

# AGRICULTURAL CLIMATE SOLUTIONS



## BC Living Lab Tree Fruit Workshop

*Key takeaways from the presentations and discussions*

*Coast Capri Hotel, Kelowna  
January 4, 2023*

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# Introduction

This event was organized as part of the fact finding on best management practices (BMPs), including the use of cover crops, for enhancing climate resilience in tree fruit orchards. It is expected to lay critical groundwork for successful industry participation in the ACS BC Living Lab climate initiative, launched last summer by the Minister of Agriculture and Agri-Food, the Honourable Marie-Claude Bibeau. “The ACS Living Labs is a \$185 million, 10-year program that aims to establish a strong Canada-wide network of regional collaborations led by farmers and including scientists and other sectoral stakeholders.”

The BC Living Lab (BC LL), similar to others rolled out in Alberta, Saskatchewan, New Brunswick, and other provinces, is a new model for collaboration and brings together producers, scientists, and other key stakeholders, to test BMPs and technologies under real-world conditions, with a view to reducing greenhouse gas emissions, enhancing carbon capture, and strengthening climate resilience in the agricultural sector. Within the BC LL program, BMPs of interest will be evaluated across four commodity groupings:

- Cattle and Forage
- Dairy
- Field Vegetables
- Perennial Row Crops (tree fruit, wine grapes, blueberries, raspberries and hazelnuts)

The Perennial Row group will focus on (i) inter row cover crops and (ii) improved irrigation and fertilizer management (this will be implemented in conjunction with cover crops in blueberries, raspberries, and hazelnuts).

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# Workshop Objectives

1. Host a grower engagement session and kick off the tree fruit component of the BCLL program
  2. Provide information on the ACS Living Lab program, with a focus on growers
  3. Provide information to growers on the drive-row vegetation alternatives that are proposed as part of our project.
  4. Provide sessions on climate, soil and other relevant topics.
  5. Provide an opportunity for grower input and discussion of the alternatives and enable a better understanding of the status quo as it relates to cover crops.
  6. Provide time for networking with academic researchers and other program collaborators.
  7. Take the first steps to recruit interested growers for participation in the project
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# BC Living Lab - What is it?

- BCLL is 1 of 13 across Canada
  - Promotes the adoption of BMPs that provide climate AND environmental benefits
  - Thematic areas
    - Climate change mitigation - C sequestration and GHG mitigation
    - Partnership
    - Real life context
    - User-centred innovation
    - Iterative - continuous improvement cycles throughout the life of the project
  - Cover crops will be the BMP of focus across all perennial crops - various associated environmental co-benefits (e.g. improved crop performance, soil health, and biodiversity above and below ground)
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# What Does the Science Say?

## **CARBON CAPTURE**

- Tree fruit orchards offer unique opportunity for carbon sequestration
  - Recent research in Okanagan orchards and vineyards show the potential of soils associated with irrigated, woody perennial to accumulate and store C. Carbon fraction is higher in cultivated soils.
  - Irrigation + the act of farming helps to build soil organic carbon (SOC). This stops if cultivation stops
  - Inter row (alleyway, drive row) soil has higher C than crop row
  - LL BMPs, such as cover cropping can help to build SOC beyond that accumulated though no till cultivation.
    - SOC is impacted by soil type + environment + management practices (i.e. limiting factors)
    - Management practices include recycling of organic matter and import of C sources (e.g. addition of compost)
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# What Does the Science Say?

## **CARBON CAPTURE**

- Extending the active root zone (ie. tree rooting system + cover crop rooting system) assists with cycling of C, increase C fraction in the soil, and has positive impact on crop yield/quality
  - Several factors impact C capture by cover crops, including:
    - Produced biomass
    - C/N ratio (influenced by type of cover crop mix)
    - Soil depth and texture
    - Crop rotation cycle
    - Residue management
  - Incorporating protective treatments such as biochar and zeolite help to retain C in the soil - (e.g. combinations of biochar-compost-cover can yield positive result)
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# What Does the Science Say?

## Nitrogen Management

- Not much is known about N<sub>2</sub>O emission from Okanagan orchards - however, data shows that N<sub>2</sub>O is lost BOTH within and outside of growing season
  - Sources of N in the soil
    - Biological N fixation
    - Commercial fertilizer
    - Decomposition of organic matter
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# What Does the Science Say?

## CO-BENEFITS ASSOCIATED WITH COVER CROPPING

- Improved soil health - fertility (nutrient cycling), soil biome diversity, water holding capacity, reduced compaction and erosion etc.
    - \*\*No global indicators of soil health, as this is very dependent on production system
  - Reducing fertilizer inputs (e.g. by utilizing crops such as legumes)
  - Pest and weed suppression
  - Enhanced biodiversity
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# General Considerations

In order to have a trial design that meets program criteria as well as producer needs, the most useful approach is to reflect on the issues from a thematic point of view. This is summarized under 4 thematic areas for consideration:

- **Grower priorities**
  - **New Tools/techniques of interest to growers**
  - **Cover Crop Selection Criteria**
  - **Orchard Selection Criteria (primary and secondary sites)**
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# Grower priorities

## What growers would like to see:

- Commercial N replacement (or reduction)
- Weed management (reduced reliance on herbicides) - one grower indicated seeing development of resistance to herbicides (Grower DM)
- Improving tree health/resilience
- Improving soil fertility
- Demonstration of BMPs to other growers - one grower shared their own experiences with testing cover crop mixes on their organic farm (Grower KS)

## Some concerns expressed:

- Need to ensure that organic growers can participate in the LL. Many of the BMPs are already being implemented on organic farms, so there has to be additional benefits to participating (Grower KS)
  - It is important to make growers aware of the scope of testing/monitoring that will be done and the time and resource commitments that will be required on the part of the grower (Growers PS and DM)
  - Need to develop criteria for selecting cover crops with an underlying understanding of what is important to the grower - e.g. potential revenue source (Grower AS)
  - Need to consider the potential risk of rodent infestation with the establishment of cover crops (Grower MG)
  - Need to ensure that crop establishment does not impinge the effectiveness of irrigation systems, and that cover crops do not compete with main crops for irrigation water (Grower TG).
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# New Techniques/Practices of interest

- Mowing vs. crimping tool
  - Mow and blow
  - Incorporation of C sources such as pomace (also helps to solve a waste management problem for the by-product of cidery operators)
  - Testing of 'new' crops as drive row vegetation - e.g. mushrooms
  - Establishment of cover crops for replant areas (e.g. biofumigant cover crops)
  - Work with existing orchard vegetation with modifications to current practices (e.g. modification to irrigation practices, extending time to mow etc.)
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# Criteria for Orchard Selection (primary and secondary sites)

- Need to consider orchard location - need to be representative of the geographic distribution of orchards, but within reasonable proximity to researchers - (Kelowna to Penticton suggested)
  - Type of production system - organic and/or conventional
  - Tree fruit crop to be investigated - apple vs. cherry etc.
  - Orchards with cover crops already established vs. orchards with no/low involvement with cover crops
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# Criteria for Cover Crop Selection

- Crops that are applicable to both conventional and organic production (e.g. pollinator attractors such as legumes)
  - Crop row vs. drive row crops
  - C capture potential
  - Drought tolerance - establishment of certain drought tolerant crops may be very challenging (e.g. buckwheat)
  - Low growing and low maintenance crops (e.g. less mowing required)
  - Crops that benefit the soil microbiome - impact on the N cycle; impact on crop and soil health)
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# Other things to bear in mind

- Cover crop establishment may increase water usage - but need to consider that water is important for C sequestration
  - Research in wine grapes (Mehdi et al) has led to the development of criteria for cover crop selection, which may be useful as a reference to future work in tree fruit
  - Whilst the LL's iterative approach allows for adaptation of the research projects, growers and collaborators need to appreciate that the benefits may be long-term and therefore take this into consideration before making any major adjustments. Thus, growers and collaborators must always keep the 'big picture' in mind.
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# Next Steps

- Workshop proceedings to be circulated to workshop participants as soon as possible
  - BCFGGA will liaise with with Mehdi Sharifi to review cover crop selection criteria developed for grape industry for potential adoption in tree fruits
  - BCFGGA will prepare an orchard profile with key features selection as (i) primary site and (ii) secondary site.
  - Communication to growers regarding the selection process and the timelines for current year and future years' program implementation.
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