PRACTICAL INDOOR GARDENING TECHNIQUES

A Presentation by Mel Sikes, Alaska AITC

FAIRBANKS SOIL & WATER CONSERVATION DISTRICT

Alaska Agriculture in the Classroom

• Provides assistance to teachers and educators who wish to incorporate Agricultural Literacy into their lessons.

• Curriculum materials and educational resources. Available at the FSWCD office but can be mailed upon request.

• Website: [www.agclassroom.org/ak](http://www.agclassroom.org/ak) - with lessons and resources.

• 3-4-day workshops for teachers and educators on Agriculture Literacy, Indoor Gardening Techniques, and other topics.
Agriculture in Alaska
Why the Need in Alaska?

Alaska is the largest state in the US and yet it ranks last in agriculture industry and production (USDA, 2008). Our growing seasons are very short, our winters are extremely cold and much of the land in Alaska is not suitable for farming. 95-98% of our food is shipped in.
Transportation Costs Can Be Steep
Innovative Growing Methods

There is a new initiative and growing interest in our state, especially in our remote village communities, to develop and support alternative and inexpensive methods of food production. Hydroponics, aquaponics, vertical farming, high tunnels, and biomass fueled greenhouses are all cold climate growing methods used in Alaska.
Outdoor school gardens in Alaska are often not practical due to climate and school calendar because the school year can finish before the snow is gone.
Interdisciplinary Connections
Where did the idea come from?
Afterschool Programs with 21st Century Grant Schools
Indoor Gardening ASP Project in Anchorage
Hydroponic Growing System at Ruby School - 2015
NAITC Start Up Grant

Alaska Ag in the Classroom received a 2017 Fire Up grant from National Ag in the Classroom to develop an Indoor Gardening Curriculum, and to train facilitators from around Alaska to provide educator workshops and assist with the implementation of projects.
Goals of the 2017 Grant

• **Facilitator Training:** Hold a two-day workshop Alaska AITC facilitator training/meeting at the Alaska Botanical Garden in Anchorage.

• **Educator Workshop Development:** Develop a two-day hands-on educator workshop that will be presented in communities throughout Alaska.

• **Education Materials:** Develop a Curriculum to teach small and large scale year-round low-cost and practical growing techniques such as hydroponics, aquaponics, vertical hydroponics, vertical gardens, and container gardens.
Facilitator Training

From October 20-22, 2017, 10 Agriculture educators from organizations throughout Alaska met at the Alaska Botanical Garden in Anchorage for a hands-on workshop to develop the Alaska Indoor Gardening Curriculum and a teacher training workshop to share the curriculum with educators in communities all around Alaska.

- Alaska Botanical Garden
- Alaska Farm to School
- Alaska Pacific University
- Chena Hot Springs Resort
- Homer Soil and Water Conservation District
- Kenai Soil and Water Conservation District
- Southeast Island School District
- UAF Cooperative Extension Service in Juneau
- UAF Cooperative Extension Service in Palmer
- UAF Reach-Up Program
Alaska Indoor Gardening Curriculum Development

• Practical indoor gardening curriculum that provided teachers with a one stop resource page with correlated lessons that would be easy to implement and a great way to teach STEM to their students.

• Inexpensive project ideas for our more remote schools that are only accessible by plan and have no access to expensive equipment.

• Collaborative effort between our state’s different agriculture education professionals to help it to be adopted and used.

• Develop an educator workshop to train educators and to find teachers to pilot the lessons.
Introduction to Curriculum - Why Grow Indoors?

- Introduction to Curriculum
- Introductory Presentation - Powerpoint
- Alaska Science Standards and QLEs
- NGSS Topics Overview
- Journaling

Soil Growing Systems

- Reading a Seed Packet Lesson
- Starting Plants in the Classroom
- Salad Container Greenhouse Lesson
- Indoor Gardening Lighting Systems Handout
- Window Sill Garden Lesson
- Transplanting Lesson

Soil and Nutrients

- Garden Soil Exploration Lesson
- NAITC The Right Diet for Your Plants Lesson
- NAITC Plant Nutrition Deficiencies Lesson
  - Nutrition Deficiencies in Alfalfa Handout
  - Humanity Against Hunger Handout
- Chemistry in Plant Nutrition and Growth Lesson

Plant Growth and Plant Processes

- Do You Know the Parts of Plants? Lesson
Rubric for Evaluating Lessons

• The Alaska Farm to School coordinator worked with us to develop an evaluation tool for the lessons in the curriculum.

• An evaluation was put up online with the curriculum.

• The evaluation is currently under review and has been updated by a teacher in the Fairbanks North Star Borough School District.
Alaska Indoor Gardening Curriculum Lesson Evaluation

Lesson Title: 

Evaluator: 

Grade/Subject Taught: 

Help us improve this lesson by evaluating essential quality learning components:

Please circle

This lesson meets the science standards that I am required to teach to my level of students:

1. Specifies how the learning targets will be demonstrated and under what conditions. Does not meet 
   Partially meets 
   Meets goal

2. Clearly identifies the core content and idea for the lesson. Does not meet 
   Partially meets 
   Meets goal

3. Includes appropriate goals for the lesson. Does not meet 
   Partially meets 
   Meets goal

4. The lesson is cross-curricular. Does not meet 
   Partially meets 
   Meets goal

5. The lesson matches the grade span indicated. Does not meet 
   Partially meets 
   Meets goal

6. The time estimate provided is accurate. Does not meet 
   Partially meets 
   Meets goal

7. The lesson acknowledges students prior knowledge and continues to build. Does not meet towards future educational goals on this topic. 
   Partially meets 
   Meets goal

8. Clearly explains the procedure in easy to follow steps. Does not meet 
   Partially meets 
   Meets goal

This lesson increased my students achievement and helped me meet their learning goals:

1. Is learner-centered and inclusive of all learners. Does not meet 
   Partially meets 
   Meets goal

2. I was satisfied with the opportunities my students had to explore STEM. Does not meet 
   Partially meets 
   Meets goal

3. Is multi-sensory. Does not meet 
   Partially meets 
   Meets goal

4. Includes flexible individual, small group, and large group instruction. Does not meet 
   Partially meets 
   Meets goal
Educator Workshop Development

- Develop a 1.5-3 day sample workshop.
- Have all lessons available online.
- School districts in remote locations could use the curriculum and the outline to offer their own workshops.
- Each facilitator would offer workshops and could adjust the schedule depending on the interest in their community.
- Look into ways of continuing development of online training modules to teach about indoor gardening systems.
## Indoor Gardening Curriculum Sample 2.25 day Workshop

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Person Leading</th>
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<tbody>
<tr>
<td><strong>Friday</strong></td>
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</tr>
<tr>
<td>6:00pm</td>
<td>Welcome and Introductions</td>
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<tr>
<td>6:10 - 6:30pm</td>
<td>Introductions and Weekend Schedule Overview</td>
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<tr>
<td>6:30 - 7:00pm</td>
<td>Overview of Indoor Gardening Curriculum</td>
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<tr>
<td>7:00 - 8:45pm</td>
<td>Indoor Soil Growing options: Seed and Seed Starting, Light Tables, Soil Types, Plant Growth Intro Activities</td>
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<tr>
<td>8:45 - 9:00pm</td>
<td>Wrap Up and Reflection, review of next day</td>
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<tr>
<td><strong>Saturday</strong></td>
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<tr>
<td>9:00am</td>
<td>Morning Check In - Welcome</td>
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<tr>
<td>9:15 - 9:45am</td>
<td>Hydroponic Systems Overview and Power Point</td>
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<tr>
<td>9:45am - 12:00pm</td>
<td>Review of Hydroponic Lessons, Hands-on Construction of Simple Passive Hydroponic System</td>
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<tr>
<td>12:00 - 12:30pm</td>
<td>Working Lunch and Discussions</td>
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<tr>
<td>12:30 - 1:30pm</td>
<td>NFT Hydroponic Systems – Gutter Systems</td>
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<td>1:30 - 3:00pm</td>
<td>Hydroponic and Aquaponic Systems - Hands-on Construction</td>
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<tr>
<td>3:00 - 4:45pm</td>
<td>Vertical Bucket Tower Growing System - Hands-on Construction</td>
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<tr>
<td>4:45</td>
<td>Wrap up and Reflection, Review of Next Day</td>
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<tr>
<td><strong>Sunday</strong></td>
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<tr>
<td>9:00am</td>
<td>Morning Check In - Welcome</td>
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<tr>
<td>9:15 - 10:15pm</td>
<td>Soil Development, Nutrients, and Diagnosing Plant Nutrient Deficiencies</td>
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<td>10:15 - 12:00pm</td>
<td>Composting and Food Waste</td>
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<tr>
<td>12:00 - 1:00pm</td>
<td>Working Lunch and Discussions</td>
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<tr>
<td>1:00 - 2:00pm</td>
<td>School Gardening Curriculum Connections</td>
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<tr>
<td>2:00 - 3:30pm</td>
<td>Indoor Gardening Curriculum Round Table Activity Session and Discussion</td>
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<tr>
<td>3:30 - 4:00pm</td>
<td>Wrap up and Next Steps Discussion</td>
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2018 Fire-Up Grant

1. Improve and provide more quality educational resources for teachers.

2. Provide on-site support and technical assistance to educators with the piloting and implementation of indoor gardening projects.

3. Provide quality education workshops on the Alaska Indoor Gardening Curriculum for educators.

4. Educators pilot the curriculum and evaluate the lessons using the rubric created with the previous Fire-Up grant.

5. Seek out and provide assistance to rural schools and educators who cannot attend workshops.
Other Grants to Support Project

1. EPA EE Regional Grant – Collaborative $85,000 grant with the University of Alaska for 2 years of funding to develop online training modules as well as continue working with schools and 4H leaders around Alaska on indoor gardening projects. The success of the 2017 Fire-up Grant was the impetus for the ideas in the EPA grant.

2. Alaska Farm Bureau – Additional support to provide more workshops and equipment to educators.
Indoor Gardening Workshop 10/2018
Workshops in Fairbanks and Kenai
Soil Gardening Systems
Pearl Creek Elementary School

Plant Observations

My peas are doing great! I think they may not be ready to transplant. My radish plant is 10 inches tall. Notice any new leaves. My thyme plant is 12 inches tall. How is it? I hope you enjoy it.

Plant Check!

Pack #1
Dill
Spinach
Romaine
Lettuce
Broccoli

Pack #2
Lettuce
Spinach
Salad mix

Seedlings
Anchorage 4H Children’s Victory Garden Program

Goldenview Middle School

Benny Benson School
Students analyzed light wave length test of Brassicas. Comparing height of plants, possible color changes and taste variables.
Hydroponic Gardening

Hydroponics is a method of growing plants in water without soil. The water must be enriched with nutrients and the plants need some type of inert medium to support the root system.

- Hydroponics comes from the Greek language and it literally means let the water do the work.
- "hydro" means "water"
- "ponos" means "work".

Soil-less growing!
6 Types of Hydroponic Systems

• Passive Wick System
• Deep Water Culture System – Floating Platform
• Nutrient Film System – Gutter System
• Continuous Drip System
• Ebb and Flow System
• Aeroponic System
Growing Medium

- **Medium**: substance or material in which something exists or grows, from the soils and other materials for plant growth. Not meant to provide nutrients to the plant, only support.

- Hydroclay Stones
- Vermiculite
- Perlite
- Rock Wool
- Peat
- Coconut Fiber
- Sand
- Styrofoam
- Anything Inert!
What is Rockwool?

- Rockwool is made from rock which has been melted and spun into fibrous cubes.
- Rockwool is a form of Perlite in which the pebbles or rocks anchor the plant down so they don’t just float up above the water.
- Rockwool is the most popular medium for germination seeds hydroponically.
Rapid Rooters and Rock Wool Cubes
Best Plants to Use

Starting from Seed

Rock-wool is the most popular medium for germinating seeds.

For seeds, you should sprinkle water from above on each cup periodically until seeds have germinated and roots are forming.

- Lettuce - buttercrunch
- Kale, other leafy veggies
- Microgreens like broccoli, cabbage, or arugula
- Herbs – basil, dill, parsley
- Peppers
- Tomatoes (expert)
Simple Passive Hydroponics
Other Recycled Container Ideas

Salad Container Greenhouses
Recycled Container Grow Wall
Hydroponic Gardening Systems

Simple Floating Platform Hydroponic System Using a Fish Tank
Foam and Plant Net Cups

- Net cups are perfect for starting seeds, cuttings and are used in many hydroponic systems.

- Styrofoam sheet with the measurements 1 inch less than the inside measurement of the aquarium for both the length and width. This allows for a ½ inch gap between the platform and the side of the aquarium around the entire perimeter to allow the platform to float freely.

- Cut holes in the blue foam the size of the net pots. A hole saw works great!

- Place net pot in hole to make sure that it fits snuggly
Air Pump

Oxygen is vital to root development!

Set up your air pump, line and air stone in the bottom of the aquarium.
• Fill the aquarium with water.
• Mix in the nutrient according to the label.
• Test Ph, use adjuster if necessary
• Keep the water level constant. Add often.
Lighting

1. **Fluorescent** somewhat inefficient, must be kept close to the plants.

2. **LED Lights** – Energy efficient, low heat output, long lasting. More available now.

3. **HID Lights** - Most expensive, but can be cost effective, very long life

   *High Pressure Sodium* – provides more of the red/orange spectrum for flowering and fruiting.

   *Metal Halide* – Provides more blue/green spectrum for vegetative growth.

*Lights must be kept on a consistent schedule. A timer is a very good idea.*
Simple Floating Platform Hydroponic System Using a Storage Tub
Comparison of Growth
Aquaponics is the combination of aquaculture (fish farming) and hydroponics (growing plants in media other than soil).
Nutrient Film Technique Systems

• Also known as gutter hydroponics

• Nutrient Solution washed on to plant roots

• Reservoir contains nutrient solution which is pumped through system using a water pump
Be sure outlet strip isn't near the water reservoir!
Airport Heights Elementary School in Anchorage
Continuous Drip Systems

• Nutrient solution dripped onto plant from a line either above the plant or sitting on the grow medium.

• Water and nutrients in separate tank pumped through system.
Aeroponic Systems

• Nutrient solution sprayed or misted onto roots in growing chambers where roots are suspended in air.
• Used in many grow tower commercial systems.
• Nutrient solution can be in a grow chamber or outside.
Ebb and Flow systems

- Nutrient solution is temporarily and regularly flooded into the grow tray using a submerged pump connected to a timer.
- When the timer is off, the solution flows back into the reservoir.
- Plants can dry out during cycles.
- Good for plants like tomatoes.
Hydroponic Grow Tower

- Hardware store 5 gallon plastic buckets and lids.

- Uses Nutrient Film Technique with a pump system in the lower reservoir bucket.

- Does require power tools, but all can be prepared in advance before assembly.

- Uses 2 square feet of space to grow large amounts of leafy veggies.

- Costs less than $300 in supplies to build.
Food Grade Buckets
Dr. Will Hutto, has a research grant from NASA. Dr. Hutto is investigating best growing methods and technology for On Planet Agriculture through hydroponics. His conclusions will help astronauts grow food in space, on the Moon and on Mars. We are extremely lucky to be able to participate in this exciting and ground breaking research project.
Alaska Seeds of Change

Employ and empower local youth, promoting self-reliance and community involvement.

Alaska Division of Behavioral Health
Alaska Mental Health Trust Authority
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