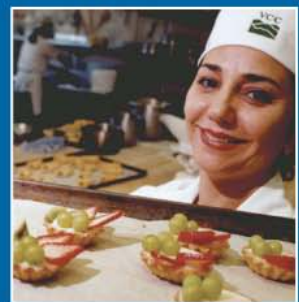
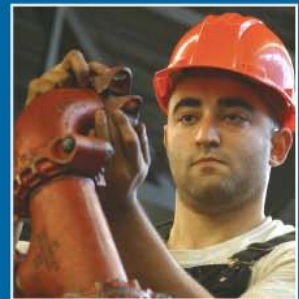


Production Horticulturist Program Outline



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PRODUCTION HORTICULTURIST PROGRAM OUTLINE

June, 2007

**Developed By
Industry Training Authority
Province of British Columbia**

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FOREWORD

The Program Outline presented in this document outlines the Production Horticulture Apprenticeship Program. This program represents the new standard for horticulture apprenticeship training in British Columbia. This document and the outlines attached will be used as a guide for instructors in the classroom, laboratories and for practical training.

Since this is a practical trade it is expected that demonstration and student participation will be integrated into all learning activities.

Safe working practices are thematic in this program. Though they are not specified in all competencies and learning tasks, they are implied as part of the program and should be stressed throughout the apprenticeship training.

The program outline also provides facility and instructor requirements as well as textbook recommendations.

SAFETY ADVISORY

Be advised that references to the WorkSafe BC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: <http://www.worksafebc.com>). Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

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SECTION 1

OCCUPATION ANALYSIS CHART

Production Horticulturist Occupation Analysis Chart

Demonstrate the ability to identify plants and describe their use. A	Identify a wide range of plants, morphological characteristics, growing requirements, use and availability. A1	Practice plant identification skills to identify plants used in all segments of horticulture. Identify plants suitable for planting in difficult situations. A2	Practice plant identification skills. Identify species suitable for landscape and production situations as well as tropical, floral, and indoor landscapes. A5	Practice plant identification skills. Identify native species suitable for landscapes and common seasonal crops used in landscapes. A6
	1	2	3	4
Demonstrate effective supervision. B	Demonstrate supervisory skills based on time and stress management, ethics, communication, power and teams. B1	Demonstrate supervisory skills based on leadership, motivation, and delegation. Describe safety management and managing in a diverse workplace. B2		
	1	2		
Practice equipment maintenance and safety. C	Practice maintenance on small one-cylinder engines and horticulture hand tools. Demonstrate personal safety in the workplace and identify fire types and extinguishing methods. C1	Practice maintenance on multiple cylinder engines. Describe safe operating procedures for horticulture equipment. C2		
	1	2		
Describe plant science as it applies to horticulture. D	Explain plant morphological characteristics, life cycles, and adaptations as they apply to plant identification, plant propagation, arboriculture and turf maintenance. D1	Examine the internal anatomy of stems, roots and leaves as they related to photosynthesis, respiration, and transpiration. D2		
	1	2		
Describe plant health and pest management. E	Identify signs and symptoms of living and non-living factors that cause plant stress. E1	Examine biological characteristics of weeds, plant feeders and pathogens and list control strategies. E2	Describe the basic concepts of Integrated Pest Management in horticulture production facilities shrubs. E5	Describe the Basic Concepts of Integrated Pest Management in Horticulture Production Facilities. E6
	1	2	3	4

Manage soils.
F

Describe physical and biological characteristics of soil, and soilless media.
F1
1

Describe chemical characteristics of soil and soilless media.
F2
2

Examine Properties of Soilless Media and Fertilizers as they Relate to Container Production.
F4
3

Describe plant production processes.
M

Perform basic plant propagation techniques.
M1
3

Describe the production of containerized nursery plants.
M2
3

Describe the production of field nursery plants.
M3
4

Analyze production systems for profitability, costs, efficiency and control of inventory.
M4
4

Practice horticultural skills.
H

Demonstrate basic horticultural skills.
H1
1

Assess plant quality and demonstrate plant-handling requirements.
H2
2

Describe the construction and operation of modern greenhouse and nursery facilities including irrigation and drainage systems.
N

Describe construction and controls in nursery and greenhouse facilities.
N1
3

Describe installation and maintenance of drainage and irrigation systems in a production facility.
N2
4

Describe systems approaches to managing phytosanitary risk.
O

Describe international, regional and national standards, regulations, and programs for managing phytosanitary risk.
O1
3

Describe the procedures for managing and being certified for *P. ramorum*.
O2
4

SECTION 2

PRODUCTION HORTICULTURIST

PROGRAM OUTLINE

SUGGESTED SCHEDULE OF TIME ALLOTMENT FOR PRODUCTION HORTICULTURIST

LINE A Demonstrate the ability to identify plants and describe their use.

		Lecture	Practical	Page
A1	Identify a wide range of plants, morphological characteristics, growing requirements, use and availability.	6	18	8
A2	Practice plant identification skills to identify plants used in all segments of horticulture. Identify plant suitable for planting in difficult situations.	6	18	19
A5	Practice plant identification skills. Identify species suitable for landscape and production situations as well as tropical, floral, and indoor landscapes.	6	18	29
A6	Practice plant identification skills. Identify native species suitable for landscapes and common seasonal crops used in landscapes.	6	18	39

LINE B Demonstrate effective supervision.

		Lecture	Practical	Page
B1	Demonstrate supervisory skills based on time and stress management, ethics, communication, power and teams.	9	9	9
B2	Demonstrate supervisory skills based on leadership, motivation and delegation. Describe safety management and managing in a diverse workplace.	9	9	20

LINE C Practice equipment maintenance and safety.

		Lecture	Practical	Page
C1	Practice maintenance on small one-cylinder engines and horticulture hand tools. Demonstrate personal safety in the workplace and identify fire types and extinguishing methods.	6	12	10
C2	Practices maintenance on multiple cylinder engines. Describe safe operating procedures for horticulture equipment.	6	12	21

LINE D Describe plant science as it applies to horticulture.

		Lecture	Practical	Page
D1	Explain plant morphological characteristics, life cycles, and adaptations as they apply to plant identification, plant propagation, arboriculture, and turf maintenance.	12	18	11
D2	Examine the internal anatomy of stems, roots, and leaves as they relate to photosynthesis, respiration and transpiration.	12	18	22

LINE E Describe plant health and pest management.

		Lecture	Practical	Page
E1	Identify signs and symptoms of living and non-living factors that cause plant stress.	12	18	13
E2	Examine the internal anatomy of stems, roots, and leaves as they relate to photosynthesis, respiration and transpiration.	12	18	24
E5	Study the biological, cultural physical, and chemical control of pests.	12	15	30
E6	Describe the basic concepts of Integrated Pest Management in production facilities	12	15	40

LINE F Manage soils.

		Lecture	Practical	Page
F1	Describe physical and biological characteristics of soil, and soil-less media.	12	18	15
F2	Describe chemical characteristics of soil and soil-less media.	12	18	25
F4	Examine the properties of soilless media and fertilization as they relate to container production	12	12	32

LINE H Practice horticultural skills.

		Lecture	Practical	Page
H1	Demonstrate basic horticultural skills.	6	18	17
H2	Assess plant quality and demonstrate plant-handling requirements.	6	18	27

LINE M Describe plant production process.

		Lecture	Practical	Page
M1	Perform basic plant propagation techniques.	12	15	33
M2	Describe the production of containerized nursery plants.	12	15	34
M3	Describe the production of field nursery plants.	12	15	41
M4	Analyze production systems for profitability, costs, efficiency and control of inventory.	24		42

LINE N Describe the construction and operation of modern greenhouse and nursery facilities including irrigation and drainage systems.

		Lecture	Practical	Page
N1	Describe construction and controls in nursery and greenhouse facilities.	12	15	35
N2	Describe installation and maintenance of drainage and irrigation systems in a production facility.	12	15	43

LINE O: Describe systems approaches to managing phytosanitary risk.

		Lecture	Practical	Page
O1	Describe international, regional, and national standards, regulations and programs for managing phytosanitary risk.	18	-	37
O2	Describe the procedures for managing and being certified for <i>P. ramorum</i> .	12	-	44

PROGRAM OUTLINE FOR LEVEL 1

LINE A: IDENTIFY PLANTS AND DESCRIBE THEIR USE

Competency: A1 Identify a wide range of plants, morphological characteristics, growing requirements, use and availability.

Learning Objectives:

- 1 Apprentices will practice skills that will enable them to identify a wide range of plants used in all segments of horticulture including examples of trees, shrubs, vines, groundcovers, bedding plants, house plants, cut flowers, weeds and invasive plants.
- 2 Apprentices will study the important plant characteristics of leaves, buds, flowers, fruits, plant shapes and branching patterns, and will learn about growing requirements and plant use and availability.

Learning Tasks

- 1 Identify and describe 50 woody and non-woody plants
- 2 Employ correct naming and plant identification terminology
- 3 Name the plant family for each plant identified
- 4 Use a dichotomous key for plant identification purposes
- 5 Recognize a range of plant materials commonly used in commercial horticulture
- 6 Recognize and describe bud, bark, foliage, flower, and fruit characteristics

Content

- identify and describe, using botanical terms, 50 woody and non-woody plants
- identify and describe each plant according to its cultural and maintenance requirements
- use binomial nomenclature and botanical terminology to correctly name plants according to the Royal Horticultural Society standard for nomenclature
- correctly name the plant family for each plant identified according to the Royal Horticultural Society standard for nomenclature
- use a dichotomous key for the identification of both deciduous and coniferous plants
- recognize the plant material common to nursery, landscape, and floriculture
- describe bud characteristics, such as, morphology, type (vegetative or flower), and arrangement
- describe bark characteristics, such as, furrowed, smooth, plate-like, etc.
- describe leaves using botanical terminology and distinguish a range of inflorescence type and fruit to aid in plant identification

Achievement Criteria:

Given 20 plants (wide range) the apprentice will identify and describe using family, botanical, and common names. Will correctly identify 14 or more plants.

LINE B: DEMONSTRATE EFFECTIVE SUPERVISION

Competency: B1 Demonstrate supervisory skills based on time and stress management, ethics, communication, power and teams.

Learning Objectives:

- 1 Apprentices will study the basic theories of supervision and demonstrate the skills associated with effective supervision. These include: time management, dealing with stress, ethics and social responsibility in the workplace, effective communication, use of power, and characteristics of effective teams.

Learning Tasks	Content
1 Manage time	<ul style="list-style-type: none">• demonstrate ability to manage personal and work time effectively
2 Manage stress	<ul style="list-style-type: none">• demonstrate ability to use stress management techniques on the job
3 Recognize ethical and social responsibility issues in the work place	<ul style="list-style-type: none">• determine the ethical and social consequences of work-place practices
4 Communicate effectively	<ul style="list-style-type: none">• identify and use verbal and non-verbal communication techniques
5 Manage conflict	<ul style="list-style-type: none">• manage job site conflicts between team members, businesses, and clientele
6 Apply the concept of power in an organization and practice power relationships	<ul style="list-style-type: none">• recognize power structure in the organization and how to apply power within the organization
7 Describe characteristics of an effective team	<ul style="list-style-type: none">• recognize characteristics of team members and how they relate to high-performance teams

Achievement Criteria:

The apprentice will correctly answer 7 or more multi-choice questions out of 10 on the skills associated with effective management. The apprentice will also be evaluated on the ability to illustrate supervisory skills through in class case examples and achieve a 70% or higher assessment.

LINE C: PRACTICE EQUIPMENT MAINTENANCE AND SAFETY

Competency: C1 Practice maintenance on small one-cylinder engines and horticulture hand tools. Demonstrate personal safety in the workplace and identify fire types and extinguishing methods.

Learning Objectives:

- 1 Apprentices will learn basic maintenance on small one-cylinder engines and equipment as applied to horticulture. They will be introduced to engine designs and functions.
- 2 Apprentices will apply safe work practices as to related horticulture equipment. They must successfully complete the WHMIS certificate to pass this course.

Learning Tasks

- 1 Describe the Workers Compensation Act in the work place (WorkSafeBC)
- 2 Summarize Workplace Hazardous Material Information System (WHMIS)
- 3 Describe and demonstrate personal safety in the workplace
- 4 Identify fire types and extinguishing methods
- 5 Use hand tools to maintain horticulture equipment
- 6 Identify engine components and function
- 7 Practice preventive maintenance and troubleshooting procedures
- 8 Describe safe operating procedures for horticulture equipment

Content

- summarize basic WorkSafeBC core requirements
- complete an on-line WHMIS certificate
- demonstrate personal safety and the use of personal protective equipment
- examine water, foam, or chemical extinguishing methods
- distinguish between paper, oil and gas, or electrical fires.
- use sockets and wrenches to remove and install parts
- show competency in using an ignition tester, tachometer, torque wrench, and feeler gauges
- identify the differences of a two-stroke, four-stroke, and hybrid four-stroke engines
- identify the carburetor, ignition system, starter components, piston, and compression.
- tune up equipment and diagnose worn or defective parts.
- safely operate string trimmers, lawnmowers, and backpack blowers
- practice starting, stopping, and adjusting equipment

Achievement Criteria:

Given a 15 question quiz, the apprentice will be able to demonstrate the knowledge of maintenance, design and function of a small one-cylinder engines and equipment as applied to horticulture, by answering correctly 11 or more questions.

LINE D: DESCRIBE PLANT SCIENCE AS IT APPLIES TO HORTICULTURE

Competency: D1 Explain plant morphological characteristics, life cycles, and adaptations as they apply to plant identification, plant propagation, arboriculture and turf maintenance.

Learning Objectives:

- 1 Apprentices will examine various shapes and arrangements of stems, leaves, flowers, and fruits. Botanically descriptive terms commonly used in horticulture will be used.
- 2 They will cover the life cycle of a temperate flowering plant. Stem, root, and leaf modifications and adaptations to environmental conditions will be studied.
- 3 They will acquire basic horticulture botanical knowledge that will assist them with their studies in plant identification, plant propagation, arboriculture and turf maintenance.

Learning Tasks	Content
1 Describe the external parts of herbaceous and woody stems	<ul style="list-style-type: none">• use the features of a stem (leaf scar shape, bud shape and position, etc.) to assist with identification of that plant• locate the appropriate parts of a stem or branch for pruning, propagation (grafting, cuttings) and other horticultural purposes
2 Describe the parts of a leaf and variations in shape	<ul style="list-style-type: none">• identify the difference between simple and compound leaves and the arrangement of leaflets within a compound leaf• group plants into specific plant families and aid in plant identification by recognizing the arrangement of veins within each leaf or leaflet
3 Describe parts of the flower	<ul style="list-style-type: none">• identify the basic parts of a flower in preparation for the study of sexual reproduction of flowering plants
4 Identify typical inflorescences	<ul style="list-style-type: none">• categorize inflorescence types as an aid in plant identification
5 Identify typical fruits	<ul style="list-style-type: none">• separate fruit types into botanical categories as an aid in plant identification
6 Describe the stages in the life cycle of a flowering plant	<ul style="list-style-type: none">• describe the events that lead to development of hybrid or open-pollinated seed
7 Describe parts of a seed and seedling	<ul style="list-style-type: none">• identify viable seed that produce healthy and vigorous seedlings
8 Identify stem, root, and leaf modifications	<ul style="list-style-type: none">• recognize various plant types, often grouped in the category “bulbs”, that are commonly available for gardens and nurseries and are propagated vegetatively• identify atypical stem and leaf features for plant identification purposes

Learning Tasks

- 9 Identify plant adaptations to environmental effects
- 10 Describe basic growth responses to plant hormones

Content

- recognize plant growth habits or modifications that are specifically adapted to certain environments
- recognize plant growth responses as a result of change in environment, horticultural practice, or plant development
- identify the hormone that is most likely responsible for a particular growth response.

Achievement Criteria:

Given a 20 question/diagram quiz, the apprentice will be able to illustrate their basic botanical knowledge by answering 14 or more correctly.

LINE E: DESCRIBE PLANT HEALTH AND PEST MANAGEMENT

Competency: E1 Identify signs and symptoms of living and non-living factors that cause plant stress.

Learning Objectives:

- 1 Apprentices will study the main types of plant stress and their causes. They will identify signs and symptoms of living and nonliving factors on plants including the environmental conditions that are conducive to plant stress.
- 2 Apprentices will inspect and describe pest, disease and weed samples.
- 3 Apprentices will be introduced to Integrated Pest Management (IPM) and its use in the horticulture industry.

Learning Tasks	Content
1 Define plant stress	<ul style="list-style-type: none">• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
2 Describe conditions that lead to plant stress	<ul style="list-style-type: none">• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
3 Distinguish between biotic and abiotic causes of plant stress	<ul style="list-style-type: none">• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
4 Recognize common indicators of abiotic plant stress	<ul style="list-style-type: none">• able to identify a range of symptoms of plant stress and begin to link symptoms to either abiotic or biotic causes
5 Identify the major plant pest types including plant feeding pests, diseases, and weeds	<ul style="list-style-type: none">• categorize plant pest types and broadly associate the symptoms of biotic plant stress with the type of plant pest
6 Recognize damage caused by various pests	<ul style="list-style-type: none">• categorize plant pest types and broadly associate the symptoms of biotic plant stress with the type of plant pest
7 Describe life stages of example pests	<ul style="list-style-type: none">• outline the lifecycle of typical pests with a focus on damaging stages and stages where effective controls can be implemented
8 Describe basic arthropod morphology	<ul style="list-style-type: none">• describe basic arthropod morphology using appropriate terminology and identify typical examples of arthropods to order
9 Identify eight orders of insects	<ul style="list-style-type: none">• describe basic arthropod morphology using appropriate terminology and identify typical examples of arthropods to order
10 Identify four types of plant-pathogens (viruses, fungi, bacteria, and nematodes)	<ul style="list-style-type: none">• link signs and symptoms to the different categories of pathogens
11 Describe the characteristics that make plants weeds	<ul style="list-style-type: none">• list the characteristics that result in the plants being treated as weeds in horticultural operations

12 Describe established methods for controlling pests (IPM)

- outline the steps and processes in an integrated pest management program

Achievement Criteria:

Given 10 plant and pest samples, the apprentice will successfully answer 7 or more correctly by identifying the signs and symptoms of living and non-living factors conducive to plant stress.

LINE F: MANAGE SOILS

Competency: F1 Describe physical and biological characteristics of soil, and soil-less media.

Learning Objectives:

- 1 Apprentices will recognize soil and soil management as keys to the successful practice of horticulture.
- 2 They will study soil formation, the physical and biological properties of soils, and soilless media as they relate to use, soil quality, and plant growth.
- 3 They will examine soils, assess some physical and biological properties of soils and interpret test results.

Learning Tasks

1 Define soil

2 Define soil quality

3 Describe a soil profile

4 Explain the physical properties soil and soilless media

5 Describe the behaviour of water in soil

6 Outline the key soil biological processes and their effects on plant growth and soil quality

7 Explain the role of organic matter in soil

Content

- define a natural soil body and contrast it to soil material or soilless media
- natural soil bodies are the result of soil forming processes (additions, losses, transformations and translocations) as influenced by soil forming factors (climate, time, biota, parent material, topography)
- define soil from a variety of perspectives particularly as a medium for plant growth
- define soil quality and discuss the importance of soil quality, relative to plant growth and environmental sustainability
- use colour, structure, texture, rooting, and consistence to describe the soil horizons that comprise a soil profile
- discuss the differences between layers of soil materials and soil horizons
- assess soil physical properties (texture, structure, density, porosity) and discuss soil physical properties and their alteration relative to plant growth and soil quality
- the role of particle size and particle size distribution is emphasized.
- measure soil water content and assess the soil's capacity to retain and transmit water relative to plant growth and soil quality
- discuss the importance of the abundance, distribution, and activity of the major groupings of soil organisms relative to plant growth and soil quality
- describe the basic composition of soil organic matter and the key roles of soil organic matter relative to soil chemical and physical behaviour

Learning Tasks

8 Describe composting methods

Content

- describe the composting process and the characteristics and uses of quality compost in horticulture

Achievement Criteria:

The apprentice will examine soil samples and describe physical and biological properties of soils and their effects on plant growth by achieving a passing grade of 70% on a combination written/practical assessment

LINE H: PRACTICE HORTICULTURAL SKILLS

Competency: H1 Demonstrate basic horticultural skills

Learning Objectives:

- 1 Apprentices will be introduced to and practice basic skills used in general horticulture.
- 2 They will learn procedures for identifying, selecting, using, and maintaining hand tools.
- 3 Apprentices will develop safe work habits and apply practical skills by maintaining beds, borders, lawns, nurseries, and containers on campus.
- 4 They will practice safe operation of common power equipment.
- 5 Apprentices will identify levels of landscape maintenance and plant standards stated in the BC Landscape Standard.

Learning Tasks

- 1 Identify hand tools used in basic horticulture
- 2 Select and use hand tools in horticulture
- 3 Perform basic horticulture tasks
- 4 Operate horticulture power equipment safely and effectively
- 5 Recognize a range of workplace hazardous
- 6 Apply appropriate safety procedures when practicing horticulture operations
- 7 Demonstrate safe work practices when lifting and bending
- 8 Demonstrate the importance of cooperative work methods
- 9 Perform basic calculations

Content

- Identify hand tools used in basic horticulture
- Select and use hand tools in horticulture
- Perform basic horticulture tasks
- Operate horticulture power equipment safely and effectively
- Recognize a range of workplace hazardous
- Apply appropriate safety procedures when practicing horticulture operations
- Demonstrate safe work practices when lifting and bending
- Demonstrate the importance of cooperative work methods
- Perform basic calculations

Achievement Criteria:

The apprentice will demonstrate knowledge of safe work habits and apply practical horticulture skills by maintaining beds, borders, lawns, nurseries, and containers on campus. They will achieve a passing grade of 70% or higher on a practical assessment.

PROGRAM OUTLINE FOR LEVEL 2

LINE A: DEMONSTRATE THE ABILITY TO IDENTIFY PLANTS AND DESCRIBE THEIR USE

Competency: A2 Practice plant identification skills to identify plants used in all segments of horticulture. Identify plants suitable for planting in difficult situations.

Learning Objectives:

- 1 Apprentices will practice skills that will enable them to identify a wide range of plants used in all segments of horticulture including examples of trees, shrubs, vines, groundcovers, bedding plants house plants, cut flowers, weeds, and invasive plants.
- 2 They will study the important plant characteristics of leaves, buds, flowers, fruits, plant shapes, and branching patterns, and will learn about species suitable for planting in difficult situations.

Learning Tasks

- 1 Identify and describe 75 woody and non-woody plants
- 2 Employ correct naming and plant identification terminology
- 3 Name the plant family for each plant identified
- 4 Recognize a range of plant materials commonly used in commercial horticulture
- 5 Recognize plants suitable for planting in difficult situations
- 6 Recognize and describe bud, bark, foliage, flower, and fruit characteristics

Content

- identify and describe, using botanical terms, 75 woody and non-woody plants
- identify and describe each plant according to its cultural and maintenance requirements
- use binomial nomenclature and botanical terminology to correctly name plants according to the Royal Horticultural Society standard for nomenclature
- correctly name the plant family for each plant identified according to the Royal Horticultural Society standard for nomenclature
- recognize the plant material common to nursery, landscape, and floriculture
- recognize plant material suitable for planting in difficult situations such as, shady, poorly drained, and droughty, locations
- describe bud characteristics, such as, morphology, type (vegetative or flower), and arrangement
- describe bark characteristics, such as furrowed, smooth, plate-like, etc.
- describe leaves using botanical terminology and distinguish a range of inflorescence type and fruit to aid in plant identification

Achievement Criteria:

Given 20 plants (wide range) the apprentice will identify and describe using family, botanical, and common names. Will correctly identify 14 or more plants.

LINE B: DEMONSTRATE BASIC SUPERVISION

Competency: B2 Demonstrate supervisory skills based on leadership, motivation, and delegation. Describe safety management and managing in a diverse workplace.

Learning Objectives:

- 1 Apprentices will study the basic theories of supervision and demonstrate the skills associated with effective supervision. These include: leadership, motivation, delegation, safety management, and managing in a diverse workplace.

Learning Tasks	Content
1 Practice leadership in the organization	<ul style="list-style-type: none">• lead a workplace team by the effective use of motivation, delegation, and team management
2 Apply motivational techniques	<ul style="list-style-type: none">• motivate workers under their direction
3 Describe safety culture	<ul style="list-style-type: none">• describe the safety culture of their organization
4 Manage a diverse work-place	<ul style="list-style-type: none">• recognize and manage diversity
5 Interpret the employment standards act	<ul style="list-style-type: none">• describe the impacts of the Employment Standards Act on horticultural operations

Achievement Criteria:

The apprentice will correctly answer 14 or more multi-choice questions out of 20 on the skills associated with effective management. The apprentice will also be evaluated on the ability to illustrate supervisory skills through in class case examples and achieve a 70% or higher assessment.

LINE C: PRACTICE EQUIPMENT MAINTENANCE AND SAFETY

Competency: C2 Practice maintenance on multiple cylinder engines. Describe safe operating procedures for horticulture equipment.

Learning Objectives:

- 1 Apprentices will learn basic maintenance on larger multiple cylinder engines and equipment as applied to horticulture.
- 2 They will be introduced to engine designs and functions.
- 3 They will apply safe work practices as to related horticulture equipment.

Learning Tasks

- 1 Describe and demonstrate safe lifting and moving techniques
- 2 Describe and demonstrate personal safety as related to large multiple cylinder equipment
- 3 Recognize workplace hazards
- 4 Use hand tools to maintain horticulture equipment
- 5 Identify engine components and function
- 6 Practice preventive maintenance and troubleshooting procedures
- 7 Describe safe operating procedures for Horticulture equipment

Content

- lift batteries from floor to the engine compartment
- remove and rotate tires
- demonstrate entry onto and exit from machinery using the three point contact
- wear appropriate safety equipment.
- recognize workplace hazards and mitigate the risk of accident and injury
- use sockets and wrenches to remove and reinstall parts
- demonstrate the use of a multimeter, battery charger, tire gauge, and hydrometer
- identify the differences between a diesel engine and a 2-stroke or 4-stroke engine
- identify the carburetor, alternator, radiator, piston, and compression.
- tune up equipment and diagnose worn or used parts
- operate a skid steer and zero turn walk behind machine
- practice connecting attachments

Achievement Criteria:

Given a 20 question quiz, the apprentice will be able to demonstrate the knowledge of safety, maintenance, design and function on multiple cylinder engines and equipment as applied to horticulture, by answering correctly answering 14 or more questions.

LINE D: DESCRIBE PLANT SCIENCE AS IT APPLIES TO HORTICULTURE

Competency: D2 Examine the internal anatomy of stems, roots and leaves as they related to photosynthesis, respiration, and transpiration.

Learning Objectives:

- 1 Apprentices will examine the internal anatomy of stems, roots, and leaves in order to appreciate their function.
- 2 They will relate the processes of photosynthesis, respiration, and transpiration to environmental influences commonly found in landscapes and production facilities.
- 3 Various growth responses to external stimuli, such as gravity and photoperiod, will also be studied.

Learning Tasks

- 1 Describe the internal anatomy of stems, roots, and leaves
- 2 Describe the movement of sap through a plant and the effects of environment on the rate of flow
- 3 Describe the flow of sugars, produced in photosynthesis, through the plant

Content

- identify the vascular cambium within a woody stem
- recognize root hairs on newly formed root tips, locate tissues which conduct water up stems to the leaves and transport sugars down to the roots for storage or to the growing tips for new cell development
- recognize tissues (leaves and green stems) that photosynthesize
- follow the flow of water from the root tips to the stomata openings in leaves
- appreciate that transpirational flow is a “pull” mechanism and distributes water and nutrients throughout the plant
- recognize the effects of environmental conditions on water use by the plant
- follow the flow of sugar from the leaves to various parts of the plant to be stored as starch in the roots or to be used immediately for cell maintenance and growth

Learning Tasks

- 4 Explain the influence of temperature, water availability, and light on the rates of photosynthesis and respiration

- 5 Describe the growth response to external stimuli

Content

- appreciate the conversion of sunlight to sugar via photosynthesis and the subsequent release of energy via respiration to be used in plant growth and cell maintenance
- relate the effects of environmental conditions (day length, light intensity, temperature, air flow, availability of water, relative humidity) on the rates of photosynthesis, respiration, and transpiration
- discuss how the rates of those processes affect growth
- recognize plant growth responses to external stimuli such as gravity and photoperiod

Achievement Criteria:

Given a 20 question/diagram quiz, the apprentice will be able to illustrate their basic botanical anatomy knowledge by answering 14 or more correctly.

LINE E: DESCRIBE PLANT HEALTH AND PEST MANAGEMENT

Competency: E2 Examine biological characteristics of weeds, plant feeders and pathogens and list control strategies

Learning Objectives:

- 1 Apprentices will study the three major plant pest types (weeds, plant-feeders, and pathogens).
- 2 They will examine the biological characteristics of pests, their effects on plants, and list various integrated strategies available for controlling them. These strategies will include an overview of cultural, biological, and chemical control tactics for each of the plant pest types.

Learning Tasks

- 1 Describe and distinguish between the major plant pest types (weeds, plant-feeders & pathogens)
- 2 Describe characteristics that make plants weeds
- 3 Describe characteristics that make vertebrates pests
- 4 Describe characteristics that make invertebrates pests
- 5 Describe characteristics that make pathogens pests
- 6 Describe the principles of cultural, biological and chemical control methods as applied to horticultural plant pests
- 7 Describe the integrated strategies and tactics for the control of major plant pest types

Content

- report on the characteristics that result in organisms being categorized as pests
- report on the characteristics that result in organisms being categorized as pests
- report on the characteristics that result in organisms being categorized as pests
- report on the characteristics that result in organisms being categorized as pests
- report on the characteristics that result in organisms being categorized as pests
- report on the principles (advantages and disadvantages) of pest control
- classify a variety of control measures as belonging to the broad categories of cultural, biological, or chemical pest control
- link strategies for integrated control to the tactics of pest control
- discuss the nature and complexity of integration (the effects of specific tactics on non-target pests and other organisms)

Achievement Criteria:

Given a 20 questions quiz, the apprentice will successfully answer 14 or more correctly by identifying biological characteristics of pests, the cultural, biological and chemical control methods applied to pests.

LINE F: MANAGE SOILS

Competency: F2 Describe chemical characteristics of soil and soil-less media.

Learning Objectives:

- 1 Apprentices will continue their studies of soil and soil management in horticulture.
- 2 They will study the chemical properties of soil and soilless media (soil reaction, soil salinity, soil fertility).
- 3 Apprentices will sample soils.

Learning Tasks

- 1 Describe how soil colloids (silicate clays, oxide clays, humus) determine soil chemical properties
- 2 Measure soil reaction
- 3 Manage soil reaction
- 4 Explain how soil reaction relates to soil fertility
- 5 Measure and manage salinity and sodicity
- 6 Explain how soil salinity and sodicity affect soil properties

Content

- describe the basic kinds of soil colloids and recognize the role that soil colloids play in soil fertility and nutrient behaviour
- discuss the relationship between cation exchange capacity and inherent fertility.
- measure soil pH using a variety of techniques including potentiometric and colourimetric methods
- examine the relationship of soil composition and soil pH to the lime requirement of acid soils
- select liming materials based on calcium carbonate equivalent and fineness of the liming material
- calculate application rates of lime given soil test information
- discuss the impact of soil reaction on nutrient availability and on plant growth
- identify the key soil management operations that alter soil pH
- measure electrical conductivity of soils and soilless media
- classify soils according to electrical conductivity and sodium content
- describe the impact of salinity and sodicity (poor drainage, high electrical conductivity, poor soil structure) on soil quality and plant growth
- outline the strategies that can ameliorate soil salinity problems

Learning Tasks	Content
7 Discuss the behaviour of nutrients, particularly nitrogen, phosphorus, and potassium, in the soil	<ul style="list-style-type: none"> • list the available forms of nutrients in the soil and the main pools or sources of nutrients • examine the nitrogen cycle from the standpoint of plant available nitrogen and environmental quality
8 Identify the processes by which plants acquire nutrients	<ul style="list-style-type: none"> • describe the methods of nutrient movement to plant roots and the influences of soil properties on nutrient uptake
9 Discuss nutrient management	<ul style="list-style-type: none"> • describe the main sources of nutrient loss from soils and the impacts on plant growth and environmental quality • discuss strategies for minimizing nutrient loss
10 Sample soils	<ul style="list-style-type: none"> • design a sampling plan and collect samples for testing
11 Interpret soil test information	<ul style="list-style-type: none"> • read a soil report and implement recommendations
12 Interpret fertilizer label information	<ul style="list-style-type: none"> • determine nutrient sources, fertilizer ratios, fertilizer application rates, and recommended method of applying fertilizer from the label and by calculation

Achievement Criteria:

The apprentice will examine soil samples and identify the chemical properties and achieve a passing grade of 70% on a combination written/lab assessment.

LINE H: PRACTICE HORTICULTURAL SKILLS

Competency: H2 Assess plant quality and demonstrate plant-handling requirements.

Learning Objectives:

- 1 Apprentices will gain practical experience in basic landscape and production nursery stock operations.
- 2 They will study plant quality assessment and handling requirements for common ornamental plant material used in the landscape and nursery industries.
- 3 Apprentices will practice loading and unloading, sorting, grading, and other types of handling of ornamental plant material.

Learning Tasks

- 1 Perform plant-grading according to the Canadian Standard for Nursery Stock and the British Columbia Landscape Standard
- 2 Identify containers used for growing and shipping ornamental plant material
- 3 Describe standards for root ball sizing
- 4 Prepare balled and burlapped plants

- 5 Securely load plant material
- 6 Demonstrate proper planting procedures

- 7 Safely operate truck and trailer

Content

- assess and grade plants according to plant foliage density, calliper, height, and width ratios according to the standards
- calculate container volume and compare results to the standards
- calculate root ball sizes for containers and field grown stock
- demonstrate digging, wrapping, and tying of root balls
- safely and efficiently lift and carry plant material to avoid physical damage to themselves and the plants
- discuss different methods of harvesting plant material for field grown stock
- safely load, unload, and secure plant material on a truck
- determine the appropriate depth and width of the planting hole
- place the plant in the hole and back fill with the appropriate soil material
- discuss appropriate post-planting maintenance requirements
- demonstrate how to safely couple the truck / tractor and trailer and operate either combination in reverse and securely park the vehicle
- perform these operations in compliance with the guidelines established in the Certified Horticulture Technician Program (CHT)

Achievement Criteria:

The apprentice will demonstrate knowledge of safe work habits and apply practical horticulture skills by handling a range of ornamental plant material. They will achieve a passing grade of 70% or higher on a practical assessment.

PROGRAM OUTLINE FOR LEVEL 3

LINE A: DEMONSTRATE THE ABILITY TO IDENTIFY AND DESCRIBE PLANTS AND DESCRIBE THEIR USE

Competency: A5 Practice plant identification skills. Identify species suitable for landscape and production situations as well as tropical, floral, and indoor landscapes.

Learning Objectives:

- 1 Apprentices will practice skills that will enable them to identify a wide range of plants used in all segments of horticulture including examples of trees, shrubs, vines, groundcovers, perennials, bedding plants, house plants, cut flowers, weeds, and invasive plants.
- 2 They will study the important plant characteristics of leaves, buds, flowers, fruits, plant shapes and branching patterns, and will learn about species suitable for a range of landscape and production situations as well as common tropical, floral, and interior landscape situations.

Learning Tasks

- 1 Identify and describe 90 woody and non-woody plants
- 2 Employ correct naming and plant identification terminology
- 3 Name the plant family for each plant identified
- 4 Recognize a range of plant materials commonly used in commercial horticulture
- 5 Recognize plants suitable for common tropical, floral, and interior landscape situations
- 6 Recognize and describe bud, bark, foliage, flower, and fruit characteristics

Content

- identify and describe, using botanical terms, 90 woody and non-woody plants
- identify and describe each plant according to its cultural and maintenance requirements
- use binomial nomenclature and botanical terminology to correctly name plants according to the Royal Horticultural Society standard for nomenclature
- correctly name the plant family for each plant identified according to the Royal Horticultural Society standard for nomenclature
- recognize the plant material common to nursery, landscape, and floriculture
- recognize plant material suitable for interior landscaping as well as house plants and floral uses such as cut flowers
- describe bud characteristics, such as, morphology, type (vegetative or flower), and arrangement
- describe bark characteristics, such as, furrowed, smooth, plate-like, etc.
- describe leaves using botanical terminology and distinguish a range of inflorescence type and fruit to aid in plant identification

Achievement Criteria:

Given 15 woody plants and 15 non-woody plants the apprentice will identify and describe using family, botanical, and common names. Will correctly identify 21 or more plants.

LINE E: DESCRIBE PLANT HEALTH AND PEST MANAGEMENT

Competency: E5 Describe the basic concepts of Integrated Pest Management in horticulture production facilities shrubs.

Learning Objectives:

- 1 Apprentices will study the biological, cultural, physical, and chemical control of viral, bacterial, fungal, and insect plant pests and diseases.
- 2 They will identify common pests and diseases of greenhouse and nursery plants and describe the timing of control measures with respect to pest life cycles.
- 3 Apprentices will examine the role of plant breeding in pest and disease control and debate the issue of genetic modification of organisms.

Learning Tasks

- 1 Identify common pests and diseases of greenhouse and nursery plants
- 2 Describe biological, chemical, cultural, and physical control for viral diseases of plants
- 3 Describe biological, chemical, cultural, and physical control for bacterial diseases of plants
- 4 Describe biological, chemical, cultural, and physical control for fungal diseases of plants
- 5 Describe biological, chemical, cultural, and physical control for arthropod pests of plants

Content

- identify the range of pests and diseases that are likely to be present on the crops being grown
- distinguish between the major viruses present in crop species and other possible causal organisms such as fungal pathogens or abiotic causes such as nutritional disorders
- recommend biological, chemical, and physical control for viral diseases
- identify the particular environmental conditions that contribute to the development of plant bacterial organisms
- recommend biological, chemical, and physical control for bacterial diseases
- identify the particular environmental conditions that contribute to the development of plant fungal organisms
- recommend biological, chemical, and physical control for fungal diseases
- identify the particular environmental conditions that contribute to the development of plant arthropod pests
- recommend biological, chemical, and physical control for arthropod pests
- use all available resources, including personal knowledge, colleagues, industry suppliers, government officials and trade representatives in order to help identify unknown plant insect pests which may be new to their cropping situation

- Learning Tasks**
- 6 Describe biological, chemical, cultural, and physical control for vertebrate pests of plants
 - 7 Explain relationships between pest life-cycles and timing of intervention
 - 8 Explain the relationship between plant health and occurrence of plant pests and diseases
 - 9 Describe the role of plant breeding in pest and disease resistance
 - 10 Debate issues of Genetic Modification (GM) of crops

Content

- identify the particular environmental conditions that contribute to the development of plant vertebrate pests
- recommend biological, chemical, and physical control for vertebrate pests
- explain the relationship between life cycle and the efficacy of control measures
- explain the relationship between plant health and vigor and susceptibility to infestation / infection by the pest organism
- describe the implications of plant breeding on plant resistance to diseases and insect infestations
- debate a range of issues surrounding genetically modified crops

Achievement Criteria:

Given a 20 question quiz on basic concepts of Integrated Pest Management in horticulture production facilities and identifying a range of pests and disease in crops being grown. The apprentice will correctly answer 14 or more questions.

LINE F: MANAGE SOILS

Competency: F4 Examine Properties of Soilless Media and Fertilizers as they Relate to Container Production.

Learning Objectives:

- 1 Apprentices will study the components of soilless media commonly used in the nursery industry in British Columbia.
- 2 They will examine the properties of soilless media and match the properties to container type and shape in order to support healthy root systems.
- 3 Apprentices will examine the types of controlled release and soluble fertilizers that are commonly used for horticulture production.

Learning Tasks

- 1 Match media to container plant type and environmental conditions
- 2 Describe the components of various soilless media used for propagation and nursery production
- 3 Describe the properties of a good soilless media for both propagation and nursery production
- 4 Describe the movement of water in large containers
- 5 Describe fertilizers used for container production of nursery crops

Content

- recognize various pot types and sizes
- the attributes of a nursery pot and select the most suitable size and shape for a particular plant type (or stage in development) and growing environment
- recognize soilless media components and their advantages and disadvantages in a nursery mix
- assess water-holding capacity, aeration, drainage, nutrient retention, and stability of a nursery medium
- relate the movement of water through a large container with the resulting pattern of root growth
- select the appropriate fertilizer to apply, calculate that amount required, and apply the fertilizer efficiently

Achievement Criteria:

Given a 20 question quiz on the components of soilless media commonly used in the nursery industry the apprentice will correctly answer 14 or more questions.

LINE M: DESCRIBE PLANT PRODUCTION PROCESSES

Competency: M1 Perform Basic Plant Propagation Techniques.

Learning Objectives:

- 1 Apprentices will discuss seed storage, seed quality, seed dormancy, and sowing techniques.
- 2 They will recognize various forms of vegetative propagation.
- 3 Environmental requirements for successful propagation will be discussed.
- 4 Apprentices will discuss plant breeding strategies and the importance of Plant Breeders' Rights in Canada.
- 5 They will perform basic propagation techniques for seed, tissue culture, cuttings, division, and grafting.

Learning Tasks

- 1 Describe commercial propagation facilities and the appropriate environments for each method of propagation
- 2 Recognize the differences between clones, hybrids, and plants from open-pollination
- 3 Perform sowing techniques used to produce seedlings
- 4 Describe dormancy and methods to overcome dormancy
- 5 Demonstrate micropropagation techniques including hardening off of explants
- 6 Demonstrate methods of asexual (vegetative) propagation
- 7 Discuss Plant Breeders' Rights and implications for breeding and plant introductions in BC

Content

- describe the diversity of propagation facilities available and the methods of environmental control required for successful propagation
- describe the breeding process that has resulted in the production of seed and stock plants used for vegetative propagation
- successfully sow various types and quantities of seed into a variety of containers
- properly prepare seed for successful germination
- demonstrate sterile techniques and describe the care required to successfully harden off and grow on tissue culture plugs
- demonstrate various methods of vegetative propagation including grafting, budding, layering, hardwood and softwood cuttings, and division
- recognize plants that are under 'Plant Breeders' Rights and the systems that allow the collection of royalties

Achievement Criteria:

The apprentice will be evaluated on the basic plant propagation techniques for production and achieve a passing grade of 70% or higher. They will also answer 7 of 10 questions on the basic principles of propagation.

LINE M: DESCRIBE PLANT PRODUCTION PROCESSES

Competency: M2 Describe the Production of Containerized Nursery Plants

Learning Objectives:

- 1 Apprentices will review and analyze all aspects of container nursery production (small trees, shrubs, vines, and herbaceous perennials) in British Columbia.
- 2 They will design a nursery and schedule a plant from liner size to a finished pot size ready for shipping.
- 3 Apprentices will discuss inventory control and current topics of production trends and environmental issues

Learning Tasks

- 1 Recognize the size and diversity of the nursery industry in British Columbia and its relationship to the Canadian industry
- 2 Apply environmental guidelines and municipal bylaws that affect nursery production in British Columbia
- 3 Design container nursery production operations
- 4 Describe various scheduling and cultural management procedures for container stock
- 5 Describe inventory management procedures
- 6 Describe shipping procedures
- 7 Describe modern production facilities and equipment
- 8 Schedule cultural management techniques

Content

- recognize the range of nursery sizes and product lines, as well as geographical distributions of nurseries within BC
- appreciate the impact of regulations that affect nursery production
- be able to access important information
- analyze organizational flow of plants and employees within the nursery
- develop a workable schedule to produce containerized plants for a set sales date
- recognize the need for accurate record keeping of inventory numbers.
- compare and contrast shipping processes
- appreciate the range of facilities and equipment available for production of high quality plants
- schedule basic maintenance practices such as weeding, spacing, pruning, and fertilizing

Achievement Criteria:

Given 20 quiz questions on production of containerized nursery plants the apprentice will correctly answer 14 or more.

**LINE N: DESCRIBE THE CONSTRUCTION AND OPERATION OF
MODERN GREENHOUSE AND NURSERY FACILITIES
INCLUDING IRRIGATION AND DRAINAGE SYSTEMS**

**Competency: N1 Describe Construction and Controls in Nursery and
Greenhouse Facilities**

Learning Objectives:

- 1 Apprentices will identify the requirements for site selection and facility layout of greenhouse and nursery operations.
- 2 They will be able to describe the construction process of a modern greenhouse, and be able to select and replace greenhouse covering materials.
- 3 They will measure greenhouse humidity, lighting, temperature, and carbon dioxide.
- 4 Apprentices will be introduced to computer control equipment.

Learning Tasks	Content
1 Describe site selection for greenhouses	<ul style="list-style-type: none">• explain the factors and principles that influence nursery and facility layout and contribute to decisions regarding equipment placement
2 Describe different styles of structures	<ul style="list-style-type: none">• explain the influence of structure style on cropping outcomes• examine the range of structures and their influence on environment, cost, and efficiency
3 Explain greenhouse construction practices	<ul style="list-style-type: none">• describe greenhouse construction requirements and perform basic greenhouse maintenance operations while maintaining structural integrity
4 Compare common glazing materials	<ul style="list-style-type: none">• discuss a wide range of greenhouse covering materials and their influence on plant physiology, growth, and business economics
5 Design a greenhouse and nursery facility	<ul style="list-style-type: none">• discuss the consequences of greenhouse and production facility layout on efficiency of labour use, ergonomics, and production efficiency• prepare a design concept
6 Explain greenhouse humidity control	<ul style="list-style-type: none">• explain the relationship of humidity to temperature• discuss the consequences involved in maintaining a set humidity• explain the influence of humidity on disease management, crop development, and production costs

Learning Tasks	Content
7 Describe greenhouse temperature control	<ul style="list-style-type: none"> • explain the use of temperature to control plant growth, pests and diseases, and crop scheduling
8 Describe greenhouse light controls	<ul style="list-style-type: none"> • explain the use of lighting to control flowering periods, crop scheduling, and crop growth • explain the influence of photoperiod, light quality, and light quantity on the economics of plant production
9 Describe greenhouse carbon dioxide control	<ul style="list-style-type: none"> • explain the influence of carbon dioxide on crop growth and its role in photosynthesis • explore the costs of supplying CO₂ in different forms to greenhouse crops
10 Identify components of environmental control systems	<ul style="list-style-type: none"> • identify the components of a typical greenhouse control system in order to effectively communicate problems to suppliers and service providers and to order correct components for repair or upgrades

Achievement Criteria:

Given a 20 question quiz on construction and controls in Nursery and Greenhouse Facilities the apprentice will answer 14 or more correctly.

LINE O: DESCRIBE SYSTEMS APPROACHES TO MANAGING PHYTOSANITARY RISK

Competency: O1 Describe International, Regional, and National Standards, Regulations and Programs for Managing Phytosanitary Risk.

Learning Objectives:

- 1 Apprentices will examine international phytosanitary standards and certification systems that are now being used in the horticulture industry for domestic, export, and import purposes.
- 2 They will study the Canadian Nursery Certification Program, the Canadian Greenhouse Certification Program, *Phytophthora ramorum* Certification, and any other relevant systems-based certification programs in Canada.

Learning Tasks

- 1 Discuss the economic and ecological impact of quarantine pests and invasive alien species
- 2 Explain the concept of integrated measures in a systems approach for pest risk management
- 3 Describe the various national and international organizations that regulate the movement of plants and plant parts in both the domestic and international markets
- 4 Describe the various international, national, and regional standards and regulations that control the international and domestic movement of plants
- 5 Describe various certification programs that control the movement of plants both domestically and internationally

Content

- discuss the ecological and economic impacts of quarantine and invasive alien pests on North America, Canada, and British Columbia
- discuss these issues in a historical, current, and future context
- explain why integrated measures for management of quarantine pests, as defined by the International Plant Protection Convention, is a preferred method of pest risk management than end point phytosanitary inspections
- describe the roles and responsibilities of the Canadian Food Inspection Agency, North American Plant Protection Organization, International Plant Protection Convention, USDA/APHIS, U.S. State Agencies, and the relationships between these organizations
- describe the impacts of the various acts, regulations, and standards that govern the movement of plants on nursery operations
- describe the impact of the various certification programs on nursery operations

Achievement Criteria:

Given a 10 questions quiz on International, Regional, and National Standards, Regulations and Programs for Managing Phytosanitary Risk and answer 7 or more correctly.

PROGRAM OUTLINE FOR LEVEL 4

LINE A: DEMONSTRATE THE ABILITY TO IDENTIFY PLANTS AND DESCRIBE THEIR USE

Competency: A6 Practice plant identification skills. Identify native species suitable for landscapes and common seasonal crops used in landscapes.

Learning Objectives:

- 1 Apprentices will practice skills that will enable them to identify a wide range of plants used in all segments of horticulture including examples of trees, shrubs, vines, groundcovers, perennials, bedding plants, house plants, cut flowers, weeds and invasive plants.
- 2 They will study the important plant characteristics of leaves, buds, flowers, fruits, plant shapes and branching patterns, and will learn about native species suitable for planting in landscape situations as well as common seasonal crops

Learning Tasks

- 1 Identify and describe 90 woody and non-woody plants
- 2 Employ correct naming and plant identification terminology
- 3 Name the plant family for each plant identified
- 4 Provide examples of native trees, shrubs, groundcovers, perennials, biennials, and annuals common to the horticulture industry
- 5 Provide examples of seasonal crops
- 6 Recognize and describe bud, bark, foliage, flower, and fruit characteristics

Content

- identify and describe, using botanical terms, 90 woody and non-woody plants
- binomial nomenclature and botanical terminology to correctly name plants according to the Royal Horticultural Society standard for nomenclature
- correctly name the plant family for each plant identified according to the Royal Horticultural Society standard for nomenclature
- provide examples of native trees, shrubs, groundcovers, perennials, biennials, and annuals common to commercial landscaping and nursery production
- provide examples of seasonal crops common to the ornamental horticulture industry
- Identify bud characteristics, such as, morphology, type vegetative or flower, and arrangement
- describe bark characteristics, such as furrowed, smooth, plate-like, etc.
- describe leaves using botanical terminology and distinguish a range of inflorescence type and fruit to aid in plant identification

Achievement Criteria:

Given 20 woody and non-woody plants the apprentice will identify and describe using family, botanical, and common names. Will correctly answer 14 or more correctly.

LINE E: DESCRIBE PLANT HEALTH AND PEST MANAGEMENT

Competency: E6 Describe the Basic Concepts of Integrated Pest Management in Horticulture Production Facilities.

Learning Objectives:

- 1 Apprentices will review the basic concepts of Integrated Pest Management (IPM).
- 2 They will practice monitoring techniques and explain 'action thresholds'.
- 3 They will describe problems that may occur when applying an IPM strategy.
- 4 They will plan an IPM program for a workplace.

Learning Tasks	Content
1 Review basic principles of Integrated Pest Management (IPM)	<ul style="list-style-type: none">• discuss the principles of Integrated Pest Management including cultural, biological, chemical, physical, and legal principles
2 Practice techniques for monitoring pest and disease occurrence in cropping situations	<ul style="list-style-type: none">• perform monitoring of pests• implement a wide variety of techniques for measuring pest and disease levels in a variety of situations and for a range of organisms
3 Explain the concept of 'thresholds' in IPM	<ul style="list-style-type: none">• practice various trapping and monitoring methods to suit a range of pest life cycles• explain economic injury levels and action thresholds• discuss injury levels, prepare graphs, predict impact, and predict when action should be taken
4 Describe problems that may occur when applying an IPM strategy	<ul style="list-style-type: none">• incorporate these principles into an IPM plan
5 Compare IPM strategies for a range of crops	<ul style="list-style-type: none">• anticipate potential problems and discuss solutions
6 Plan an IPM program for a workplace	<ul style="list-style-type: none">• examine IPM programs in nursery and greenhouse crops• synthesize all the technical and economic data and develop an IPM program that will be tailored to an individual workplace situation• analyze characteristics of each site and cropping plan and formulate an appropriate course of action

Achievement Criteria:

Given a 20 multiple choice questions on the basic concepts of Integrated Pest management in horticulture production facilities the apprentice will correctly answer 14 or more correctly.

LINE M: DESCRIBE PLANT PRODUCTION PROCESSES

Competency: M3 Describe the Production of Field Nursery Plants.

Learning Objectives:

- 1 Apprentices will review and analyze all aspects of field nursery production (shade trees, small trees, and conifers) in British Columbia.
- 2 They will examine typical production cycles for field-grown plants. Harvesting methods of bareroot and ball and burlap (by hand or machine) will be demonstrated. Cold storage environments and shipping methods will also be covered.
- 3 Apprentices will discuss the use of cover crops to increase organic matter, prevent erosion, and promote weed control.

Learning Tasks

- 1 Recognize the magnitude and diversity of nursery field product that is produced in BC
- 2 Describe equipment needs for a field production nursery
- 3 Describe properties of soil and soil preparation techniques used for field production
- 4 Describe inventory management systems
- 5 Describe common production schedules for shade trees and conifers
- 6 Schedule maintenance requirements of fertilization, irrigation, pruning, and weed control
- 7 Describe harvesting techniques
- 8 Discuss the benefits of proper field management

Content

- appreciate the scope of plant product sizes and types grown in BC
- describe the range of equipment used for successful and efficient field production
- prepare a field for planting so that healthy plants with strong fibrous root systems are produced
- recognize the need for accurate inventory control of field-grown stock
- outline the timing required for production of certain types of field stock
- organize maintenance activities that will result in healthy saleable plant material
- list the steps required to harvest, store, and ship plants (bareroot or B & B) correctly so that growth after transplanting is not compromised
- review the benefits of proper field management as it relates to a successful field production nursery

Achievement Criteria:

The apprentice will be demonstrate harvesting methods of bareroot and ball and burlap. They will achieve a passing grade of 70% or higher on this practical assessment. They will also be required to answer 10 quiz questions on all aspects of field nursery production.

LINE M: DESCRIBE PLANT PRODUCTION PROCESSES

Competency: M4 Analyze Production Systems for Profitability, Costs, Efficiency and Control of Inventory.

Learning Objectives:

- 1 Apprentices will review the components of the production cycle.
- 2 They will analyze costing, profitability, efficiency, and inventory control for a commercial nursery.
- 3 They will describe emerging technologies and their potential applications.

Learning Tasks

- 1 Describe the production cycle
- 2 Analyze the cost of production and the impacts on profitability in a commercial nursery
- 3 Describe efficient nursery practices and their impact on profitability
- 4 Describe inventory control methods
- 5 Discuss emerging technologies and their potential impact on nursery operations

Content

- describe the various components of a commercial nursery production cycle
- identify direct and indirect production costs
- describe nursery practices in terms of efficiency and identify their impact on profit
- describe the range of inventory management techniques
- discuss the range of new and emerging technologies and their impact on efficiency and profitability of nurseries

Achievement Criteria:

The apprentice will be given a case study to analyze and assess the production systems for profitability, costs, efficiency and control of inventory. They will achieve a 70% or higher.

LINE N: IRRIGATION AND DRAINAGE

Competency: N2 Describe the Construction and Operation of Modern Greenhouse and Nursery Facilities Including Irrigation and Drainage Systems

Learning Objectives:

- 1 Apprentices will describe the basis of the hydrological cycle and reasons for poor drainage and its affect on crops.
- 2 They will study the components of both drainage and irrigation systems, and the requirements for installing and maintaining both these systems.
- 3 Apprentices will demonstrate the use of a builder’s level to determine land and drain slopes.

Learning Tasks	Content
1 Describe water management to control plant growth	<ul style="list-style-type: none">• describe the influence of water management on plant structure, speed of growth, uniformity and quality of product, crop scheduling, and flowering• describe the hydrological cycle and its influence on water supply
2 Describe various water management systems	<ul style="list-style-type: none">• recognize the range of water management systems common to nursery and greenhouse facilities• practice efficient crop irrigation. The apprentice will be able to match irrigation system to greenhouse and crop
3 Describe common irrigation components	<ul style="list-style-type: none">• describe irrigation components in order to purchase new parts from suppliers
4 Perform basic installation and repair of irrigation systems	<ul style="list-style-type: none">• install, replace, or repair irrigation components
5 Perform a basic irrigation audit	<ul style="list-style-type: none">• measure for irrigation uniformity (carry out irrigation audit)
6 Describe factors that influence design of irrigation systems	<ul style="list-style-type: none">• recognize the factors which influence irrigation system design as they apply to crop and greenhouse/nursery operations• identify irrigation volumes, rates, and frequency using control equipment
7 Describe benefits of adequate drainage and the causes of poor drainage	<ul style="list-style-type: none">• identify indicators of poor drainage and the benefits of proper drainage
8 Describe surface and subsurface drainage methods and materials	<ul style="list-style-type: none">• describe surface and subsurface drainage methods and perform basic maintenance
9 Use a builder’s level	<ul style="list-style-type: none">• set up a builder’s level, read a survey rod, and perform differential leveling

Achievement Criteria:

The apprentice will demonstrate the basic skill and techniques for modern greenhouse and nursery facilities including irrigation and drainage systems through on site evaluation case studies. They will achieve a 70% or higher.

LINE O: DESCRIBE SYSTEMS APPROACHES TO MANAGING PHYTOSANITARY RISK

Competency: O2 Describe the Procedures for Managing and Being Certified for *P. Ramorum*.

Learning Objectives:

- 1 Apprentices will review biology, history, risk, and control measures for *P. ramorum* in nurseries in Canada.
- 2 They will have the opportunity to write the *P. ramorum* certification examination and, if successful, be recognized as *P. ramorum* certified.

Learning Tasks

- 1 Outline the biology and life cycle of *P. ramorum*
- 2 Describe the history of *P. ramorum* infestation in North America
- 3 Analyze risk of *P. ramorum* at a range of nursery sites
- 4 Evaluate 'Best Management Practices' (BMP) for the control of *P. ramorum*

Content

- apply an understanding of the biology of *P. ramorum* to a site analysis of the environmental conditions on a commercial nursery
- describe the history of *P. ramorum* infestation and its origins and its impact on the nursery industry
- analyze the risk of a *P. ramorum* infestation and develop a risk management plan for a commercial nursery Evaluate 'Best Management Practices' (BMP) for the control of *P. ramorum*
- review the range of BMP, evaluate them based on the environmental conditions of the nursery, and select the appropriate practices

Achievement Criteria:

Given a 20 question quiz on the procedures for managing and being certified for *P. Ramorum*. The apprentice will answer 14 or more questions correctly.

SECTION 3

TRAINING PROVIDER STANDARDS

FACILITY REQUIREMENTS LEVEL 1:

- Classroom
- Access to live 'in situ' plant material as well as herbaria, and visual samples (slides, photographic databases, etc.)
- Access to tools and equipment listed in Section 3
- Access to a service bay and a site for equipment operation
- Botany or Science teaching lab outfitted with compound and dissecting microscopes
- Microscope slides of showing root, stem and leaf anatomy (monocot and dicot)
- Microscope slides showing woody stem growth
- Handlens (10X)
- Glassware, lamps, stir plate (with heating capacity)
- Refrigerator and microwave
- Collection of arthropods, disease organisms, and examples of plant stress
- Soil Science or Chemistry teaching lab
- Glassware, lamps, stir plate (with heating capacity)
- Refrigerator, drying oven and microwave
- Nested sieves, shakers, scales
- Hydrometers and sedimentation cylinders
- Munsell colour books
- Access to the range of hand and power tools common to the horticulture industry and a landscape and nursery site for their use and operation as listed in Section 3

FACILITY REQUIREMENTS LEVEL 2:

- Classroom
- Access to live 'in situ' plant material as well as herbaria, and visual samples (slides, photographic databases, etc.)
- Access to tools and equipment listed in Section 3
- Access to a service bay and a site for equipment operation
- Botany or Science teaching lab outfitted with compound and dissecting microscopes
- Microscope slides showing root, stem and leaf anatomy (monocot and dicot)
- Microscope slides showing woody stem growth
- Hand Lens (10X)
- Glassware, lamps, stir plate (with heating capacity)
- Collection of arthropods, disease organisms, and examples of plant stress
- Soil Science or Chemistry teaching lab
- Glassware, lamps, stir plate (with heating capacity)
- Refrigerator, drying oven and microwave
- Nested sieves, shakers, scales
- pH meters
- Soil sampling equipment
- Access to container nursery stock
- Access to field grown stock/plant material that can be prepared for transplanting
- Trailer and tractor nursery equipment
- Access to large tree transplanting equipment
- Nursery hand carts and tree dollies
- Multiple nursery stock containers
-

FACILITY REQUIREMENTS LEVEL 3:

- Classroom
- Access to live 'in situ' plant material as well as herbaria, and visual samples (slides, photographic databases, etc.)
- Access to a container nursery
- Pest lab with samples and dissecting microscopes
- Diagnostic resources
- Access to greenhouse complete with a wide range of crops
- Access to nursery complete with a wide range of crops
- Access to tissue culture lab with appropriate plant material
- Access to fertilizer, pots, and media samples
- Access to greenhouses and nursery areas with a variety of control equipment including computer systems
- Access to greenhouses with variety of control facilities (lights, thermal screens, blackout screens, carbon dioxide input, heating equipment)

FACILITY REQUIREMENTS LEVEL 4:

- Classroom
- Access to live 'in situ' plant material as well as herbaria, and visual samples (slides, photographic databases, etc.)
- Access to a container nursery
- Pest lab with samples and dissecting microscopes
- Diagnostic resources
- Access to greenhouse complete with a wide range of crops
- Access to nursery complete with a wide range of crops
- Access to commercial nurseries using innovative production practices and technology
- Access to nursery and greenhouse with adequate space for performing irrigation audits and level surveying exercises
- Builder's levels and surveying equipment
- Classroom with a collection of a broad range of irrigation and drainage equipment

FACULTY CREDENTIAL AND EXPERIENCE REQUIREMENTS LEVEL 1:

All Course Outlines

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma.
- Teaching competence as demonstrated by successful completion of Provincial Instructor Diploma (PIDP) or equivalent or regular faculty status at an institution which has a defined faculty review process (as specified by institutional policy) or contract faculty who have at least completed the Instructional Skills Workshop (PIDP 3102) or equivalent.
- Two years relevant industry experience.

Additional Credentials and Experience for Specific Outlines

A1

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of plant identification experience.

B1

- Subject matter competence as demonstrated by a Business Diploma with Human Resource or Organizational Behaviour specialty or Baccalaureate Degree in with a minor in Business or Certified Landscape Professional.
- Two years supervisory or management experience in a private or public organization.

C1

- Subject matter competence as demonstrated by a Outdoor Power Equipment Trades Qualification/Apprentice Certificate.
- 2 years of relevant industry experience.

D1

- Subject matter competence as demonstrated by a or Baccalaureate Degree in Horticulture, Botany, Agronomy, Plant Biology, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

E1

- Subject matter competence as demonstrated by a Horticulture Diploma or Baccalaureate Degree in Horticulture, Agronomy, Forestry, Crop Science, or Pest Management and/or a Diploma in Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

F1

- Subject matter competence as demonstrated by a Baccalaureate Degree in Soil Science Horticulture, Agronomy, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Pest Management with a minimum of 5 years experience in teaching the subject matter.

H1

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of practical landscape or nursery experience

FACULTY CREDENTIAL AND EXPERIENCE REQUIREMENTS LEVEL 2:

All Course Outlines

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma.
- Teaching competence as demonstrated by successful completion of Provincial Instructor Diploma (PIDP) or equivalent or regular faculty status at an institution which has a defined faculty review process (as specified by institutional policy) or contract faculty who have at least completed the Instructional Skills Workshop (PIDP 3102) or equivalent.
- Two years relevant industry experience.

Additional Credentials and Experience for Specific Outlines

A2

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of plant identification experience.

B2

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in with a minor in Business or Certified Landscape Professional.
- Two years supervisory or management experience in a private or public organization.

C2

- Subject matter competence as demonstrated by a Outdoor Power Equipment Trades Qualification/Apprentice Certificate or equivalent within Horticulture training or education, with a minimum of 2 years of relevant industry experience.

D2

- Subject matter competence as demonstrated by a or Baccalaureate Degree in Horticulture, Botany, Agronomy, Plant Biology, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

E2

- Subject matter competence as demonstrated by a Horticulture Diploma or Baccalaureate Degree in Horticulture, Agronomy, Forestry, Crop Science, or Pest Management and/or a Diploma in Agriculture or Forestry with a minimum of 5 years experience in teaching the subject matter.

F2

- Subject matter competence as demonstrated by a Baccalaureate Degree in Soil Science Horticulture, Agronomy, Forestry, or Crop Science and/or a Diploma in Horticulture, Agriculture or Pest Management with a minimum of 5 years experience in teaching the subject matter.

H2

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture and 2 years of practical landscape or nursery experience

FACULTY CREDENTIAL AND EXPERIENCE REQUIREMENTS LEVEL 3:

All Course Outlines

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma.
- Teaching competence as demonstrated by successful completion of Provincial Instructor Diploma (PIDP) or equivalent or regular faculty status at an institution which has a defined faculty review process (as specified by institutional policy) or contract faculty who have at least completed the Instructional Skills Workshop (PIDP 3102) or equivalent.
- Two years relevant industry experience.

Additional Credentials and Experience for Specific Outlines

A5

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture, Botany, Agronomy, Plant Biology, Forestry, or Crop Science. Two years specific experience in plant identification.

M2

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture.
- Five years relevant industry experience in container nursery production.

E5

- Subject matter competence as demonstrated by a Horticulture Diploma or Baccalaureate Degree in Horticulture, Agronomy, Forestry, Crop Science, or Pest Management.
- Two years specific experience in greenhouse or nursery plant health management

M1

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate, or Horticulture Diploma, or Baccalaureate Degree.
- Five years relevant industry experience in propagation.

F4

- Subject matter competence as demonstrated by a Baccalaureate Degree in Soil Science Horticulture, Agronomy, Forestry, or Crop Science.
- Five years relevant industry experience in container production

N1

- Subject matter competence as demonstrated by a Horticulture Diploma or a Baccalaureate Degree in Horticulture or Horticultural Science.
- Minimum five years relevant industry experience.

O1

- Subject matter competence as demonstrated by a Baccalaureate Degree.
- Five years relevant industry experience plus an understanding of risk analysis.

FACULTY CREDENTIAL AND EXPERIENCE REQUIREMENTS LEVEL 4:

All Course Outlines

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma.
- Teaching competence as demonstrated by successful completion of Provincial Instructor Diploma (PIDP) or equivalent or regular faculty status at an institution which has a defined faculty review process (as specified by institutional policy) or contract faculty who have at least completed the Instructional Skills Workshop (PIDP 3102) or equivalent.
- Two years relevant industry experience.

Additional Credentials and Experience for Specific Outlines

A6

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture, Botany, Agronomy, Plant Biology, Forestry, or Crop Science.
- Two years specific experience in plant identification.

O2

- Canadian Nursery Certification Institute (CNCI) P. ramorum accredited instructor

N2

- Two years relevant industry experience in irrigation and drainage.

M3

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture.
- Five years relevant industry experience in a container nursery production

E6

- Subject matter competence as demonstrated by a Horticulture Diploma or Baccalaureate Degree in Horticulture, Agronomy, Forestry, Crop Science, or Pest Management
- Two years specific experience in greenhouse or nursery plant health management

M4

- Subject matter competence as demonstrated by a Horticulture Trades Qualification/Apprentice Certificate or Horticulture Diploma or Baccalaureate Degree in Horticulture, Botany, Agronomy, Plant Biology, Forestry, or Crop Science.
- Five years relevant industry experience

REQUIRED TEXTBOOKS AND MANUALS LEVEL 1:

- A-Z Encyclopedia of Garden Plants - Latest edition. Brickel, C. and T. Cole. Dorling Kindersley, Toronto, ON.
- Kwantlen University College School of Horticulture Plant identification Database, www.kwantlen.ca/horticulture/
- Training in Management Skills Canadian Edition - Latest edition. Hunsaker, P. and D. Dilamarter. Pearson Education Canada.
- Outdoor Power Equipment - Latest edition. Webster, Jay. Nelson Canada, Scarborough, ON.
- WorkSafeBC Website (WCB Internet)
- Equipment Manufacturers Websites (Internet)
- Botany for Gardeners - Latest edition. Capon, Brian. Timber Press, Portland, OR.
- Competency C-06 Explain the Effects of Hormones on Plant Growth and Development - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1996. Province of British Columbia.
- Soil Science and Management - Latest edition. Plaster J. Edward. Thomson/Delmar Learning, Clifton Park, NY.
- British Columbia Landscape Standard - Latest edition. BC Landscape and Nursery Association and the British Columbia Association of Landscape Architects, Surrey, B.C.
- Grounds Keepers Safety Guide - Latest edition. Hamilton Canadian Centre for Occupational Health and Safety., ON.

RECOMMENDED TEXTBOOKS, PAPERS AND MANUALS LEVEL 1:

- Abiotic Disorders of Landscape Plants : A Diagnostic Guide - Costello, Laurence Raleigh. 2003. University of California, Agriculture and Natural Resources, Oakland, CA.
- Integrated Pest Management Manual for Landscape Pests in British Columbia. Gilkeson, Linda A. 2000. Pollution and Remediation Branch, Victoria, BC. (Also available online at <http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/ipm-manuals.htm>).
- Ball Identification Guide to Greenhouse Pests and Beneficials - Gill, Stanton. 1998. Ball Publication, Batavia, Ill.
- Field Guide to Noxious and Other Selected Weeds of British Columbia - Cranston, Roy. 2002. Ministry of Agriculture, Food and Fisheries; Ministry of Forests, Victoria, BC (Also available online at [<http://www.agf.gov.bc.ca/cropprot/weedguid/weedguid.htm>]).
- Pacific Northwest Plant Disease Management Handbook - 2000. Extension Services of Oregon State University, Washington State University, and the University of Idaho.
- Soil Management Handbook for the Lower Fraser Valley - Bertrand, R.A., G.A. Hughes-Games, and B.C. Nikkel. 1991. Ministry of Agriculture, Fisheries & Food, Abbotsford, B.C.
- Western Fertilizer Handbook - Soil Improvement Committee, California Fertilizer Association. Latest edition.(Horticulture ed.) Interstate Pub Inc., Danville, Illinois.

Personal Apprentice Equipment

- CSA-approved steel-toed footwear(*Required)
- Rainwear (*Recommended)
- Calculator(*Recommended)
- Workgloves(*Recommended)
- Hand Lens (10X) (*Recommended)

REQUIRED TEXTBOOKS AND MANUALS LEVEL 2:

Textbooks or other Resources

- A-Z Encyclopedia of Garden Plants - Latest edition. Brickel, C. and T. Cole. Dorling Kindersley, Toronto, ON.
- Kwantlen University College School of Horticulture Plant identification Database, www.kwantlen.ca/horticulture/
- Training in Management Skills Canadian Edition - Latest edition. Hunsaker, P. and D. Dilamarter.
- Outdoor Power Equipment - Webster, Jay. 2001. Nelson Canada, Scarborough, ON.
- Botany for Gardeners - Capon, Brian. Latest edition. Timber Press, Portland, OR.
- Competency C-06 Explain the Effects of Hormones on Plant Growth and Development - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1996. Province of British Columbia.
- Integrated pest management manual for landscape pests in British Columbia - Gilkeson, Linda A. 2000. Pollution and Remediation Branch, Victoria, BC. (Also available online at <http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/ipm-manuals.htm>).
- Weeds of Canada - 1970. Agriculture Canada Publication No. 948.
- Soil Science and Management - Latest edition. Plaster J. Edward. Thomson/Delmar Learning, Clifton Park, NY.
- British Columbia Landscape Standard - Latest edition. BC Landscape and Nursery Association, BC Society of Landscape Architects, BC.
- Canadian Standards for Nursery Stock - Latest edition. Canadian Nursery and Landscape Association.

RECOMMENDED TEXTBOOKS, PAPERS AND MANUALS LEVEL 2:

- WorkSafeBC Website (WCB Internet)
- Equipment Manufacturers Websites (Internet)
- Field guide to noxious and other selected weeds of British Columbia - Cranston, Roy. 2002. Ministry of Agriculture, Food and Fisheries; Ministry of Forests, Victoria, BC (Also available online at [<http://www.agf.gov.bc.ca/cropprot/weedguid/weedguid.htm>]).
- Abiotic disorders of landscape plants: a diagnostic guide - Costello, Laurence Raleigh. 2003. University of California, Agriculture and Natural Resources, Oakland, CA.
- Ball Identification Guide to Greenhouse Pests and Beneficials - Gill, Stanton. 1998. Ball Publication, Batavia, Ill.
- Pacific Northwest; plant disease management handbook - 2000. Extension Services of Oregon State University, Washington State University, and the University of Idaho.
- Handbook for Pesticide Applicators and Pesticide Dispensers - Latest edition. Provincial Ministry of Environment, Province of British Columbia.
- Western Fertilizer Handbook - Soil Improvement Committee, California Fertilizer Association. Latest edition. (Horticulture Ed.) Interstate Pub Inc., Danville, Illinois.
- Soil Fertility Manual - Latest edition. Potash & Phosphate Institute and the Foundation for Agronomic Research. Province of British Columbia Ministry of Skills, Training and Labour and the Centre for Curriculum and Professional Development, Norcross, GA.
- Horticulture Apprenticeship Competency H3, Describe Nutrient Testing Practices and Interpret Results - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1995. Province of British Columbia.
- Horticulture Apprenticeship Competency H4, Describe the Fertilizer Types and Practical Considerations for their use - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1995. Province of British Columbia.

Personal Apprentice Equipment

- CSA-approved steel-toed footwear(*Required)
- Rainwear (*Recommended)
- Calculator(*Recommended)
- Workgloves(*Recommended)
- Hand Lens (10X) (*Recommended)

REQUIRED TEXTBOOKS AND MANUALS LEVEL 3:

- A-Z Encyclopedia of Garden Plants - Latest edition. Brickel, C. and T. Cole. Dorling Kindersley, Toronto, ON.
- Kwantlen University College School of Horticulture Plant identification Database, www.kwantlen.ca/horticulture/
- Competency L-2 Describe Production, Handling and Shipping of Nursery Container Crops - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Province of British Columbia.
- British Columbia Landscape Standard - Latest edition. BC Landscape and Nursery Association, BC Society of Landscape Architects, BC.
- Identify and Explain Control Measures used for Various Pests in Area of Specialty - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Apprenticeship Competency Guide D5. Centre for Curriculum, Transfer and Technology, Publication MN 1454.
- Competency H-5 Describe Media, Containers and Transport Methods Used in Nursery and Greenhouse - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Province of British Columbia.
- Competency H-6 Describe the Maintenance of Container Growing Media During the Growing On Period - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Province of British Columbia.

RECOMMENDED TEXTBOOKS, PAPERS AND MANUALS LEVEL 3:

- Entomology and Pest Management - Latest edition. Pedigo, L. P. Prentice Hall, Upper Saddle River, NJ.
- Concepts in Integrated Pest Management - Latest edition. Norris, R.F., et al. Prentice Hall, Upper Saddle River, NJ.
- IPM for Floriculture and Nurseries - Latest edition. Dreistadt, Steve (editor) University of California, Oakland CA Publication 3402.
- Pests of Landscape Trees and Shrubs - Latest edition. Dreistadt, Steve (editor) University of California Oakland CA. Publication 3359.
- Knowing and Recognising - Latest edition. Malais, M.H. and W.J. Ravensberg. Koppert Biological Systems, Reed Business Information, Doetinchem, Netherlands.
- A Colour Handbook of Biological Control in Plant Protection - Latest edition. Helyer, N. et al. Timber Press, Portland, OR.
- Pest Management Recommendations for Greenhouse Crops - Latest edition. Ontario Ministry of Agriculture. Publication 365, Ontario MAF.
- Nursery and Landscape Plant Production and IPM - Ontario Ministry of Agriculture. Latest edition. Publication 383, Ontario MAF.
- IPM for Tomatoes - Latest edition. Srand, L.L. (editor). University of California Publication 3274.
- Greenhouse Vegetable Production Guide for Commercial Growers - Latest edition. B.C.M.A.F. Crown Publications, Victoria, BC.
- Nursery Crop Production Guide for Commercial Growers - Latest edition. Mathers, H. and Leidenfrost, P. B.C. Crown Publications, Victoria, BC.
- A Gardener's Guide to Pest Prevention and Control in the Home Garden - Latest edition. B.C.M.A.F. Crown Publications, Victoria.
- Applied Bionomics Biological Technical Manual - Latest edition. Matteoni, J.A. and D. Elliot. Applied Bionomics, Sydney, BC.
- Common Sense Pest Control - Latest edition. Olkowski, W. et al. Taunton Press, Newtown, CT.
- Describe Biological and Environmental Methods of Pest Control and Their Limitations - Ministry of

Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development.. 1998. Apprenticeship Competency Guide D3. Centre for Curriculum, Transfer and Technology, Publication MN 1452.

- Explain the Fundamentals of an Integrated Pest Management Program. Apprenticeship Competency Guide D4 - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Centre for Curriculum, Transfer and Technology, Publication MN 1453.
- Plan, Implement, Monitor and Evaluate an IPM Program for the Worksite. Apprenticeship Competency Guide D6 - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Centre for Curriculum, Transfer and Technology, Publication MN 1455.
- IPM in Greenhouses - Vocational Educational Productions, California State Polytechnic. (video)
- IPM in the Landscape - Vocational Educational Productions, California State Polytechnic. (video)
- Protecting Nature's Balance: IPM in B.C. U.B.C. Access. (video)
- Introduction to Greenhouse Production - McMahon, R. Latest edition. Ohio State University, Columbus, OH.
- Greenhouse Engineering - Aldrich and Bartok. Latest edition. NRAES, Ithaca, NY.
- Greenhouse Operation and Management - Nelson, Paul V. Latest edition. Prentice Hall, NJ.
- Ball, V. Ball Red Book, Volume 1 Structures. Latest edition. Ball Publishing, West Chicago, Ill.
- Competency Guide I2, Compare Environmental Control Systems - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Horticulture Apprenticeship Item code MN 1472.
- Horticulture Apprenticeship Competency Guide J1, Describe Greenhouse and Nursery Protective Structures - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Item code MN 1473.
- Greenhouse Construction - Jones, G. and Peter Nemeth. Kwantlen University College, Langley, B.C.. In Kwantlen Langley Library. (video)
- Introduction to Greenhouse Design and Construction - Vocational Educational Productions. 1991. California Polytechnic State University, San Luis Obispo, CA. (video)
- Introduction to Greenhouse Management - Vocational Educational Productions. 1991. California Polytechnic State University, San Luis Obispo, CA. (video)

Personal Apprentice Equipment

- CSA-approved steel-toed footwear (*Required)
- Leather Gloves (Recommended)
- Rainwear (Recommended)
- Calculator (metric conversion) (Recommended)
- Workgloves (Recommended)
- Pocket Knife (Recommended)
- Felco pruners with scabbard (Recommended)
- Good quality hand lens (10 X power) (Recommended)
- Notebook (Recommended)
- Valid tetanus immunization (Recommended)

REQUIRED TEXTBOOKS AND MANUALS LEVEL 4:

- A-Z Encyclopedia of Garden Plants - Latest edition. Brickel, C. and T. Cole. Dorling Kindersley, Toronto, ON.
- Kwantlen University College School of Horticulture Plant identification Database, www.kwantlen.ca/horticulture/
- P. ramourm Certification Manual - Latest edition. Canadian Nursery Certification Institute. British Columbia Landscape and Nursery Association, Surrey, BC.
- Competency L-1 Describe the Production, Harvesting and Shipping of Field Grown Nursery Stock - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Province of BC.
- British Columbia Landscape Standard - Latest edition. BC Landscape and Nursery Association, BC Society of Landscape Architects, BC.
- Competency D-6, Plan, Implement, Monitor and Evaluate an IPM Program for the Worksite - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Province of British Columbia.
- Concepts in Integrated Pest Management - Latest edition. Norris, R.F., et al. Prentice Hall, Upper Saddle River, NJ.

RECOMMENDED TEXTBOOKS, PAPERS AND MANUALS LEVEL 4:

- Entomology and Pest Management - Latest edition. Pedigo, L. P. Prentice Hall, Upper Saddle River, NJ.
- IPM for Floriculture and Nurseries - Latest edition. Dreistadt, Steve (editor). University of California, Oakland CA Publication 3402.
- Pests of Landscape Trees and Shrubs - Latest edition. Dreistadt, Steve (editor). University of California Oakland CA. Publication 3359.
- Knowing and Recognising - Latest edition. Malais, M.H. and Ravensberg, W.J. Koppert
- Biological Systems - Latest edition. Reed Business Information, Doetinchem, Netherlands.
- A Colour Handbook of Biological Control in Plant Protection - Latest edition. Helyer, N. et al. Timber Press, Portland, OR.
- Pest Management Recommendations for Greenhouse Crops - Latest edition. Ontario Ministry of Agriculture. Publication 365, Ontario MAF.
- Nursery and Landscape Plant Production and IPM - Latest edition. Ontario Ministry of Agriculture. Publication 383, Ontario MAF.
- IPM For Tomatoes - Latest edition. Strand, L.L. (editor). University of California Publication 3274.
- B.C. Nursery Crop Production Guide for Commercial Growers - Latest edition. Mathers, H. and Leidenfrost, P. Crown Publications, Victoria, BC.
- A Gardener's Guide to Pest Prevention and Control in the Home Garden - Latest edition. B.C.M.A.F. Crown Publications, Victoria, BC.
- Applied Bionomics Biological Technical Manual - Latest edition. Matteoni, J.A. and Elliot, D. Applied Bionomics, Sydney, BC.
- Common Sense Pest Control - Latest edition. Olkowski, W. et al. Taunton Press, Newtown, CT.
- Competency Guide D3 Describe Biological and Environmental Methods of Pest Control and Their Limitations - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Publication MN 1452, Province of British Columbia.
- Competency Guide D4 Explain the Fundamentals of an Integrated Pest Management Program - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Publication MN 1453, Province of British Columbia.
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 - Horticulture Apprenticeship Competency Guide Q2, Describe the Design and Installation of Surface Drainage Systems - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Item code MN 1468.
 - Horticulture Apprenticeship Competency Guide Q3, Explain Factors Affecting Irrigation Design - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Item code MN 1511.
 - Horticulture Apprenticeship Competency Guide Q4, Describe Irrigation Equipment, Installation and Maintenance - Ministry of Education, Skills and Training and the Ministry of Labour and the Centre for Curriculum and Professional Development. 1998. Item code MN 1512.
 - Current product catalogues (hard copy or CD) from Rainbird, Toro.

Personal Apprentice Equipment

- CSA-approved steel-toed footwear (*Required)
- Leather Gloves (Recommended)
- Rainwear (Recommended)
- Calculator (metric conversion) (Recommended)
- Workgloves (Recommended)
- Pocket Knife (Recommended)
- Felco pruners with scabbard (Recommended)
- Good quality hand lens (10 X power) (Recommended)
- Notebook (Recommended)
- Valid tetanus immunization (Recommended)