

Sustainable Growing Practices

Indigenous Greenhouse Factsheets



Project sponsor: the B.C. Indigenous Advisory Council on Agriculture and Food (IACAF)



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Introduction

Incorporating practices that support the living systems within your greenhouse to be healthy and balanced can improve yields and reduce pests and disease. This factsheet provides an overview of key sustainable growing practices: Integrated Pest Management, Crop Rotation and Soil Health Management and Irrigation Management.

Integrated Pest Management (IPM)

Pest control is critical for healthy greenhouse operations. Integrated Pest Management (IPM) is a comprehensive, science-based approach to managing pests that focuses on long-term pest and disease prevention and control while minimizing risks to human health and the environment. It combines various control methods to deliver sustainable, cost-effective solutions. This approach requires ongoing monitoring and adjustment of strategies based on results and changing conditions.

Key components of IPM:

1. Prevention and cultural control

- Using pest resistant plant varieties
- Maintaining healthy soil and proper irrigation
- Implementing crop rotation and sanitation practices
- Creating barriers to pest entry

2. Monitoring and identification

3. Setting action thresholds

- Determining acceptable pest levels
- Establishing economic injury levels
- Making evidence-based decisions on when to act

4. Control methods

- Biological control: using natural enemies like predators, parasites and pathogens
- Physical/mechanical control: traps, barriers, temperature management
- Cultural control: modifying the environment to reduce pest survival
- Chemical control: used as a last resort, selecting the least toxic pesticides, utilizing spot treatments to minimize exposure to humans and the environment

Biological control: Use of beneficial insects

Greenhouse crops are susceptible to numerous pests, including aphids, whiteflies, thrips, and spider mites. An environmentally friendly and effective way to manage these pests is by introducing beneficial insects and mites into the greenhouse. This strategy reduces the reliance on pesticides and promotes ecological balance.

Common greenhouse pests and biological controls

1. **Aphids:** Controlled using parasitic wasps (*Aphidius colemani*, *Aphidoletes aphidimyza*), convergent ladybugs, or biopesticides.
2. **Whiteflies:** Managed with parasitoid wasps (*Encarsia formosa*, *Eretmocerus*).
3. **Thrips:** Addressed using predatory mites (*Amblyseius swirskii*, *Neoseiulus cucumeris*).
4. **Spider Mites:** Mitigated with predatory mites (*Phytoseiulus persimilis*, *Neoseiulus californicus*)

For effective biological control implementation:

- Monitor pest populations weekly using magnifying glasses and sticky traps

- Introduce beneficial insects preventatively or curatively based on pest presence
- Maintain optimal greenhouse conditions for beneficial insect activity (e.g., humidity and temperature)

Crop rotation

Rotating families of crops assists with both soil fertility and pest management.

- Rotate crops with different nutrient requirements and root structures to prevent soil nutrient depletion and reduce pest and disease buildup.
- Include legumes (beans, peas, vetch and others) in the rotation to fix nitrogen in the soil, reducing the need for synthetic fertilizers.

Soil health

Soil health is critical to plant vigor and yields. It is especially important when managing a greenhouse using permanent raised beds systems it is essential to prioritize soil health. Here are some best practices to implement in a greenhouse system.

Soil testing

Soil testing can provide information on soil nutrients, pH levels, electrical conductivity and organic matter content. Test results can assist in informing your soil management strategies. For accurate soil test results, a composite soil sample must be created by taking samples from several locations that are representative of the entire sampled area. Failure to take a representative sample can lead to an under or overapplication of nutrients.

Lab testing of greenhouse soil up to three times per season can provide a breakdown of fertilizing elements, guiding more precise adjustments and soil management. Testing the mineral content of irrigation water is also recommended to address salinity at its source.

Contact the Ministry of Agriculture and Food for information on soil labs and test result interpretation.

Electrical Conductivity (EC) test for soil

The electrical conductivity (EC) test measures a soil's ability to conduct electricity, expressed in millisiemens per centimeter (mS/cm). This metric reflects the concentration of fertilizing elements in the soil solution, enabling growers to monitor and optimize fertilization strategies.

How the test works

A salinometer or conductivity meter is used to measure EC. This compact device, equipped with an electrode, provides quick insights into soil salinity levels. By offering near-instant results, it allows greenhouse managers to make timely fertilization adjustments without waiting for lab analysis. Adding fertilizer increases the soil's conductivity, so EC readings rise with higher fertilizer levels.

Importance of measuring EC

Regular EC testing empowers greenhouse operators to independently monitor fertilization, particularly in controlled environments where fertilizers accumulate due to the absence of natural leaching by rain. This is critical for avoiding excessive salinity, which can harm plants despite indicating high fertility levels. Objectives of EC Testing are to:

1. Identify excessive salinity, allowing you to postpone fertilization or implement measures like leaching to reduce salinity levels and
2. Monitor fertilization. Low readings indicate a need to fertilize.

For more detailed information on measuring EC, see the Small-Scale Greenhouse Guide for Indigenous Communities in British Columbia.

Risks of excessive salinity

High soil salinity poses several challenges, including:

- **Accumulation of harmful elements:** Sodium, chlorine, and sulfur can become problematic in large quantities.
- **Plant health issues:** Increased risks of blossom end rot in peppers, water stress due to osmotic imbalance, and reduced yields in crops like tomatoes.
- **Pathogen susceptibility:** Cold soil combined with high salinity encourages fungal pathogens, such as Pythium in crops like cucumbers.

Interpreting EC test results

To prevent salinity-related risks, measure soil EC every two weeks. However, remember that EC tests do not differentiate between types or proportions of fertilizing elements. Variations in results can occur due to recent fertilization, nutrient uptake, and greenhouse conditions.

Addition of organic matter

Regular additions of organic matter to your soil such as compost and well-rotted manure can improve soil structure, enhance water retention, and provide essential nutrients.

Planting cover crops such as clover, rye, or vetch during off-seasons or when areas are being unused that will later get dug or tilled in is another way to add organic matter to soil. Cover crops prevent soil erosion, add organic matter, and improve soil fertility when turned into the soil.

Minimizing soil disturbance

- No-till or reduced-till practices can be beneficial. Minimize tillage to maintain soil structure, reduce erosion and compaction, and preserve soil organic matter.
- Use conservation tillage methods that leave crop residues on the soil surface to protect against erosion and improve moisture retention.

Irrigation management

Implementing efficient irrigation systems such as drip or soaker hoses to deliver water directly to the soil and plant roots reduces water waste and soil erosion and can reduce disease problems in your greenhouse.

Application of mulch or tarps to conserve soil moisture, regulate soil temperature, and suppress weeds is also beneficial.

Keep in mind that water quality can impact soil quality and characteristics over time. Consider testing irrigation water and monitor.



Figure 1. Drip line irrigation supports water conservation and minimizes nutrient leaching