus phaenopyrum
Elaeagnus angustifolia
Fraxinus pennsylvanica
Ginkgo biloba
Gleditsia triacanthos 'Skyline'
Magnolia soulangeana
Malus moerlandaii 'Profusion'
Malus 'Red Jade'
Morus alba 'Pendula'
Picea abies
Picea pungens 'Glauca'
Pinus nigra
Pinus strobus
Pinus sylvestris
Populus tremuloides
Prunus serrulata 'Kwanzan'
Prunus virginiana 'Schubert'
Pseudotsuga menziesii

Pyrus calleryana
Quercus robur
Quercus rubra
Sorbus aucuparia
Syringa reticulata 'Ivory Silk'
Thuja occidentalis 'Emerald' or 'Smaragd'
Tilia cordata 'Greenspire'
Tsuga canadensis
Zelkova serrata

Shrubs

Acer palmatum 'Atropurpureum'
Acer palmatum 'Dissectum'
Amelanchier canadensis
Azalea Evergreen var
Azalea 'Exbury' var
Berberis thungergii
Buddleia davidii
Buxus 'Green Gem'
Chaenomeles japonica
Chamaecyparis pisifera 'Filifera Aurea'
Clethra alnifolia 'Paniculata'
Cornus alba 'Elegantissima'
Cornus sericea
Corylus avellana 'Contorta'
Cotoneaster apiculatus
Daphne cneorum
Deutzia gracilis
Erica carnea
Euonymus alatus 'Compactus'
Euonymus fortunei 'Emerald Gaiety'
Euonymus fortunei 'Gaiety'
Euonymus fortunei 'Goldtip'
Forsythia intermedia 'Spectabilis'
Genista pilosa
Hamamelis mollis

Hydrangea paniculata 'Grandiflora'
Hydrangea quercifolia
Ilex verticillata
Ilex x *meserveae* 'Blue Princess'
Juniperus chinensis 'Mint Julep'
Juniperus chinensis 'Old Gold'
Juniperus sabina 'Tamariscifolia'
Kalmia latifolia
Kerria japonica
Kolkwitzia amabilis
Ligustrum amurense
Lonicera morrowii
Magnolia stellata
Mahonia aquifolium
Myrica pensylvanica
Philadelphus virginalis
Picea abies 'Nidiformis'
Picea abies 'Pendula'
Picea glauca 'Conica'
Pieris japonica
Pinus mugo mughus
Potentilla fruticosa
Prunus cistena
Prunus triloba var 'multiplex'
Pyracantha coccinea 'Orange Glow'
Rhododendron 'PJM'
Rhus typhina 'Laciniata'
Ribes alpinum
Rosa rugosa
Salix discolor 'Pendula'
Salix purpurea 'Nana'
Sorbaria sorbifolia
Spiraea bumalda 'Goldflame'
Spiraea nipponica 'Snowmound'
Syringa meyeri 'Palabin'

Taxus media 'Densiformis'
Taxus media 'Hicksii'
Viburnum opulus 'Roseum'
Viburnum plicatum tomentosum
Viburnum trilobum 'Compactum'
Weigela florida
Yucca filamentosa

Groundcovers

Ajuga reptans
Arctostaphylos uva-ursi
Celastrus scandens
Cotoneaster dammeri 'Coral Beauty'
Euonymus fortunei 'Coloratus'
Galium odoratum
Hedera helix
Iberis sempervirens
Juniperus conferta
Juniperus squamata 'Blue Star'
Pachysandra terminalis
Sagina subulata
Sedum var.
Thymus serpyllum
Vinca minor

Climbers / Vines

Clematis tangutica
Lonicera x brownii 'Dropmore Scarlet'
Parthenocissus tricuspidata 'Veitchi'
Rosa 'Sea Foam'
Wisteria sinensis

Perennials, Bulbs & Grasses

Astilbe hybrids
Bergenia cordifolia
Convallaria majalis
Cortaderia selloana
Dicentra spectabilis

Echinacea purpurea
Festuca ovina glauca
Hemerocallis hybrids
Hosta 'Royal Standard'
Impatiens wallerana
Iris sibirica
Lavandula angustifolia
Leucanthemum var.
Matteuccia struthiopteris pensylvanica
Miscanthus sinensis 'Morning Light'
Miscanthus sinensis 'Purpurascens'
Nicotiana sylvestris
Oenothera fruticosa
Paeonia lactiflora
Phalaris arundinacea 'Picta'
Phlox subulata
Tradescantia x *andersoniana*

Appendix C

Suggested Resources

Dirr, Michael A. Dirre's *Hardy Trees and Shrubs: an illustrated encyclopedia*. 17th edition. 2003 Timber Press

Dirr, Michael A. *Manual of Woody Landscape plants: their idendification, ornamental characteristics, culture, propagation and uses*. 1998 Stipes Publishing

Shigo, Alex L. *Modern Aboraculture: a system approach to the care of trees and their associates*. 1991 Shigo and Trees, Associates LLC

Ball Red Book, 16th edition, Vic Ball, editor. 1998 Ball Publishing

Pest of Landscape Trees and Shrubs: an integrated pest management guide. Publication #3359. Steve H. Dreistadt, editor. 1994 Regents of the University of Californai

Phillips, Rober and Martyn Rix. *Annual and Biennials: the definitive reference with over 1000 photographs.* 2002 Firefly Books.

A to Z Encyclopedia of Garden Plants. Christopher Brickell and Trevor Cole, editors. 2004 Dorling Kindersely Books

Step-by-Step Gardening Techniques. Christoper Brickell, editor. 1989 Arch Cape Press

Rice, Laura William and Robert P. Rice Jr. *Practical Horticulture*. 2nd edition. 1993 Regents/Prentice Hall

Phillips, Roger and Martyn Rix. *The Random House Book of Perennials. Volume 1. Early Perennials*. Random House

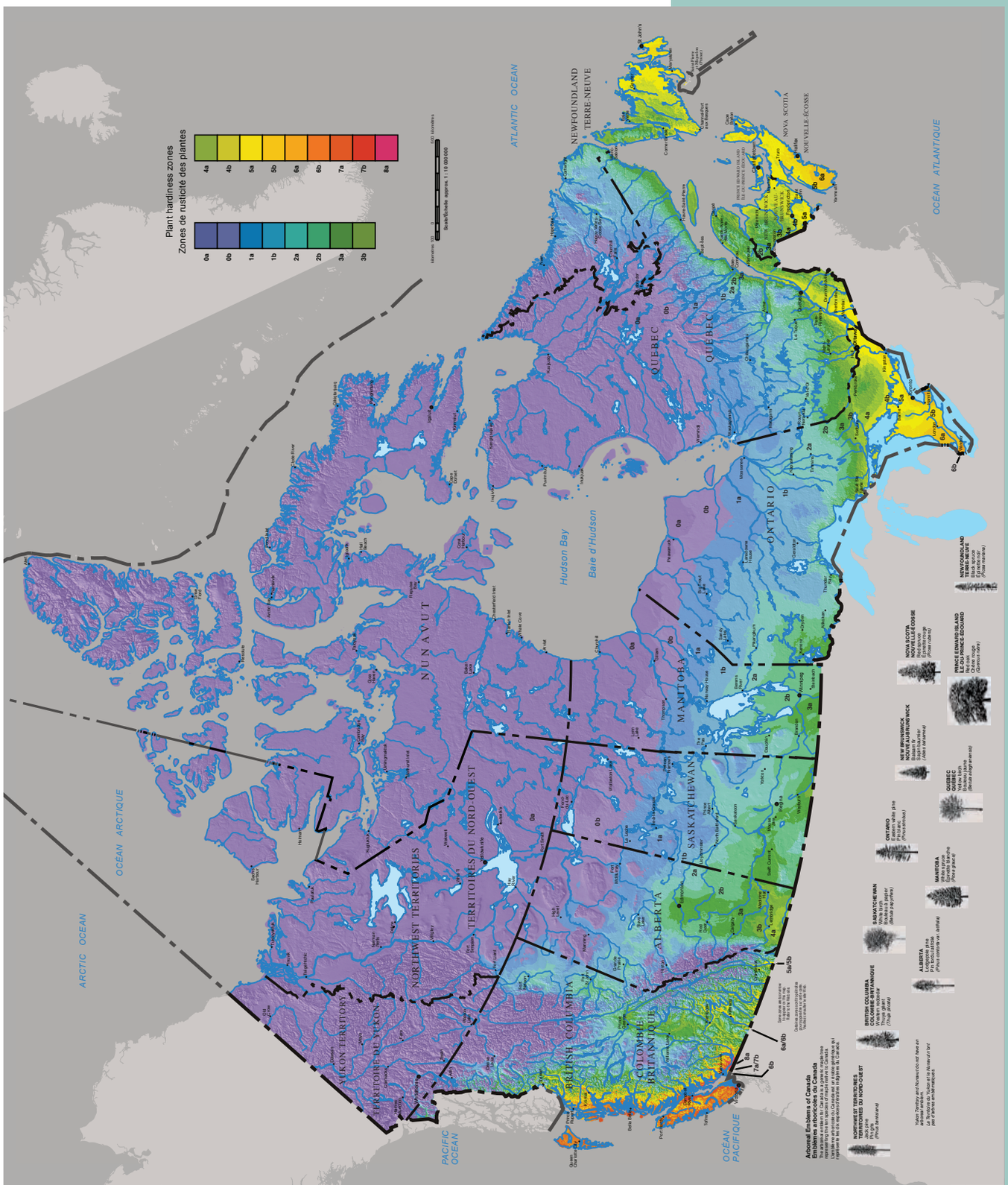
Phillips, Rober and Martyn Rix. *The Random House Book of Perennials. Volume 2. Late Perennials*. Random House

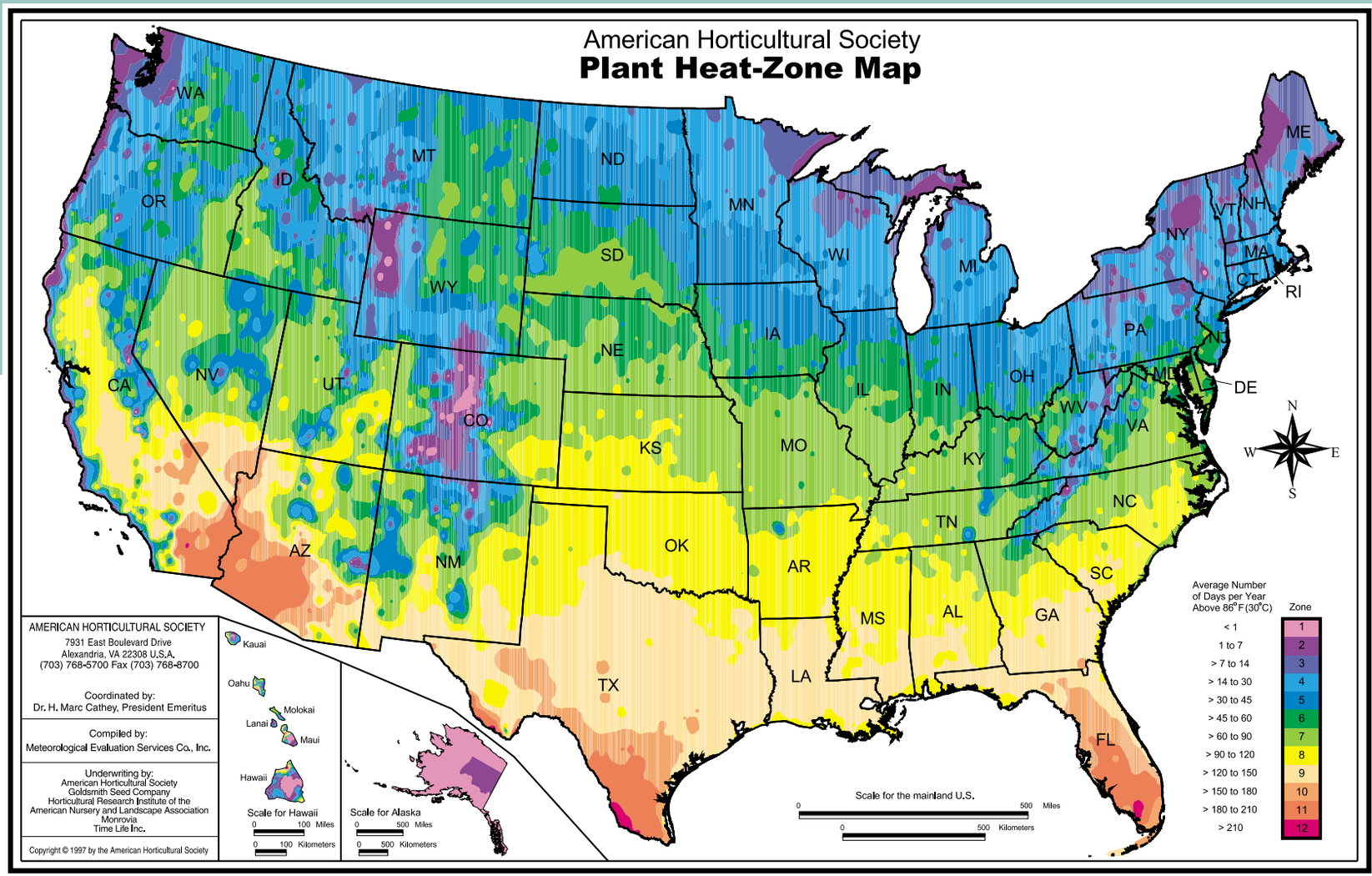
Plant Propagation: the fully illustrated plant-by-plant manual of practical techniques. Alan Toogood, editor. 2004 Dorling Kindersley Books

Brickell, Christopher and David Joyce. *Cavendish Encyclopedia of Pruning and Training*. 1996 Cavendish Books Inc.

Hardiness Zone Maps

Appendix D





Plant Heat Zone Map courtesy American Horticultural Society **www.ahs.org**