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Canadian Ornamental Horticulture Research  
and Innovation Cluster Projects (no. 2032)



# Pre- and post-harvest treatments to maintain quality and control diseases of greenhouse and nursery crops species

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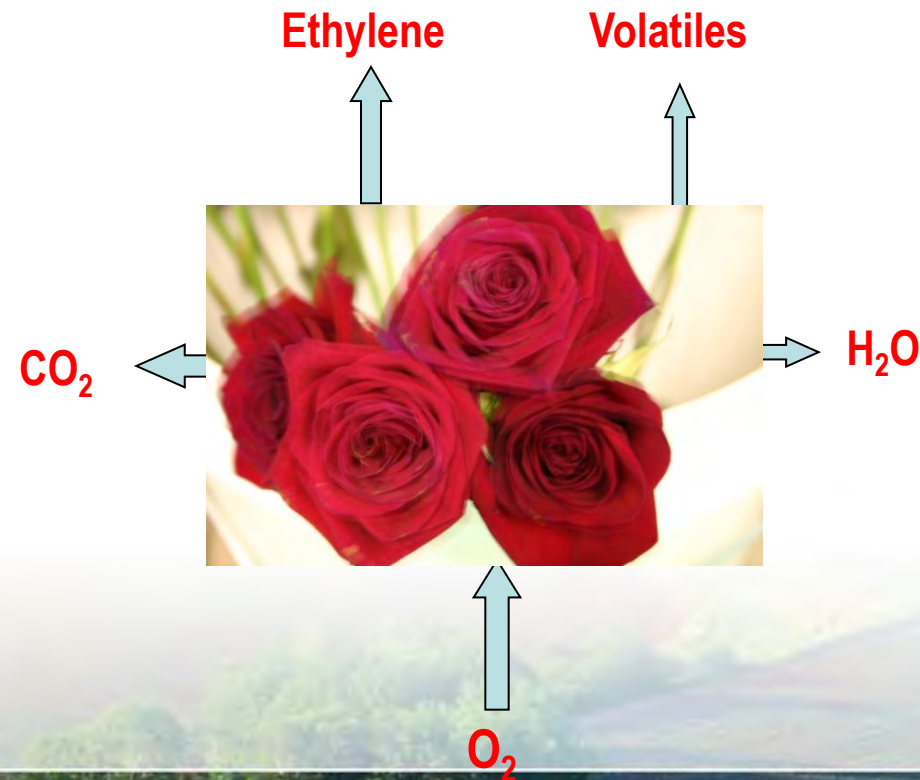
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Canada 

# Quality of fresh flowers and pot plants:

## Appearance (color, vase-life) and free of diseases



- **Main reasons for loss of ornamental value:**
  - Flower senescence
  - Deterioration of petals due to microbial caused diseases
  - Loss turgor of petals, stem and leaves by microbial diseases in stalk solution
  - Intolerance of flowers to low temperature
  - Poor postharvest handlings from production to distribution

# Factors affecting vase life of cut flowers and strategies to improve it

## Physiological factors

- Flower respiration and  $Q_{10}$
- Chilling tolerance
- Ethylene sensitivity
- Yellowing of leaves
- Water balance of the stalk
- Microbial infections

## Strategies

**Good temperature management**

**Ethylene action inhibitor (1-MCP, Ethylbloc)**

**Clean stalk solution**

**Antimicrobial treatments**

**Good/new germplasms selection for postharvest vase life**





# Objectives

- 1. Establish the optimal treatment regimes for 1-methylcyclopropene (1-MCP) and natural antimicrobials on cut flowers and/or potted plants.**
- 2. Develop storage and handling methodologies to keep plants in optimal condition during transportation and vase display.**
- 3. Develop protocols and best practices for maintaining ornamental crop tolerance to decay and low temperature.**



# Experiments

- **Effect of 1-MCP on quality of vase life of cut flowers.**
- **Effect of 1-MCP on chlorophyll fluorescence of cut flowers.**
- **Effect of selected antimicrobial agents with combination of 1-MCP on the postharvest quality of cut flowers.**
- **Quantitative proteomic approaches to investigate the effect of 1-MCP on senescence of cut flowers.**



# Materials and Methods

- **Plant materials**
- Flower stalks of **Snapdragon** (*Antirrhinum majus*), **Gerbera** (*Gerbera jamesonii* H.), **Carnation** (*Dianthus caryophyllus*), and **Rose** (*Rosa hybrida*) were obtained from a commercial grower, Avon Valley Floral (AVF), NS.
- Flowers were harvested, held in an upright position and immediately transported to the laboratory, Kentville, AAFC. Cut flowers were subjected to 1-MCP treatment, flower stems were trimmed to a length of 30-45 cm and placed vertically in a 250-ml flower bag containing water. Flowers were placed under controlled environmental conditions (relative humidity 60-75%, temperature 20 ° C and dark).



# Materials and Methods (cont')

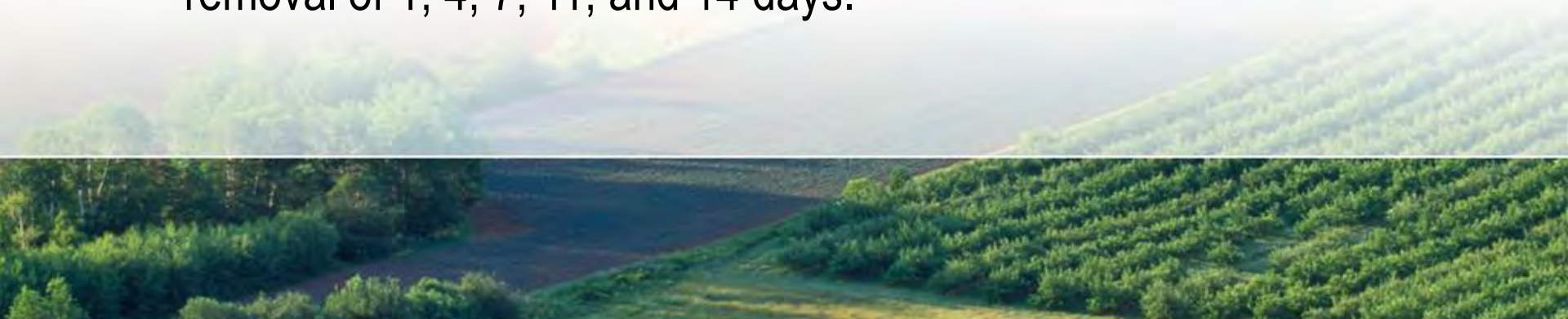
## Experiment treatments and methods

### 1-MCP treatment

### Quality evaluations

Quality measurements including water uptake, color, abscission and wilting, digital images, chlorophyll fluorescence and microbial populations were conducted.

Quality parameters were evaluated at each removal day. For each flower type, 3 stems were used for each treatment and at each removal of 1, 4, 7, 11, and 14 days.





## Materials and Methods (cont')

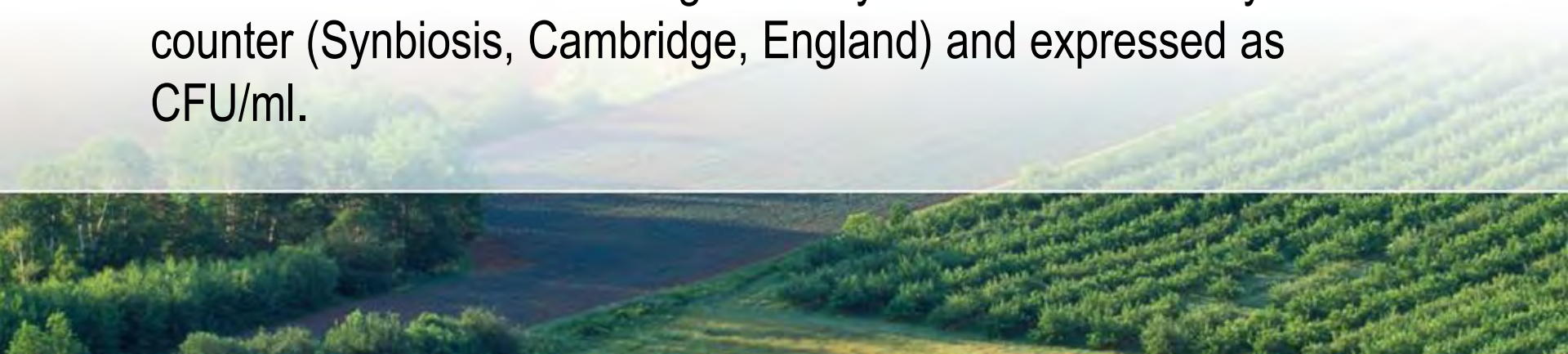
### *Color:*

The lightness ( $L^*$ ), chroma ( $C^*$ ) and hue angle ( $h^\circ$ ) values on petal were measured using a Chromameter CR-400 color spectrophotometer (KONIC MINOLTA, Canada).

### *Microbial populations in stalk solution*

On each sampling day, 1ml of water in bags was subjected to microbiological analysis, including aerobic plate counts, yeasts and moulds counts.

Colonies were counted using an Acolyte automated colony counter (Synbiosis, Cambridge, England) and expressed as CFU/ml.





# Materials and methods (cont')

## *Chlorophyll fluorescence (CF) on the sepal*

CF is light emission of chlorophyll molecules when they lose excitation energy as the electrons moves back to ground state.

CF can be used as an indicator for physiological status and stress in any green plant tissues.

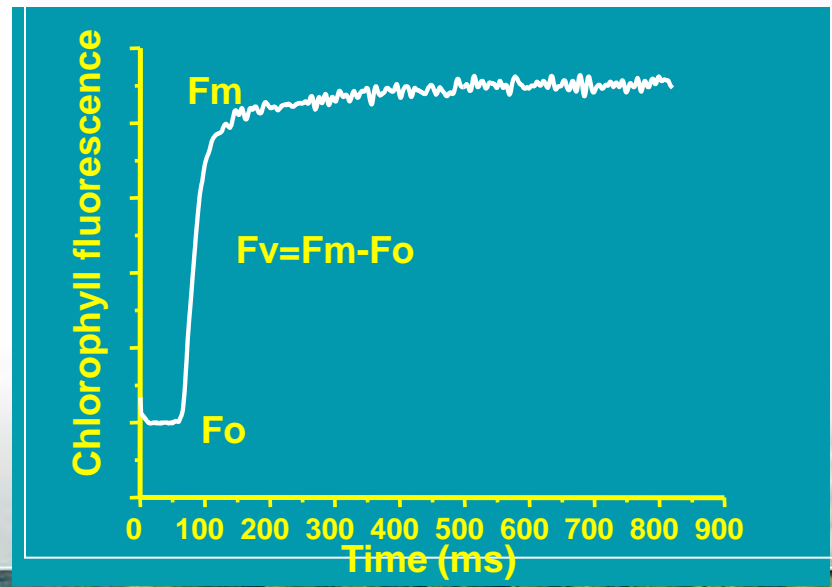
### **Parameters of CF:**

F<sub>o</sub>: minimum fluorescence

F<sub>v</sub>: variable fluorescence

F<sub>m</sub>: maximum fluorescence

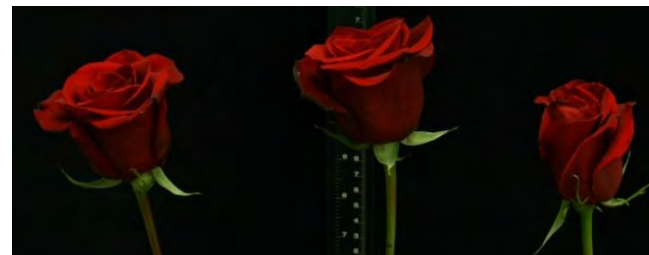
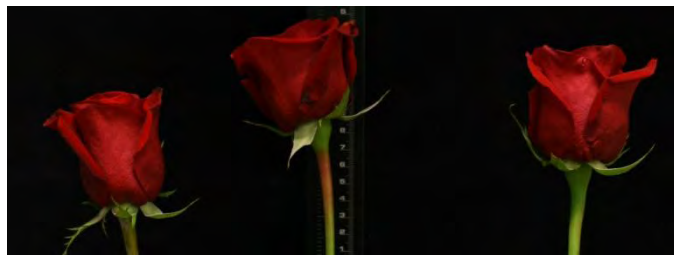
F<sub>v</sub>/F<sub>m</sub>: excitation transfer efficiency



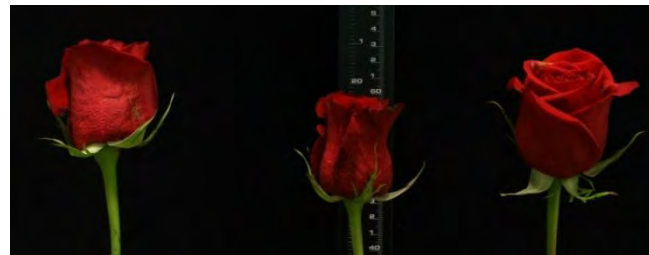
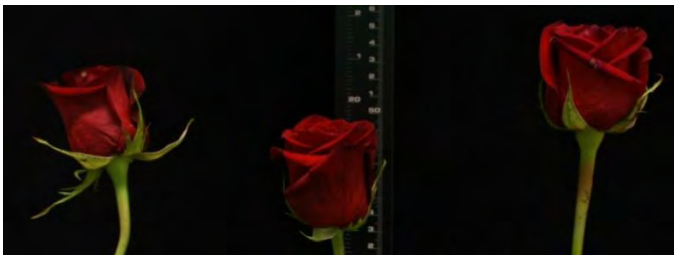
## Control

## 1-MCP

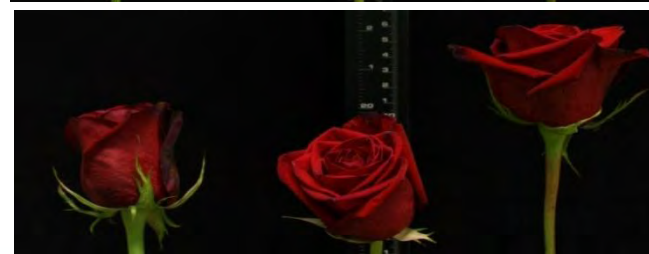
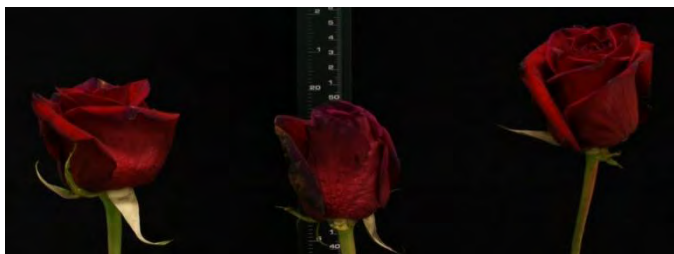
D1



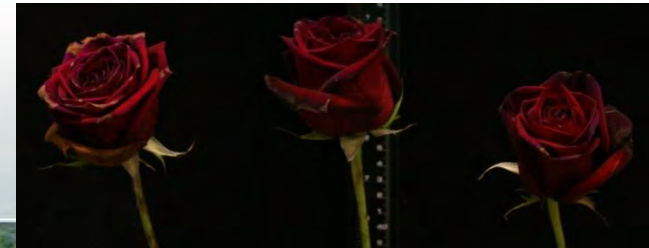
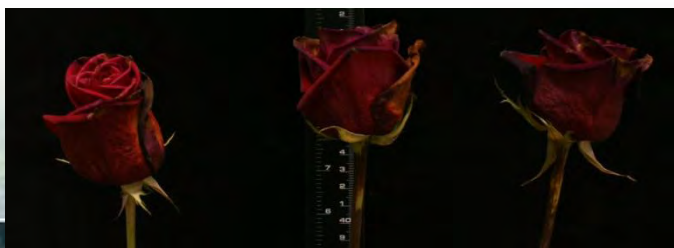
D4



D7



D11





**Control**

**1-MCP**

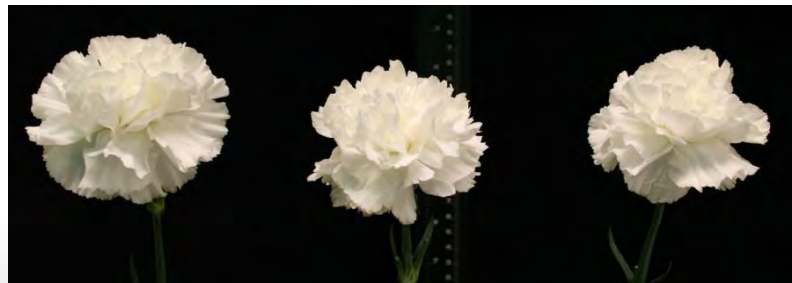
**D1**



**D4**



**D7**



**D11**





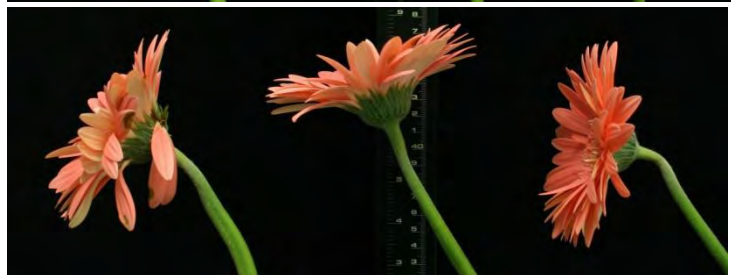
# Control

# 1-MCP

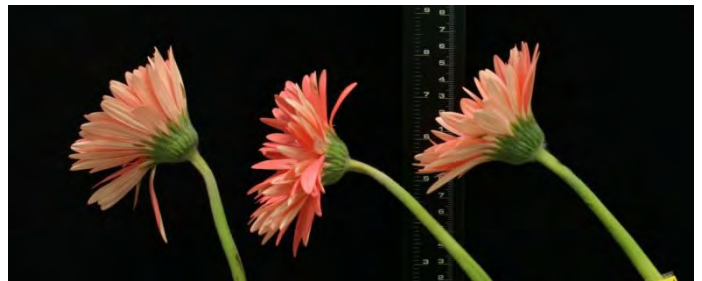
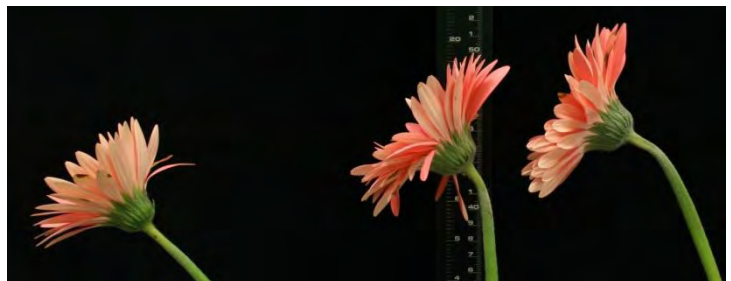
D1



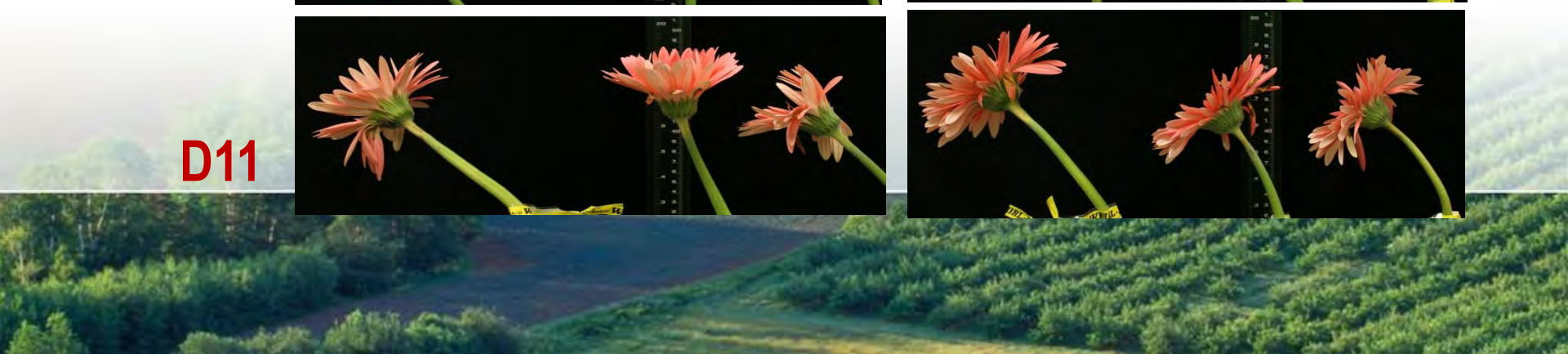
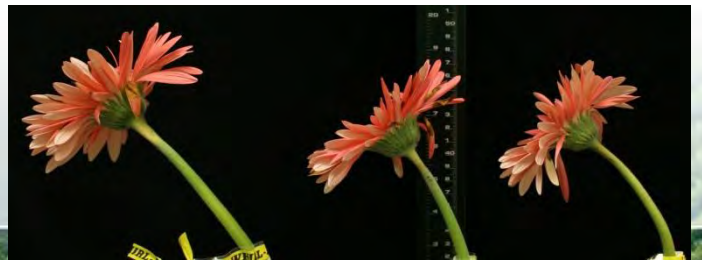
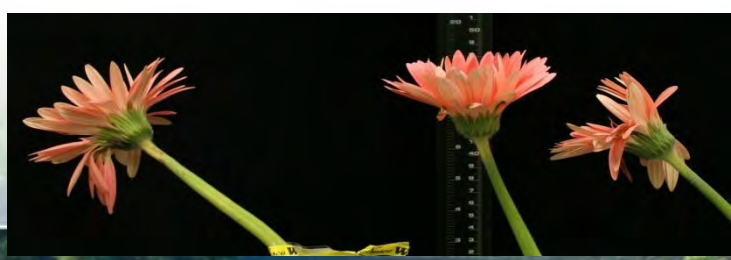
D4



D7



D11



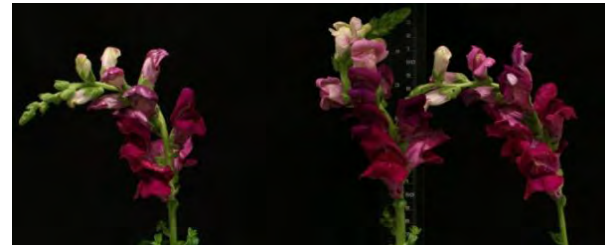
**Control**

**1-MCP**

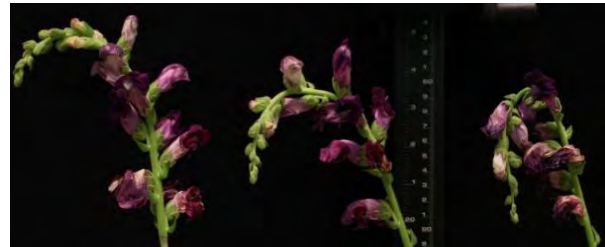
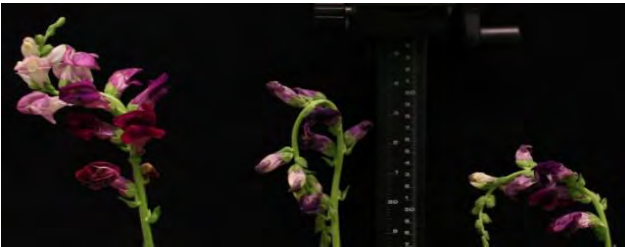
**D1**



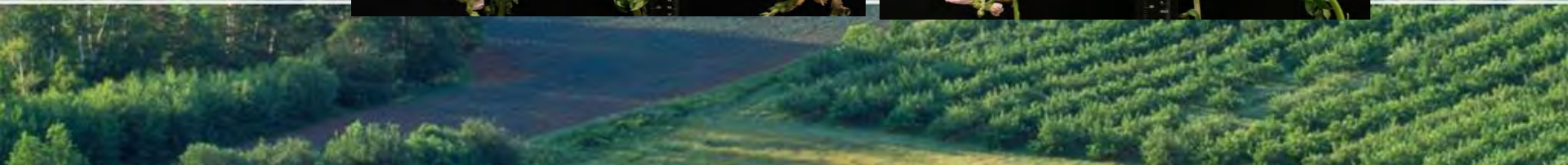
**D4**



**D7**



**D11**





# Results-Vase life and Chlorophyll fluorescence of cut flowers after 1-MCP treatment

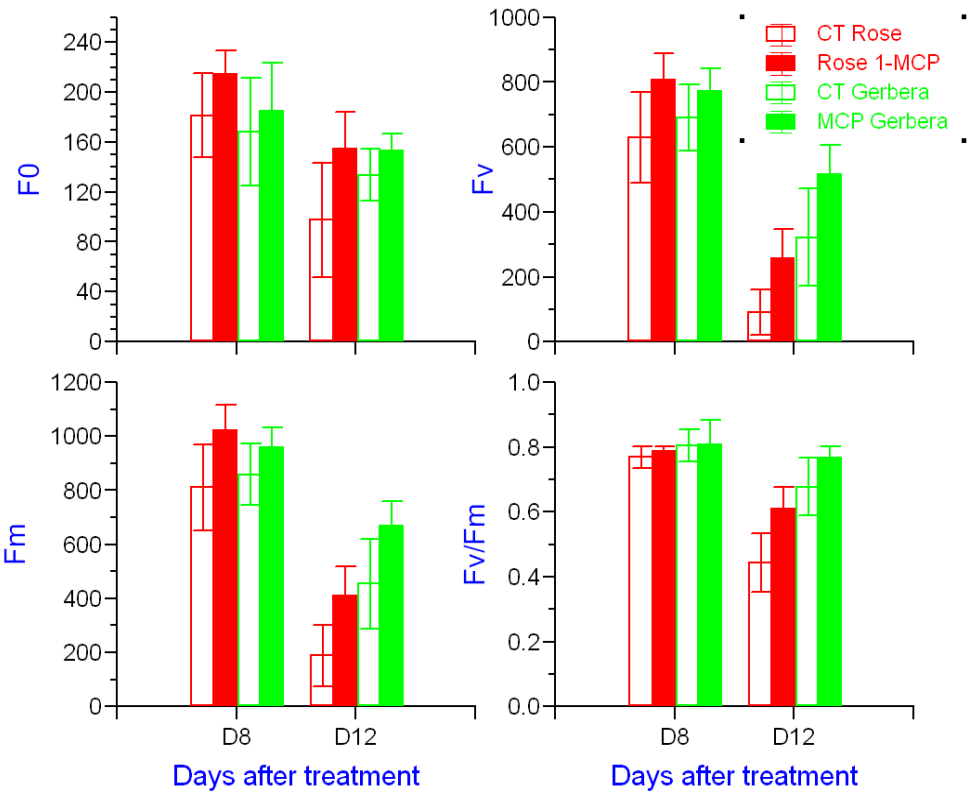
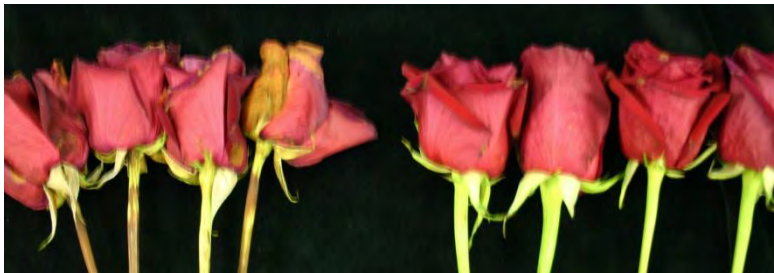
**Control**

**1-MCP**

D8



D12



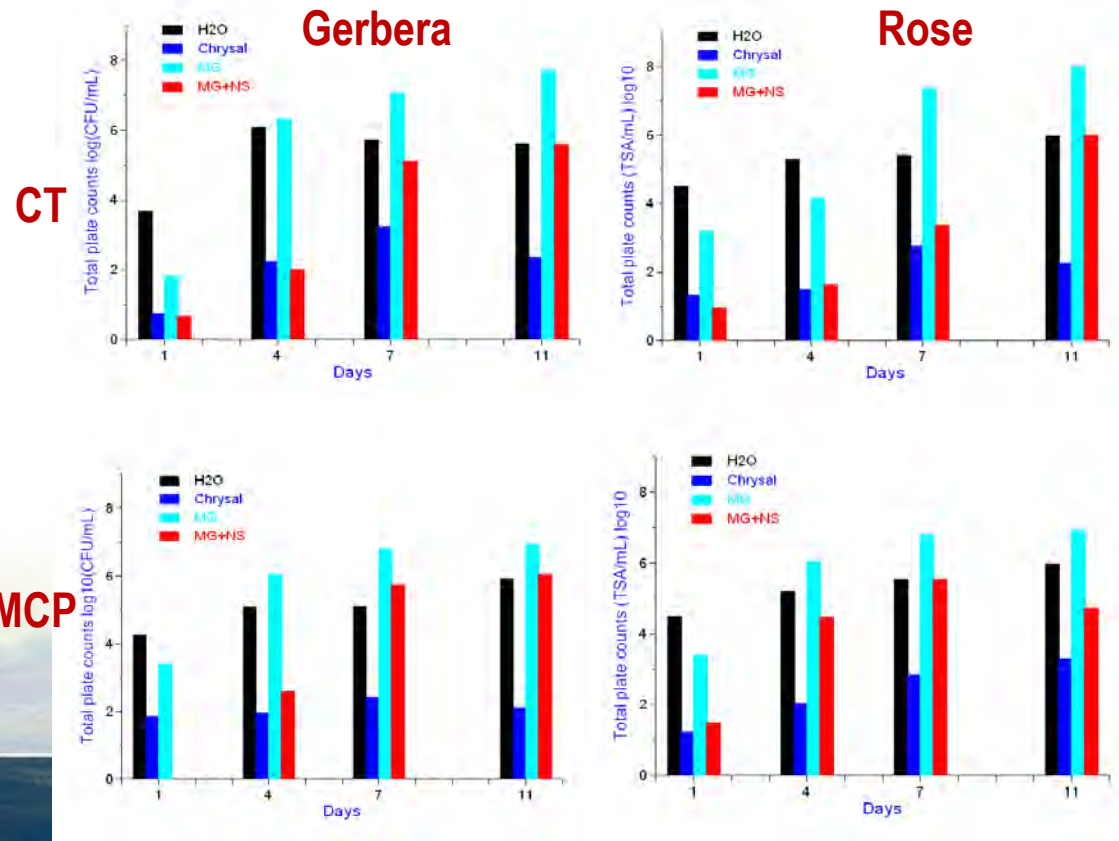


# Results (cont')- Effect of 1-MCP and antimicrobial agents on the postharvest quality of cut flowers during vase life

Antimicrobial agents:

Chrysal (C); MicroGARD (MG); MicroGARD+Natural Seal (MG+NS)

Antimicrobial agents had significant effect on bacterial population in the stalk solution during the vase life



# Summary

- Postharvest quality (vase life) of four types of cut flowers with various ethylene sensitivity were evaluated.
- In addition to color and water uptake, CF is an important quality parameter and should be incorporated in the postharvest evaluation.
- Both ethylene sensitivity and microbial contamination play important roles in determining the vase life of cut flowers.
- Treatment of 1-MCP significantly delayed the senescence of cut flowers, especially for 'carnation', 'rose' and 'gerbera'.
- Antimicrobial agents showed the potential to reduce the microbial population (bacteria, yeast and molds) in stalk solution.
- No interaction between antimicrobial agents and 1-MCP was found.



## Science Cluster-Outcomes

1. Lead to the development of environmentally friendly pre- and postharvest technologies mainly use of 1-MCP and natural antimicrobials agents to improve the quality (vase life) of ornamental plants.
2. Result in extended shelf-life through effective control of postharvest pathogens and enhanced overall postharvest quality of targeted plants and cut flowers.
3. Gain fundamental knowledge of senescence of cut flowers.
4. Scientific publication, conference proceedings and industry reports.
5. Establish a long term postharvest research platform to support Canadian ornamental industry.





## Challenges and future plan in 2012

- Continue the antimicrobial agents evaluations on selected cut flowers.
- Establish an optimal treatment regime (1-MCP and antimicrobial agents) and postharvest management for selected cut flowers.
- Conduct the quantitative proteomic studies on cut flowers (rose) to gain fundamental insights and knowledge of flowers senescence and effect of 1-MCP and antimicrobial agents on quality of cut flowers.
- Working together with the Canadian flower industry to solve problems during postharvest.





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**Thank you!**  

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**Merci beaucoup !**

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**Canada**