Ozone Gardens for the Citizen Scientist
Margaret Pippin¹, Gay Reilly¹, Abbey Rodjom², Emily Malick³

¹NASA Langley Research Center, Hampton, VA, ²Ohio University, Athens, OH, ³Virginia Living Museum, Newport News, VA

Virginia Living Museum

Marshall Early Learning Center

Our Lady of Mount Carmel School

Our Ozone Gardens

NASA Langley partnered with the Virginia Living Museum and two schools to create ozone bioindicator gardens for citizen scientists of all ages. The garden at the Marshall Learning Center is part of a community vegetable garden designed to teach young children where food comes from and pollution in their area, since most of the children have asthma. The Mt Carmel garden is located at a K-8 school. Different ozone sensitive and ozone tolerant species are growing and being monitored for leaf injury. In addition, CarClips ozone monitors were placed in the gardens and data are compared to ozone levels at the NASA Langley Chemistry and Physics Atmospheric Boundary Layer Experiment (CAPABLE) site in Hampton, VA. Leaf observations and plant measurements are made two to three times a week throughout the growing season.

Pictured to the right are young citizen scientists planting seeds and a NASA intern checking the ozone monitor at the museum garden.

A Look At Stippling

Ozone and Leaf Stippling June- July 2015

Data Collection Sheets designed for Citizen Scientists of all ages visiting the museum

- **Age Range**
  - 1-3
  - 3-5
  - 6-8
  - 9-10
  - 11-13
  - +13

- **Color Worksheet**
  - Green
  - Orange
  - Red
  - Purple
  - Brown

- **A Look At Stippling**
  - **Up to 10% Stippling**
  - **10-25% Stippling**
  - **25-50% Stippling**
  - **50-75% Stippling**
  - **75-100% Stippling**

- **Snap Bean Leaf Progression**
  - 6/12/15
  - 6/19/15
  - 6/26/15
  - 7/1/15
  - 7/10/15
  - 7/15/15
  - 7/20/15
  - 7/22/15

- **Ozone Sensitivity**
  - Sensitive
  - Tolerant

- **Ozone Sensitive Native Plants**
  - Common Milkweed
  - Cutleaf Coneflower
  - Black Cherry

- **Ozone Tolerant Native Plants**
  - La Chipper Superior
  - Rudbeckia laciniata
  - Prunus serotina

- **Typical ozone induced stipple**
  - Gray
  - Orange
  - Yellow
  - Red
  - Purple

- **Snap Bean**
  - S-156
  - R-331

- **Potato**
  - Solanum tuberosum

- **Tobacco**
  - Nicotiana tabacum

- **Cigar Wrapper Tobacco**
  - Bel-W-3

- **Phaseolus vulgaris**
  - Snap Bean

- **Percent Stippling**
  - Average Stippling Percent
  - Percent by the end of the summer

- **Prediction**
  - Is there other signs of injury not related to ozone on the plant? If there is, briefly explain.
  - Does this leaf show signs of ozone injury?
  - Is there signs of ozone injury anywhere on leaves?

- **Ozone ID**
  - What is the plant's ID number?
  - What is today's date?

- **Permit**
  - What is the severity of ozone injury on the affected leaves?
  - What is the length of the labeled leaf?
  - How many plants total are in the garden?

- **Tobacco**
  - Which plants show obvious signs of ozone injury?

- **Stippling**
  - To find the Stippling Percent for the rows, divide by 6 to find the average value for all of the Bottom Leaves

- **Average Stippling Percent**
  - Which plant had the lowest Average Stippling Percent?
  - Which plant had the highest Average Stippling Percent?

- **Snap Bean**
  - Common Milkweed
  - Cutleaf Coneflower
  - Black Cherry

- **Tobacco**
  - Tobacco

- **Cigar Wrapper Tobacco**
  - Cigar Wrapper Tobacco

- **Phaseolus vulgaris**
  - Snap Bean

- **Percent Stippling**
  - Average Stippling Percent
  - Percent by the end of the summer

- **Prediction**
  - Is there other signs of injury not related to ozone on the plant? If there is, briefly explain.
  - Does this leaf show signs of ozone injury?
  - Is there signs of ozone injury anywhere on leaves?

- **Ozone ID**
  - What is the plant's ID number?
  - What is today's date?

- **Permit**
  - What is the severity of ozone injury on the affected leaves?
  - What is the length of the labeled leaf?
  - How many plants total are in the garden?

- **Tobacco**
  - Which plants show obvious signs of ozone injury?

- **Stippling**
  - To find the Stippling Percent for the rows, divide by 6 to find the average value for all of the Bottom Leaves

- **Average Stippling Percent**
  - Which plant had the lowest Average Stippling Percent?
  - Which plant had the highest Average Stippling Percent?