CHAPTER 4 METRIC CONVERSIONS

Metric		Imperial Equivalent	
600	mm	24	inches
1	cm	0.4	inches
15	m	50	feet
30	m	100	feet

Conversions in this table are rounded to a convenient number.
See Appendix E for exact conversion factor.

Values from tables and examples are not included in Metric Conversions

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CHAPTER 4

CROPS

INTRODUCTION

This chapter discusses crop management practices for protection of the environment. It contains introductory information on the relationship between crops and the environment. It also contains information on crop production environmental concerns, legislation and beneficial management practices related to

- Outdoor crops,
- Indoor and container nursery crops.

CROPS AND THE ENVIRONMENT

The primary role of agricultural crops is to provide a food source for humans and livestock. Other important categories include fibre, oil, ornamental, industrial and secondary crops. Environmental concepts related to crops are listed in alphabetical order below.

Buffers

Buffers on farms are generally defined as specially managed areas used to separate farm activities from sensitive areas that may be impacted by those activities. The objective of a buffer is to intercept and retain contaminants, preventing them from reaching a sensitive area or to deliver other agricultural or environmental benefits.

➔ see Buffers, **page 11-4**

Carbon Sequestration

Plants and soil organic matter play an important role in removing carbon dioxide from the air and storing (sequestering) it. Carbon is the main component in plant material and soil organic matter. Any uptake of carbon dioxide from the air by plant material or soil mitigates the effects of climate change. Following other beneficial practices recommendations for cropping can aid in carbon sequestration and help farming operations and help farming operations adapt to climate change by building the resiliency.

➔ see Climate Change, **page 12-1**

Cover Crops

Cover cropping and relay cropping are practices that can aid in the management of pests, nutrients and soil tilth. Such practices also benefit wildlife and provide additional forage yield. Cover crops are used to protect against soil erosion, to improve soil structure and soil fertility, to suppress some insect pests and weeds, and to promote higher populations of some beneficial insects. They accelerate the movement of rainwater into the soil and toward drainage systems, reducing the time free water remains on the field surface.

Cover crops include crops such as fall rye, barley or annual rye grass grown between plowdown and reseeding of perennial forage or hay crops or between plantings of annual crops.

Relay cropping is a form of cover cropping used by forage producers. It involves planting a second crop before the first crop is harvested. Relay cropping is practiced to reduce weed growth during the growing season, to provide an active crop available for fall manure application after corn is harvested, to protect soil from erosion, and to provide additional forage yield.

Optimizing crop uniformity and yield can assist in avoiding under-utilization of nutrients.

Flood Management

Most crops grown in B.C. are intolerant of flooding. Flooding depletes soils of oxygen and increases nitrogen losses. Flooding often leads to erosion or deposition of soil and sediments resulting in land loss or crop smothering, respectively. Flooding frequently results in higher levels of plant disease that reduce stands and yields. Soil remediation would likely be required after a flood, and crop production may be reduced for several years.

Grasses

Forage grasses offer a unique opportunity to producers for improved nutrient management and environmental protection. Healthy grass stands build soils with good tilth and help protect soil from erosion by wind and water by binding soil particles and covering the soil surface. If soil moisture conditions are appropriate, grass can take up significant amounts of nutrients.

The timing of forage harvest and the cutting height of the grass also play a critical role in the capture and filtration of runoff. Leaving longer plant stands late in the season near watercourses will help to filter suspended solids from runoff.

Integrated Pest Management

The use of Integrated Pest Management in crop cultivation enhances populations of beneficial organisms, such as native pollinators, predators, and parasitoids of crop pests. It is a decision-making process for managing pests in an effective, economical and environmentally sound way. Techniques used range from preventative and cultural measures to the use of biological, physical, behavioural and chemical controls.

Nutrient Cycle

Crops play an integral role in nutrient cycling. For example, some crops remove excess nutrients from the soil, some capture nutrients for soil recycling that would otherwise have been lost and others capture nitrogen from the air. The nutrient cycle provides valuable sources of food and energy to the soil biota (bacteria, fungi and insects), plants and animals.

Under certain soil and climatic conditions, crops can take up or transform nutrients in such a way that the plant tissue can be harmful to animals. For example, grasses will "luxury consume" potassium which can lead to grass tetany in dairy cattle. In addition, nitrate-nitrogen can accumulate in plant tissue and cause nitrate toxicity to livestock and wildlife.

Soil Erosion Control

Plant roots bind soil particles together by exerting pressure and releasing glue-like organic compounds, resulting in aggregates that are more resistant to soil erosion. Plants protect soil from the erosive impact of raindrops and wind as well as from the erosive effects of overland flow by reducing the velocity of water runoff.

Soil Structure

Good soil structure increases soil permeability, resulting in reduced runoff flow. The growth and decay of crop roots and organic residues enhance microbial activity and growth of soil microbes. Microbial activity improves soil structure and organic matter content.

Runoff Filtration

Standing crops, or crop residue attached to the soil, will decrease water velocities, resulting in fewer suspended solids and dissolved chemicals being carried by runoff water to watercourses. Crops and crop residue allow water to infiltrate the soil more rapidly than bare soil, as well as reduce runoff and erosion. An added benefit is that water is filtered by the soil and reduces pollution entering groundwater.

Wildlife Habitat

Crops can provide wildlife with feed and habitat. Some crops may be specifically planted as 'lure' or 'sacrifice' vegetation for migrating birds. In addition, shelterbelts or windbreaks may provide soil and water conservation benefits as well as habitat for beneficial birds or insects. Riparian plantings offer such benefits in addition to enhancing fish habitat and improving water quality.

➔ see Riparian Areas, **page 11-15**

OUTDOOR CROPS

This section discusses outdoor crop practices common to these crops:

- Berries,
- Bulbs,
- Christmas trees,
- Fiber,
- Field grown flowers and nursery stock,
- Field vegetables (including corn),
- Forage seeds,
- Forages,
- Ginseng,
- Grains and oilseeds,
- Grapes,
- Medicinal and herb,
- Nuts,
- Pastures,
- Tree fruits,
- Sod,
- Specialty crops.

➔ see Indoor Crops and Container Nurseries, **page 4-16**, for outdoor container nurseries

OUTDOOR CROP ENVIRONMENTAL CONCERNS

Primary environmental concerns related to outdoor crop management are:

- Poor crop establishment or harvesting annual crops that leave the soil bare for extended periods and results in soil erosion.
- Harvesting of crops that results in excessive soil removal.
- Leachate from stored crops (e.g., silage) that results in water pollution.
- Crop processing dust or crop residue burning that results in air pollution.
- movement of invasive plants, exotic pests or infected plant material that results in biodiversity impacts and/or threats to other crops.
- Conversion of land to agricultural production that results in loss of habitat and release of greenhouse gas to the atmosphere.
- Conversion or development of cropping areas that decrease the carbon storage capacity of the system through the loss of tree and shrub components.
- Non-point source pollution due to over-fertilization of soils and excess nutrients leaching to groundwater and surface water.

For detailed information on these concerns:

➔ see Impacts on Biodiversity and Habitat, **page 7-7**, and refer to Farm Activities and Impacts

➔ see Soil Quality Factors, **page 8-1**, refer to Compaction

➔ see Soil Loss by Harvest, **page 8-15**

➔ see Water Quality and Quantity Factors, **page 9-2**, refer to Contaminants

➔ see Air Contaminants, **page 10-1**, refer to Dust and Particulates and to Open Burning

➔ see Farm Activities and Impacts related to Climate Change, **page 12-5**, and refer to Land Clearing

OUTDOOR CROP LEGISLATION

The following is a brief outline of the main legislation that applies to outdoor crops.

➔ see **page A-1** for a summary of these and other Acts and Regulations

Agricultural Land Commission Act

The *Agricultural Land Commission (ALC) Act S.B.C. 2002, c. 36, and Agricultural Land Reserve (ALR) Regulations* are the legislative framework for the establishment, administration, and procedures of BC's agricultural land preservation program. The ALC Act takes precedence over, but does not replace other legislation and bylaws that may apply to the land. Local and regional governments, as well as other provincial agencies, are expected to plan in accordance with the provincial policy of preserving agricultural land.

The *ALR General Regulation, B.C. Reg. 171/2002*, identifies the procedures for submitting applications and notices of intent.

The *ALR Use Regulation, B.C. Reg. 30/2019* specifies land uses permitted in the ALR.

The policies of the Commission provide interpretation and clarification of the regulations; outline guidelines, strategies, rules or positions on various issues and provides clarification and courses of action consistently taken or adopted, formally or informally.

ALC Policies and Bylaws

Drinking Water Protection Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

- SECTION 23(1): subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

Environmental Management Act

The *Open Burning Smoke Control Regulation* regulates the burning of waste materials in the treefruit and grape industries and relevant legislation.

The *Code of Agricultural Environmental Management* has specific requirements regarding the collection, storage, and use of agricultural by-products. Agricultural vegetative debris from crop production is considered an agricultural by-product under the AEM Code.

SECTION 30: solid agricultural by-products may be stored only in a permanent storage structure or as temporary field storage.

General storage requirements for agricultural by products in Section 34 require that:

- Any leachate generated during storage must be collected or contained until it can be used in applying nutrients to the land.
- Runoff must be diverted away from the storage structure or storage area.
- The storage structure or storage area must be maintained so as to prevent contaminated runoff, leachate, wastewater, and solids from escaping, and if they do they must not enter a watercourse, cross a property boundary, or go below the water table.
- Air contaminants from stored agricultural by-products must not cross a property boundary.
- Agricultural by-products must be stored in a manner that will deter the attaction of animals and vectors.

Plant Protection Act

Administered by AFF, this Act is the provincial counterpart to the federal *Plant Protection Act* that focuses on plant protection issues affecting Canada. It provides for the prevention of the spread of pests destructive to plants in BC. Inspectors have powers to enforce the provisions of the Act, including the authority to establish quarantine areas. To assist in the enforcement of the Act, the BC Plant Protection Advisory Council advises and co-ordinates the actions of provincial and federal officials to deal with potential hazards to BC agriculture and forestry from insects, plant diseases, weeds or other biotic agents. The Council's power comes from the mandates of the agencies whose members sit on committees struck to deal with plant protection issues in specific commodity sectors.

The purpose of this Act is to prevent the deleterious spreading of insects, pests, or diseases that are destructive to plants. Under this Act, inspectors may enter premises at any reasonable time for an inspection of the premises. They can order the treatment, confiscation, or destruction of plants. Regulations under this Act include:

- *Bacterial Ring Rot Regulation,*
- *Blueberry Maggot Control Regulation,*
- *Domestic Bacterial Ring Rot Regulation,*
- *Golden Nematode Regulation,*
- *Little Cherry Control Regulation,*
- *Northern American Gypsy Moth Eradication.*

Public Health Act

Administered by the Ministry of Health, this Act has a specific prohibition that "a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard". This prohibition would apply to farm practices that may result in a health hazard, such as when nutrients, contaminants or pathogens are discharged to land, water or air to pose a public health problem. Any situation that entails a health hazard will enable health officers to investigate using their powers under the Act. Under the *Public Health Act*, the local Health Authority must investigate any health hazard and has authority to order that a person prevent or stop a health hazard, or mitigate the harm or prevent further harm from a health hazard amongst other powers. Similar regulatory provisions exist for addressing health hazards to drinking water supplies under the *Drinking Water Protection Act*.

Weed Control Act

Administered by AFF, this Act places the responsibility for the control of noxious weeds on the occupiers of the land. It provides for the appointment of inspectors to ensure compliance and, failing that, for a method by which they can control weeds and recover the costs from the occupier. Weed Control Committees may be established by municipal councils to administer the Act within a municipality. Committees report to the municipal council and the Minister. This Act imposes a duty on all land occupiers to control designated noxious plants.

Wildlife Act

The provincial *Wildlife Act* protects wildlife designated under the Act from direct harm, except as allowed by regulation (e.g., hunting or trapping), or under permit. Legal designation as Endangered or Threatened under the Act increases the penalties for harming a species. The Act also enables the protection of habitat in a Critical Wildlife Management Area. .

Fisheries Act

Administered by both Fisheries and Oceans Canada and Environment and Climate Change Canada, this Act is established to manage Canada's fisheries resources, including fish habitat. The Act can also be administered provincially by FLNRORD and ENV. The Act applies to all Canadian waters that contain fish, including ditches, channelized streams, creeks, rivers, marshes, lakes, estuaries, coastal waters and marine offshore areas. It also applies to seasonally wetted areas that provide fish habitat such as shorelines, stream banks, floodplains, intermittent tributaries and privately owned land. The Act includes provisions for stiff fines and imprisonment to ensure compliance.

The purpose of this Act is to provide a framework for (a) the proper management and control of fisheries; and (b) the conservation and protection of fish and fish habitat, including by preventing pollution.

This Act was updated in 2019 and now empowers the Minister to make regulations for the purposes of the conservation and protection of biodiversity.

The definition of fish habitat is: "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas". The quantity, timing and quality of the water flow that are necessary to sustain fish habitat are also deemed to be a fish habitat. Furthermore, serious harm to fish includes the death of fish or any permanent alteration to, or destruction of, fish habitat.

Provisions of the *2019 Fisheries Act* relevant to agricultural operations include:

- Protection for all fish and fish habitats;
- Prohibition against the death of fish or the 'harmful alteration, disruption or destruction of fish habitat';
- A permitting framework and codes of practice to improve management of large and small projects impacting fish and fish habitat;
- Protection of fish and/or fish habitats that are sensitive, highly productive, rare or unique; and
- Consideration for the cumulative effects of development activities on fish and fish habitat.

Specific sections of the Act include:

SECTION 34.2(1) The Minister may establish standards and codes of practice for:
(a) The avoidance of death to fish and harmful alteration, disruption or destruction of fish habitat;
(b) The conservation and protection of fish or fish habitat; and
(c) The prevention of pollution.

SECTION 34.4(1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

SECTION 35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.

Every person who contravenes subsection 34.4(1) or 35(1) is guilty of an offence and liable.

Notifying authorities about serious harm to fish or deposit of a deleterious substance:

SECTION 38 (4.1) Every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations of a harmful alteration, disruption or destruction of fish habitat that is not authorized under this Act, or of a serious and imminent danger of such an occurrence, if the person at any material time:
(a) Owns or has the charge, management or control of the work, undertaking or activity that resulted in the occurrence or the danger of the occurrence; or
(b) Causes or contributes to the occurrence or the danger of the occurrence.

SECTION 38 (5) If there occurs a deposit of a deleterious substance in water frequented by fish that is not authorized under this Act, or if there is a serious and imminent danger of such an occurrence, and detriment to fish habitat or fish or to the use by humans of fish results or may reasonably be expected to result from the occurrence, then every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations.

SECTION 38 (7) As soon as feasible after the occurrence or after learning of the danger of the occurrence, the person shall provide an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations with a written report on the occurrence or danger of the occurrence.

Plant Protection Act

Administered by Agriculture and Agri-Food Canada, this Act is to protect plant life and the agriculture and forestry industries by preventing the importation, exportation, and spread of injurious pests.

Species at Risk Act

This Act has sections that protect listed species, their residence and critical habitat. It applies to federal lands, internal waters (i.e., all watercourses), territorial seas of Canada, and the air space above them.

The provisions of the *Species at Risk Act* (known as the'safety net') could be invoked on BC crown and private lands using a federal order under the Act if provincial action is not sufficient to protect listed species.

OUTDOOR CROP BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable outdoor crop related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Outdoor Crop Soil Management

Improper crop management practices can cause soil degradation. Bare soils are prone to erosion and compacted soils will contribute to reduced crop yield and quality. Both conditions carry a greater risk of runoff flows transporting sediments into watercourses. Follow the same beneficial management practices outlined under protecting soil quality when cultivating for crop production.

➔ see **Chapter 8, Soil**

Cover Crops

Cover cropping and relay cropping are practices that can aid in the management of pests, weeds, nutrients and soil tilth, while benefiting wildlife and providing additional forage yield. Cover cropping can also be an important practice in adapting to climate change by increasing the resilience of cropping systems to floods or drought. Implement the following practices:

- Plant annual cover crops following crop harvest (e.g., oats after carrots).
- Plant annual cover crops to fill gaps between perennial crop rows (e.g., barley between raspberry rows).
- Plant perennial cover crops to fill gaps between perennial crop rows (e.g., grasses between orchard rows).
- If fall manure application is planned, plant cover crops early enough to ensure that sufficient growth has occurred to utilize nutrients (emergence by mid September is typically necessary).

Relay Crops. Relay cropping is a form of cover cropping used by forage producers (e.g., the use of Italian ryegrass between the rows of silage corn). Relay cropping uses cover crops planted between rows of the main crop (typically corn), which remain in the field after the main crop is harvested. Relay cropping is practiced to reduce weed growth during the growing season, to provide an active crop available for fall manure application after corn is harvested, to protect soil from erosion, and to provide additional forage yield. Implement the following practice:

- Plant a relay crop instead of a fall-planted cover crop if fall manure application is planned to ensure better nutrient uptake.

Catch Crops. Catch crops are a specific type of cover crop. The primary goal of a catch crop is to utilize nutrients that would otherwise be leached from bare soil during the fall and winter. In spring, catch crop nutrients

can be removed from the field as a livestock feed or recycled by cultivation into the soil for use by a subsequent crop. Implement the following practices:

- Following crop harvest, test the soil for residual nutrient levels to determine the need for a catch crop.
- Plant a catch crop if there are unused nutrients in the soil.

Plowdown of Cover Crops. When cover crops are plowed down, the decomposition of plants, shoots and roots releases a flush of nutrients, particularly nitrogen, into the soil. In high precipitation areas, spring is the preferred season for plowdown to reduce the risk of nitrogen leaching to watercourses or groundwater.

Contour Cropping

On long sloping fields, crops grown in strips on the contour will minimize the effects of concentrated water flow. This will encourage water to infiltrate into the ground, reducing soil erosion.

Crop Rotation

Crop rotation refers to the practice of growing two or more crops with different growth habits and that are hosts for different problem pests on a given field during different time periods. For example, in the dairy industry a perennial grass or grass-legume mix can be grown for a period of time after which the crop is plowed down with an annual silage corn crop replacing it. The two crops have different rooting characteristics, and varying nutrient and cultivation requirements. Crop rotation can provide an environmental benefit by improving soil structure and nutrient management by reducing erosion and by allowing greater flexibility in the management of pests.

Buffers

Establish and maintain an adequate vegetative buffer between outdoor crop activities and sensitive areas to avoid noise, minimize dust, and reduce odours from causing a nuisance or pollution. Buffers and hedgerows also sequester carbon, mitigating the impacts of agricultural activities on climate change. Agroforestry practices, such as alley cropping, offer options to blend buffer functions with crop production.

➔ see Buffers, **page 11-4**

Outdoor Crop Nutrient Management

The management of nutrients for crops is necessary to achieve a desired yield and uniformity. Nutrient requirements for every crop will be different. Forage grasses, for example, are greater nitrogen users than silage corn. It is important to know the nutrient requirements of a given crop to prevent the waste of nutrients, prevent pollution or greenhouse gas emissions. Nutrients that are not utilized by the crop may leach into groundwater and/or be transported by surface runoff.

Nutrient management refers to the balancing of nutrients removed by a crop during growth with the nutrients available to it from all sources in a manner that protects the environment.

➔ see **Chapter 6,** Nutrient Application

Planting Date. Planting dates will impact nutrient uptake. While crops are usually planted when climate, soil or market conditions are suitable, nutrients only become available in response to specific weather, soil conditions and to human activity. As a result, planting and growth do not always mirror optimum nutrient availability.

- Choose crop variety and planting dates appropriate to the climate and soil conditions of the site to optimize nutrient availability.

Outdoor Crop Water Management

Water management is critical to most crops. A high watertable or drought conditions will reduce the yield of a crop, resulting in reduced utilization of applied nutrients. Where possible, base irrigation decisions on the level of moisture in the soil, crop needs and the growing conditions.

➔ see Irrigation, **page 9-21**

➔ see Drainage, **page 9-42**

Noxious and Invasive Species Management

Noxious and invasive species include insects, plant diseases, and weeds. Transfer is common in areas where farm equipment and farm products moveback and forth between fields and farms. Bacteria, fungi or other organisms growing on the crop or in the soil are readily picked up by equipment. Plant disease and weed infestations can result in significant losses in crop quality and/or yield. Severe contamination may even reduce the range of crops that can be grown on a site.

➔ see **Chapter 7**, Biodiversity

To ensure that pests, diseases and weeds are not spread, implement the following practices:

- Purchase certified plant material or seed, and visually inspect plant material for pests upon receipt and prior to planting.
- When using equipment in fields with known disease or weed problems, rinse equipment thoroughly before moving out of the field.
- Use strategic management and available mitigation guidelines when removing and disposing of dead or diseased plant material (i.e., pruning waste) and trees to prevent the spread of harmful agricultural pests.

➔ see **Chapter 5**, Pest Management

Invasive Pests and Biosecurity

Invasive Species Council of BC

Fraser Valley Agricultural Pest Assessment project

Outdoor Crop Management

Annual Crops. Production and harvesting of annual crops (e.g., carrots, sweet corn) can result in soil erosion when soil is left bare over winter. Harvesting of certain crops can result in significant soil loss. Crop residues from annual crops can generate leachate if they come in contact with water, resulting in a risk of pollution.

➔ see Soil Loss by Harvest, **page 8-15**

Cranberries. Water management for cranberries differs markedly from that of other berries and crops due to the variety of ways that water is used in cranberry production. Water is used for irrigation, disease and insect control, frost protection, and harvesting. Growers impound water near cranberry beds to address the crops' extensive water requirements.

The extensive use of water in cranberry production creates the potential to place fertilizers, pesticides, and other chemicals (such as wood residue) in solution or suspension and to carry them into adjacent waterways. Implement the following practices to prevent water pollution:

- Recover and recycle flood water used in cranberry production.
- After application of a pesticide, impound the affected runoff within the boundaries of the farm for the period of time specified on the pesticide label.
  - When discharging water.
  - Screen debris from water used for harvesting prior to discharge.
  - If unsure about discharge water quality, test it prior to discharge to meet the water quality objectives of the watercourse.

BC Water Quality Website

  - If the water quality is acceptable, release it from impoundment areas gradually to avoid excessive rise in the water table and/or flooding of downstream neighbours.
  - If the water quality is unacceptable, obtain authorization from ENV before discharge.

Forage Areas Used by Livestock. Implement the following crop practices for fields that are grazed or used as livestock overwintering sites:

- Leave sufficient plant cover to protect the soil from compaction and erosion.
- Manage grazing levels to ensure carbon reserves in forage roots and the soils are maintained or increase, to buffer and adapt to climate change.
- This may require increased crop residue to be left in the fall on affected areas or reduced stocking rates to prevent excessive trampling.
- Account for the nutrient content of manure deposited by livestock to match the affected area's need for fertilizer.

➔ see Outdoor Livestock Areas, **page 3-8**

➔ see Nutrient Application, **page 6-10**

Forage Grass. Potassium levels in forage grass grown on dairy farms have been increasing to cautionary levels in recent years. Potassium is the only major nutrient associated with the concept of 'luxury consumption.' Luxury consumption of potassium is strongly associated with the intensive production of grass forages and refers to the uptake of a nutrient well in excess of a plant's requirement for growth. Grass tetany may result from cows eating grass grown on high potassium soils.

Nitrate-nitrogen can, if the concentration in soil is high enough or if there are rapid changes in moisture or temperature, accumulate in plant tissue and cause nitrate toxicity to livestock.

Soil and forage testing are essential to monitor both potassium and nitrate levels on intensive operations. Potassium leaches very slowly which can result in accumulation in the soils if application exceeds crop needs.

➔ see Nutrient Management Planning, **page 6-30**

Forage Plowdown. When perennial forage stands are plowed down, the decomposition of plants, shoots and roots releases a flush of nutrients, particularly nitrogen, into the soil. In high precipitation areas, spring is the preferred season for plowdown to reduce the risk of nitrogen leaching to watercourses or groundwater.

Medicinal and Herb Crops. Medicinal and herb crops are generally grown indoors. Care should be taken not to plant invasive herbs outdoors.

Growing Industrial Hemp Outdoors

Good Agriculture and Collection Practices

Nursery Stock - Field Grown. Implement the following practices to minimize soil loss:

- When planting container nursery stock into a field use the largest feasible pot size to reduce the amount of native soil lost during harvest.
- Practice root pruning for all ball and burlap plant material to minimize root ball size– do not exceed industry standards for root balls to preserve soil.
- After nursery crop harvest, rest the soil with a seeded cover crop for one year.
- Work cover crop into the soil after it has grown to trap nutrients and provide more organic matter to the soil.
- Replace soil removed in the root ball by the addition of soil amendments such as compost.

➔ see **Chapter 6**, Nutrient Application

- Rinse vehicles and equipment before leaving a field to drive on a local road.

To burn prunings and culled plants, follow the burn decision flowchart.

➔ see Open Burning, **page 10-22**

Canadian Landscape Standard 2016

Sod. Implement the following practices to minimize soil loss:

- Reduce harvest to once every 15 months (suggested).
- Optimal harvest sod soil thickness is 1 cm (suggested).
- Use netting material (biodegradable, if possible) to reduce the volume of soil harvested.
- Apply organic and/or mineral material to the soil between harvests.

Tree Fruit and Berry. If burning of prunings is practiced, follow the burn decision flowchart.

➔ see Open Burning, **page 10-22**

Crop Residue

There are possible disadvantages to using plant materials (e.g., crop residues) as mulch to protect the soil or for nutrient management. These include the possibility of introducing invasive pests or plant pathogens; providing refuge for plant pests; tying up soil nutrients; and labour required in managing the residues.

Crop residue that is not managed properly, can be an environmental concern. However, retaining crop residues can be an effective tool in adapting croplands to a changing climate. Implement the following practices for crop residue:

- Incorporate residue into the soil that is easily moved or transported by wind or water (e.g., can be washed or blown to watercourses), but maintain residue that will protect the soil from wind or water erosion.
- Manage leachate from residue piles to prevent water pollution.

➔ see Leachate, **page 9-57**

Forage Seed Production. If burning of stubble is practiced, follow the open burning regulations.

➔ see Open Burning, **page 10-22**

New Crop Development

When developing new cropland, protect critical fish and wildlife habitat.

➔ see Wildlife and Wildlife Habitat Protection, **page 7-22**

➔ see Riparian Areas, **page 11-15**

➔ see Climate Change Factors, **page 12-1**

Stewardship Crops

There are many crop and non-crop plantings that exist for land and/or stewardship purposes, including:

- Lure or sacrifice crops grown to draw wildlife away from feeding on forage cash crops.
- Field margins, shelterbelts, timberbelts, and hedgerows dedicated to wildlife use or providing refuge for wildlife and domestic livestock during harvesting or inclement weather.
- Grass fields normally used for annual cropping but which have been set aside for the sole purpose of providing a benefit to soil biota and to enhance soil structure and fertility.
- Purpose grown bioenergy crops (e.g., hybrid willow plantations) that can provide a source of renewable farm energy and also serve as buffers and provide wildlife refuge.

Roadsides, field corners and riparian areas can also be planted with stewardship crops. Such areas can be managed for limited harvest as well as to provide cover for wildlife. Stewardship crops are increasingly being placed as buffers for overland water flow to capture nutrients and sediments.

➔ see **Chapter 11** Stewardship Area

Crop Handling

Harvested crops may be lost (spilled) in the field, during handling to and from storage, and while in storage. To prevent surface water or groundwater contamination, implement the following practices:

- Keep crops contained during transport to eliminate losses.
- Clean up spills before water sources are negatively impacted.
- Remove waste feed promptly to reduce odours and rodent activity.

Crop Processing

For concerns related to disposal of crop wash water, crop drying (e.g., grain) and feed mills

➔ see On-Farm Processing and Sales, **page 2-66**

Livestock Feed.

- Contain raw materials and processed feeds. Uncontained feed has the potential to contaminate surface water or groundwater.
- Select a site with good drainage, preferably elevated and easily accessible.
- Divert roof water and clean runoff away from the site.
- Clean up spilled feed as soon as possible to reduce odour, discourage rodent activity, and to prevent contamination of surface water.
- Collect, store and handle feed-contaminated surface water.

➔ see Runoff, **page 9-50**

➔ see Leachate, **page 9-57**

- Install dust collection or suppression equipment to prevent the dispersion of feed dusts.
- Establish and maintain an adequate buffer between feed processing areas and neighbours to mitigate noise and dust from causing nuisance or pollution.

➔ see Buffers, **page 11-4**

➔ see Dust and Particulate, **page 10-12**

Crop Waste Disposal

Crop wastes such as culls and procesing wastes are considered agricultural by-products under the AEM Code and need to be managed so that they are stored and composted in a way that the leachate generated is collected and contained. Run off, leachate and solids are not to enter a watercourse, cross property boundaries or enter the water table.

Where appropriate from a pest management standpoint, manage culled or spoiled unusable crops as soil amendments. Do not bury crop waste or dispose of at landfills: buried organic matter releases methane as it decomposes, contributing to climate change.

If insect or disease issues dictate field sanitation measures for mitigation, use recommended strategic management and mitigation guidelines to remove and dispose of dead or diseased crop and pruning waste, plant material and trees to prevent the spread of harmful agricultural pests.

Available resources include:

- BC Tree Fruits Production Guide Insects Management Chapter – Spotted Winged Drosophila – Cultural Management
- Technical Report on Eastern Filbert Blight in hazelnut orchards from BC – Section 4 – Disposal Guidelines

➔ see **Chapter 6** for use of crop wastes as soil amendments. Water that contains crop waste must be handled as contaminated water.

➔ see Contaminated Water Collection, Storage, and Use, **page 9-54**

Crop Storage

Crops must be stored properly to prevent contamination of water sources. Consider the risks of seasonal flooding or storm runoff when selecting a crop storage location. Most contamination under forage and vegetable storage conditions is caused by nutrient rich leachate leaving crop material or water contacting the stored crop, creating leachate. Store crops on hard surfaces to more easily divert and contain leachate and cover to avoid precipitation contacting the stored crop.

➔ see Buildings and Roads, **page 2-2**

➔ see Runoff, **page 9-50**

➔ see Leachate, **page 9-57**

Forage Crop Storage

The following comments on feed storages are separated based on whether such storages are located in high or low precipitation climates. High precipitation exceeds 600 mm total winter precipitation; low precipitation is less than 600 mm.

➔ see Appendix B.1, **page B-2**

Hay Storage: Low Precipitation. Implement the following practices:

- Choose a well-drained site not subject to seasonal water flow or flooding.
- Lay out the site for convenient clean-up of spillage.
- Divert clean runoff away from the site.

➔ see Runoff, **page 9-50**

- Ensure any contaminated runoff leaving the site is controlled and collected.
- Consider covering hay with a tarp or structure to prevent leachate formation.
- Gravel splash pads at the base of hay shed walls for roof stormwater erosion control.

Hay Storage: High Precipitation. Implement the following practices in addition to those listed above for low precipitation areas:

- Cover hay storages to reduce feed losses and to eliminate leachate.
- Use eavestroughs, downpipes and drain piping for roof stormwater control.

Silage Storage: Low Precipitation. Silage leachate poses a great pollution concern. If silage leachate is produced, contain it to prevent entry into watercourses. In low precipitation areas, open pit storages are suitable. Implement the following practices:

- Locate silage storage away from yard drain inlets, ditches and wells and 15 m or more from watercourses (suggested).
- Choose a well-drained site not subject to seasonal water flow or flooding.
- Divert clean runoff away from the site.
- Since silage leachate is expected to be generated, have an impervious floor (e.g., concrete or other material) to contain the leachate.
- Construct silo floors to drain towards the open end to avoid the pooling of rainwater and silage leachate within the silo storage area itself.
- Divert any potentially contaminated flows away from watercourses.
- Direct contaminated flows onto adjacent fields to soak in if pollution will not occur or divert to a liquid storage facility such as a manure pit.

Store silage in plastic bags on sites similar to those above with the following additional practices in place to prevent leachate escape:

- Prepare the site base with fine compacted gravel, concrete, or asphalt to prevent bag puncture.
- Fence to deter livestock and wildlife in order to prevent bags from tearing.
- Keep free of ruts and weeds to discourage rodents.
- Where required, bait the site to control rodents.

Silage bag handling can result in a large amount of waste plastic material which must be disposed of correctly.

➔ see Farm Refuse Disposal, **page 2-23**

Silage Storage: High Precipitation. Implement the following practices **in addition** to those listed above for low precipitation areas:

- Cover storages to reduce silage leachate.
- Use eavestroughs, downpipes and drain piping for roof stormwater control.

INDOOR AND CONTAINER NURSERY CROPS

This section discusses indoor crop practices common to these crops

- Button & specialty mushrooms,
- Container-grown nursery stock,
- Greenhouse-grown crops.

INDOOR AND CONTAINER NURSERY CROPS ENVIRONMENTAL CONCERNS

Primary environmental concerns related to indoor crops and container nursery production are:

- Escape of leachate or spent nutrient solution from the production facility that results in nutrients causing water pollution.
- Increased water flow leaving the site due to the amount of impervious surface that results in soil and watercourse erosion and downstream flooding.
- Emissions from greenhouse boilers that result in air pollution.
- Inappropriate crop residue management that results in soil, water and air pollution.
- Movement of plant material infested with invasive plants or exotic pests or the invasive plants or exotic pests themselves that results in impacts to biodiversity.
- Mushroom media production that results in water or air pollution.
- Emissions from greenhouse lights that result in light pollution.
- Energy use and greenhouse gas emissions; greenhouse operations are among the most energy-intensive agricultural operations in BC.

For detailed information on these concerns:

➔ see Heat Production and Agricultural Boilers, **page 2-54**

➔ see Impacts on Biodiversity and Habitat, **page 7-7**, and refer to Farm Activities and Impacts

➔ see Soil Quality Factors, **page 8-2,** refer to Contaminants

➔ see Water Quality and Quantity Factors, **page 9-1**, refer to Contaminants, and to Overland Flow

➔ see Air Contaminants, **page 10-1,** refer to Dust and Particulates

➔ see Light Emissions, **page 4-23**

➔ see Climate Change Factors, **page 12-1**

INDOOR AND CONTAINER NURSERY CROPS LEGISLATION

The following is a brief outline of the main legislation that applies to indoor crops and container nurseries.

➔ see **page A-1** for a summary of these and other Acts and Regulations

Local Bylaws

Many local governments have specific bylaws on cannabis production, mushroom media (composting) production, greenhouse coverage, heating fuel (emissions) and lighting.

 Agricultural Land Commission Act

The *Agricultural Land Commission (ALC) Act S.B.C. 2002, c. 36, and Agricultural Land Reserve (ALR) Regulations* are the legislative framework for the establishment, administration, and procedures of BC's agricultural land preservation program. The ALC Act takes precedence over, but does not replace other legislation and bylaws that may apply to the land. Local and regional governments, as well as other provincial agencies, are expected to plan in accordance with the provincial policy of preserving agricultural land.

The *ALR General Regulation, B.C. Reg. 171/2002*, identifies the procedures for submitting applications and notices of intent.

The *ALR Use Regulation, B.C. Reg. 30/2019* specifies land uses permitted in the ALR.

The policies of the Commission provide interpretation and clarification of the regulations; outline guidelines, strategies, rules or positions on various issues and provides clarification and courses of action consistently taken or adopted, formally or informally.

ALC Policies and Bylaws

 Drinking Water Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

SECTION 23(1): subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

There are two regulations under the act that pertain generally to crops and specifically to mushroom media production.

 Environmental Management Act

The *Code of Practice for Agricultural Environmental Management requires persons to use environmentally responsible and sustainable agricultural practices when carrying ou*t agricutural operations, for the purpose of minimizing the introduction of waste into the environment and preventing adverse impacts to the environment and human health. Section 52 of the AEM Code contains requirements for the application of nutrient sources other than to land, with specific requirements for container crops.

- The AEM Code requires that nutrient sources or any leacheate produced do not escape during transport or piping;
- During container production, nutrient sources are not to be discharged or applied directly into a watercourse, across property boundaries, or go below water tables, and;
- Contaminated runoff, leacheate, and drift from sprayed nutrient sources does not enter a watercourse, cross a property boundary, or go below water tables;
- The AEM Code specifices that the total amount of available nitrogen from all applied nutrient sources applied in one year of application is equal to or less than the amount of nitrogen needed for optimum crop growth.

Operations that apply nutrient sources to crops but not to land are required to maintain records of crop nutrient requirements, the nutrient application rates and types of nutrient sources applied.

Mushroom Compost Facilites Regulation applies when a farm is producing media that will be sold off-farm. It regulates air and water discharges by requiring an implemented **pollution prevention plan**. The specifications for the plan are identified in the Regulation.

Plant Protection Act

Administered by AFF, this Act is the provincial counterpart to the federal *Plant Protection Act* that focuses on plant protection issues affecting Canada. It provides for the prevention of the spread of pests destructive to plants in BC. Inspectors have powers to enforce the provisions of the Act, including the authority to establish quarantine areas. To assist in the enforcement of the Act, the BC Plant Protection Advisory Council advises and co-ordinates the actions of provincial and federal officials to deal with potential hazards to BC agriculture and forestry from insects, plant diseases, weeds or other biotic agents. The Council's power comes from the mandates of the agencies whose members sit on committees struck to deal with plant protection issues in specific commodity sectors.

The purpose of this Act is to prevent the deleterious spreading of insects, pests, or diseases that are destructive to plants. Under this Act, inspectors may enter premises at any reasonable time for an inspection of the premises, plans, root mediums, or containers. They can order the treatment, confiscation, or destruction of plants. Regulations under this Act include:

- *Bacterial Ring Rot Regulation,*
- *Balsam Woolly Adelgid Regulation,*
- *Blueberry Maggot Control Regulation,*
- *Domestic Bacterial Ring Rot Regulation,*
- *Golden Nematode Regulation,*
- *Little Cherry Control Regulation,*
- *Northern American Gypsy Moth Eradication.*

Public Health Act

Administered by the Ministry of Health, this Act has a specific prohibition that "a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard". This prohibition would apply to farm practices that may result in a health hazard, such as when nutrients, contaminants or pathogens are discharged to land, water or air to pose a public health problem. Any situation that entails a health hazard will enable health officers to investigate using their powers under the Act. Under the *Public Health Act*, the local Health Authority must investigate any health hazard and has authority to order that a person prevent or stop a health hazard, or mitigate the harm or prevent further harm from a health hazard amongst other powers. Similar regulatory provisions exist for addressing health hazards to drinking water supplies under the *Drinking Water Protection Act*.

Weed Control Act

Administered by AFF, this Act places the responsibility for the control of noxious weeds on the occupiers of the land. It provides for the appointment of inspectors to ensure compliance and, failing that, for a method by which they can control weeds and recover the costs from the occupier. Weed Control Committees may be established by municipal councils to administer the Act within a municipality. Committees report to the municipal council and the Minister.

Fisheries Act

Administered by both Fisheries and Oceans Canada and Environment and Climate Change Canada, this Act is established to manage Canada's fisheries resources, including fish habitat. The Act can also be administered provincially by FLNRORD and ENV. The Act applies to all Canadian waters that contain fish, including ditches, channelized streams, creeks, rivers, marshes, lakes, estuaries, coastal waters and marine offshore areas. It also applies to seasonally wetted areas that provide fish habitat such as shorelines, stream banks, floodplains, intermittent tributaries and privately owned land. The Act includes provisions for stiff fines and imprisonment to ensure compliance.

The purpose of this Act is to provide a framework for (a) the proper management and control of fisheries; and (b) the conservation and protection of fish and fish habitat, including by preventing pollution.

This Act was updated in 2019 and now empowers the Minister to make regulations for the purposes of the conservation and protection of biodiversity.

The definition of fish habitat is: "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas". The quantity, timing and quality of the water flow that are necessary to sustain fish habitat are also deemed to be a fish habitat. Furthermore, serious harm to fish includes the death of fish or any permanent alteration to, or destruction of, fish habitat.

Provisions of the *2019 Fisheries Act* relevant to agricultural operations include:

- Protection for all fish and fish habitats;
- Prohibition against the death of fish or the 'harmful alteration, disruption or destruction of fish habitat';
- A permitting framework and codes of practice to improve management of large and small projects impacting fish and fish habitat;
- Protection of fish and/or fish habitats that are sensitive, highly productive, rare or unique; and
- Consideration for the cumulative effects of development activities on fish and fish habitat.

Specific sections of the Act include:

SECTION 34.2(1) The Minister may establish standards and codes of practice for:
(a) The avoidance of death to fish and harmful alteration, disruption or destruction of fish habitat;
(b) The conservation and protection of fish or fish habitat; and
(c) The prevention of pollution.

SECTION 34.4(1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

SECTION 35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.

Every person who contravenes subsection 34.4(1) or 35(1) is guilty of an offence and liable.

Notifying authorities about serious harm to fish or deposit of a deleterious substance:

SECTION 38 (4.1) Every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations of a harmful alteration, disruption or destruction of fish habitat that is not authorized under this Act, or of a serious and imminent danger of such an occurrence, if the person at any material time
(a) Owns or has the charge, management or control of the work, undertaking or activity that resulted in the occurrence or the danger of the occurrence; or
(b) Causes or contributes to the occurrence or the danger of the occurrence.

SECTION 38 (5) If there occurs a deposit of a deleterious substance in water frequented by fish that is not authorized under this Act, or if there is a serious and imminent danger of such an occurrence, and detriment to fish habitat or fish or to the use by humans of fish results or may reasonably be expected to result from the occurrence, then every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations.

SECTION 38 (7) As soon as feasible after the occurrence or after learning of the danger of the occurrence, the person shall provide an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations with a written report on the occurrence or danger of the occurrence.

Plant Protection Act

Administered by Agriculture and Agri-Food Canada, this Act is to protect plant life and the agriculture and forestry industries by preventing the importation, exportation, and spread of injurious pests.

INDOOR AND CONTAINER NURSERY CROPS BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable legislation, including the above, and where appropriate, use the following beneficial management practices to protect the environment.

Implement the following practices for indoor crops and container nursery facilities:

- Locate with proper setbacks from watercourses;

➔ see Farm Building Siting, **page 2-8**

- Locate where contaminated runoff or leachate can be controlled and collected:
  - Fine textured soils (soils with more than 20% clay content) are preferred as leachate does not move as quickly through clays and remain on the surface allowing them to be collected.
- Collect and manage roof water if roof area is more than 10% of a site area (suggested).
- Consider integrating rainwater collection system with irrigation water supply to reduce dependence on surface or groundwater sources.
  - Stormwater flow is increased as impervious roofing or yard areas are increased.

➔ see Buildings and Roads Practices, **page 2-6**

- Implement energy conservation practices in construction, maintenance and operation of indoor crop and nursery facilities see Energy Use, **page 2-57.**
- Establish and maintain an adequate buffer between greenhouse, container nursery and mushroom facilities and neighbours to avoid noise, dust, and odours from causing a nuisance or pollution. Plant buffers with trees or shrubs to sequester C and offset greenhouse gas emissions from the operation.

➔ see Buffers, **page 11-4**

Nursery Production Resource Guide for BC

Greenhouse Vegetable Production

Cannabis Production Best Management Practices Guide

Nutrients Applied Through an Irrigation System (Fertigation)

When nutrients are applied through an irrigation system, implement the following practices:

- Install an efficient and uniform application system.
- Install a device to prevent backflow.
- Match application rates and amounts to crop requirements to reduce over watering and excessive leaching (e.g., a computerized irrigation scheduler controlling a drip system is more efficient than an overhead system).
- For container crops, use drip irrigation when practical to apply water to the crop.
- Avoid areas where crops are not grown to eliminate the need to capture any nutrient-rich water.

Irrigation Management Guide for BC

Leachate. The degree of leaching required to maintain healthy container crops is strongly related to the tolerance such crops exhibit to accumulations of salts within the growing media. Manage salt levels in growing media to minimize the need for leaching and the subsequent discharge of nutrient-rich water. Leachate may account for 10% to 30% of total irrigation water applied. If leachate has nutrient or pesticide levels that could cause pollutionthe water must be captured and recirculated or retained until such time that it can be discharged without causing pollution.

➔ see Leachate, **page 9-57**

Implement the following practices to manage leachate:

- For impervious subsoil, recover irrigation waste water in field drains for storage.
- For pervious subsoil, use concrete floors or polyethylene floor liners in greenhouses or nurseries to collect all leachate.
- In greenhouse or nursery production, use water recirculation techniques to both reuse leachate as a nutrient source and to conserve water.
  - due to disease transfer concerns, recirculation is not feasible on all operations

Spent Nutrient Solution. The concentration of nutrients in recirculated water can be reduced by decreasing the amount of fertilizer added at the end of a production cycle. Dispose of the spent nutrient solution at the end of the cycle by applying to other suitable agricultural crops.

➔ see Nutrient Application, **page 6-1**

Any effluent discharge into the environment, which is not being used as a fertilizer for crop production, requires a permit from ENV.

Noxious Species and Invasive Pests

To ensure that neither diseases nor pests are spread, implement the following practices when purchasing propagative plant material:

- Do not propagate invasive plants.
- Use certified pest-free plant material if available:
  - monitor plants upon arrival to the farm;
  - if possible, isolate new plant material for a period of time prior to moving into production areas.

➔ see **Chapter 5**, Pest Management

Soilless Media

Storage of Media. Store raw materials as well as prepared and spent media in such a way as to prevent their release into the environment.

Use of Media. The choice of growing media in a greenhouse or nursery operation has a significant effect on overall water consumption. Watering efficiency can be increased through the choice of substrates with higher water holding capacity. However, such substrate use may be limited by an often higher potential for root rot.

Disposal of Media. Dispose of unused, spent or waste media in a manner that does not cause pollution. Reuse within the operation or use these materials as a soil conditioner.

➔ see Soil Conditioner Application **page 6-29**

Greenhouse

Cooling. Shade materials such as nettings or curtains are preferred over shading compounds that are sprayed on greenhouse roof or walls. Shading compounds used on the outside of greenhouse structures can contribute to stormwater contamination. Roof venting is also an important component of greenhouse climate regulation. Fans used to pull air out of the structure should be properly maintained to prevent noise.

Capture and appropriately deal with contaminated water that will cause pollution.

➔ see Runoff, page **9-50**

Consider using rainwater collected from greenhouse roof systems as an alternative source of irrigation water.

Crop Residue. Other parts of this Guide address concerns associated with crop residue from greenhouses:

- Crop prunings, plants and waste organic media application to soil.

➔ see Soil Conditioner Application, **page 6-28** organic wastes for compost

➔ see Compost, **page 2-48** plastic clips, strings, pots, rockwool

➔ see Farm Waste, **page 2-19**

Building Drains. Greenhouses may be constructed with perimeter drains to divert clean roof water away from the building foundation. If a greenhouse also has separate drains to collect spent irrigation water or contaminated floor water, implement the following practice:

- Test drains to ensure they are not cross-connected by introducing a ENV-approved dye into the contaminated water drain system and checking that the dye does not show up in the perimeter drain discharge.

Boiler Emissions. Greenhouse operations are among the most energy intensive agricultural operations. Greenhouse boilers may generate air emissions that contribute to climate change or particulatesthat could result in air pollution.

➔ see Heat Production and Agricultural Boilers, **page 2-54**

Light Emissions. Greenhouses may emit light that causes a nuisance to neighbours and excess lighting contributes to energy waste and greenhouse gas emissions. Depending on the intensity of your lights and the light emission reduction desired, consider using the following:

- Do not use supplemental lighting during the evening hours of 6 PM to midnight. (crops need a period of darkness; this will minimize impacts on your neighbours).
- Control light emissions:
  - Use light abatement material such as black-out curtains, light abatement screens or thermal curtains on side walls and overhead if feasible.
- Consider vegetation buffers for very close neighbours (an IPM program may be required to reduce potential insect problems resulting from the buffer). Vegetative buffers sequester carbon helping to offset greenhouse gas emissions from the operation.

Nursery

Wood Residue. The use of wood residue products such as sawdust and hog fuel is regulated under the Environmental Management Act as leachate from this material can be toxic to fish.

➔ see Wood Residue, **page 2-37**

Crop Residue. Other parts of this Guide address concerns associated with crop residue from nurseries:

- prunings, plants and waste organic media application to soil
  ➔ see Nutrient Application, **page 6-1**
- organic wastes for compost
  ➔ see Compost, **page 2-48**
- sheet plastic, pots, trays, fertilizer bags, pesticide containers
  ➔ see Farm Waste, **page 2-19**

Mushroom Media Production. The production of mushroom media is predominantly from organic raw material that, if not handled carefully, may create considerable leachate and odour problems. Beneficial practices specific to mushroom media production include those associated with:

a) Storage of raw materials, final products and by-products;

b) Media preparation, including composting, facility design and operation;

c) Effluent (specifically "goody" or "brown" water) control, storage and recycling;

d) Air emissions management and odor abatement.

Generally speaking, the storage of raw material and of products or by-products of the operation, and the production of mushroom compost must not cause pollution. Minimum standards for composting and the production of mushroom compost (mushroom media) are set in the *Mushroom Compost Facilities Regulation*, the *Code of Practices for Agricultural Environmental Management* and the *Public Health Act* and include:

a) Location of a mushroom compost facility is subject to regulatory minimum setbacks for facilities, for operations and for storage of organic material, products or by-products from water sources and property boundaries. Local governements that have specific mushroom production bylaws may differ from the provincial setbacks. Operations and storage sites must also not be located, even temporarily, in areas prone to annual flooding or otherwise standing water. The careful attention to facility design and site selection will also help to minimize odour nuisance problems.

b) A pollution prevention plan for the mushroom composting facility that respects air, surface and groundwater must be prepared and implemented. It needs to take into consideration all sources of air contaminants and liquid effluencts and includes monitoring and reporting.

c) Control and containment of air emissions and leachate. A mushroom facility must be, and its operations must be conducted, on an impermeable surface that prevents pooling of water and the release of leachate into the environment. Leachate can be effluents from all organic material or water (precipitation or run-on) that has come in contact with organic materials. The leachate (also called "goody" water or "brown" water) must be collected and treated in an enclosed system. Furthermore, all organic materials except for baled straw must be covered.

   Leachate that has been treated and that is not recycled back into the operation may be discharged to land or water. The Ministry of the Environment and Climate Change Strategy has to be notified prior to the release. The disposal to land is usually similar to that designed for a septic field. It is often the least odourous and most environmentally friendly method to manage the remaining leachate.

Air emissions from the composting process and the leachate collection and treatment system can be quite odorous, in particular problem with wet straw-bedded horse manure or poultry litter. Therefore, raw material can be mixed outdoors but must then be moved for composting into an enclosed facility that is under negative pressure with an aerated floor for composting within the same calendar day. Emissions from both, the compost operation and the leachate collection and treatment system, must be collected and treated by a scrubber and a biofilter. Scrubbers produce substantial amounts of waste products such as ammonium sulfate. It is recommended to have a disposal plan.

Air contaminants from forced air ventilation must not enter a watercourse or cross a property boundary. Some odour emissions from mushroom compost facilities may fall into that category.

In addition, the following measures can help to reduce the generation of leachate of run-off.

- Ensuring good moisture content management and the protection of piles by diversion (drains, berms) of run-on can effectively reduce leachate to almost zero.
- Mushroom barns may be constructed with perimeter drains to divert clean roof water away from the roof and building foundation. If a mushroom barn also has separate drains to collect contaminated water, implement the following practice:
  - Test drains to ensure they are not cross-connected by introducing an approved natural food dye into the contaminated water drain system and checking that the dye does not show up in the perimeter drain discharged.
    ➔ see Runoff, **page 9-50**

Fresh Media Storage. Mushroom media is typically stored on a concrete pad near the mushroom house while the beds are filled. During this time, the compost may be exposed to rain, creating leachate and contaminated runoff.

Implement the following practices:

- Locate media storage (fresh and spent) away from yard drain inlets, ditches, wells and watercourses:
  - 15 m or more from watercourses (suggested).
  - 30 m or more from water intake used for domestic purposes (suggested).
- Minimize the amount of runoff:
  - Schedule compost deliveries to arrive as the compost is required.
  - Fill beds as soon as possible after the compost arrives, keeping it out of the rain.
  - Provide a covered storage area for fresh media in high precipitation areas.
  - Clean up debris from receiving and filling areas frequently.
  - Divert run-on away from fresh media piles.
  - Collect all contaminated runoff that can pose a pollution risk.
  - Use controlled infiltration of the the leachate, as it cannot be recycled.
    ➔ see Runoff, **page 9-50**

Compost Facility Requirements Guideline

Spent Media. Once mushrooms have been harvested, the compost is considered "spent media" substrate (SMS). It is a by-product which is usually removed from the mushroom production site and used as soil amender. All pertinent regulatory standards for the storage of organic material apply and it is recommended to remove that substrate as soon as possible from the facility site.

Summary of General Composting Best Management Practices

On-farm Composting in British Columbia: a Step -by-Step Guide for small to Medium-sized Farm Operations

Mushroom Production

Farm Practices for Mushroom Production

Compost Facility Requirements Guideline

Crop Waste Disposal

Manage culled or spoiled unusable crops as soil amendments.

➔ see **Chapter 6** for use of soil amendments.

Water that contains crop waste must be handled as contaminated water.

➔ see Contaminated Water Collection, Storage, and Use, **page 9-60**