An Alaska Native Plant-based Horticulture Curriculum for Elementary Schools

Abstract: 3316

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Research Question

- Higher altitude schools with exceptionally cold climates cannot utilize current plant-based curricula unless each activity is adapted to the particular environment.
- Can a successful plant-based curriculum be designed emphasizing the Alaska resources of native plants, Alaska ethnobotany, and cold climate horticulture?

Purpose

To design and adapt existing curricula from other environments to Alaska conditions using native plants and resources in order to expand the partnership between the Georgeson Botanical Garden and K-6 schools in Alaska.

Rationale

- The use of garden-based curricula is justified in the fact that concepts and skills from virtually every subject can be learned through a garden (Braun et al., 1999).
- Garden-based curricula provide a vehicle for higher order thinking in which students are active participants of constructing knowledge and topics in depth instead of passive by standards accumulating information (Drake, 1998; Subramanian, 2002).
- The Alaska environment has extreme weather conditions with short hours of daylight in the winter and long hours of daylight in the summer. Teachers must know how the amount of sunlight affects seed germination and plant growth.
- Native plants of Alaska are extremely vast. Teachers must know which native seeds are affected by depth when sown in soil.
- Over 30 varieties of Salix spp. (willow) can be found in Alaska. This useful ethnobotanical plant of Alaska can easily be propagated to make new plants. Teachers must know what species of Salix have significant rooting in a hydroponic system.

Hypothesis

Adapting plant-based curricula to Alaska environment will create a useful curriculum for grades K-6.

Lesson Plan Criteria

1. Meets Alaska Content Standards
2. Supplies and seed sources are readily available either within the community or through mail order
3. Plants and soils are well-known and easily recognizable by the community
4. Lesson is completed in reasonable time frame (2-3 weeks)
5. Background and information relevant
6. Reasonable teacher preparation time length (1-2 hours)
7. Reasonable time frame for lesson (1-2 classes)
8. Plants grow in field soils
9. Useful secondary product (i.e. use in landscaping)

Experiment

Experimentation for three lesson plans using Alaska Native Plants:
- Photoperiod effects on seed germination percent
- Effects of seed depth on seed germination percent
- Effects of hydroponics system on root establishment of Salix spp.

Methods and Results

Photoperiod Experiment

- Seeds from 72 Native plant species
- 2 Treatments:
  - Light-covered with clear plastic wrap to retain moisture
  - Dark-covered with aluminum foil
- Light Treatment: 3000 lux 12hrs/day in Greenhouse
- Dark Treatment: 0 lux 24hrs/day
- 4 replicates: 25 seeds per replicate
- Bottom watering system
- After 7 days, remove clear plastic wrap and aluminum foil
- Calculate percent germination across 4 replicates
- Findings suggest 6 species had a significantly higher germination percent when sown in light compared to dark. 5 species had a significantly higher percent when sown in dark compared to light.

Results:

<table>
<thead>
<tr>
<th>Seed successfully germinated</th>
<th>Light</th>
<th>Dark</th>
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<tr>
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Depth Experiment

| Seed from 73 Native plant species
| 2 Treatments:
| Surface 0 cm depth
| Buried 3 cm depth
- Surface seeds 200/miles 2-3 24 hrs/day under Grow Light Table (40 watt fluorescent lights)
- 4 replicates: 25 seeds per replicate
- Trays covered with plastic dome lids or clear plastic wrap to retain moisture
- Overhead watering
- After 30 days, calculate average percent germination across the 4 replicates using 40% germination rate as threshold
- Results:
- 15 species germinated significantly better at 0 cm depth
- 2 species germinated significantly better at 3 cm depth
- 4 species thrive on the surface or at 3 cm depth

Hydroponics Experiment

Vegetative cuttings 5 species Salix spp.
- 4 treatments: water, water with aeration, 4.1 waterlola mix, waterlola mix with aeration
- Aeration dominance tested for Salix bebbiana and Salix purpurea
- Cuttings exposed to 2000 lux 24 hrs/day
- Aeration: 15 second or 3 times week
- After 30 days, calculate significant rooting differences across replicates
- Findings suggest that for Salix all species produced significantly more roots in water than water with aeration, cola, or cola with aeration. Only cola with aeration produced zero roots for all species.

Discussion

The Presently Proposed Curriculum:

1. Meets Alaska Content Standards
2. Supplies and seed sources are readily available within the community
3. Plants and soils are commonly and easily recognizable by the community
4. Lesson is completed in reasonable time frame
5. Background Information relevant
6. Reasonable teacher preparation time length
7. Reasonable time frame for lesson
8. Plants grow in field soils
9. Useful secondary product

Limitations
- Seed lot outdated (1996/1997)
- Limited sample size
- Species may not be common in all areas of Alaska
- Future Areas of Research
- Pilot lesson plans to local K-6 classrooms
- Cola titration for hydroponics experiment
- Test other native plant species

Conclusion

The experimentation of plant-based curricula was successful in creating a practical K-6 plant-based horticulture curriculum for Alaska schools, using native plants and resources.