Lesson Title: Let's Get Growing!

Grade: 4-6

Duration of Lesson: 3 - 50 minute classes and additional time for observation and garden care.

Brief: Students will perform geometry and plant science exercises while planting a classroom garden.

Note: Lesson is based upon math and science applications when using **Grow and Know Your Food** garden boxes, part of the ***Grow and Know with Montana Agriculture*** project. Plans for classroom garden boxes and growing instruction available at aginmontanaschools.org by following the teacher's link to the ***Grow and Know with Montana Agriculture*** project.

Materials:

1 - prebuilt complete and ready for planting **Grow and Know Your Food** garden box and guide. You can use any gardening container for the science portion of this lesson, however you will have to adjust the math lessons if not using the **Grow and Know Your Food** garden box.
3 - packets of miscellaneous leaf lettuce seeds (oak leaf, red, green, trout back, etc.)
1 - packet radish, endive, or other short season plant seeds
Rulers and yard sticks
Graph paper
Colored pencils
Journals or notebooks
A tray to set the box on to catch excess water (a lid from a large Rubbermaid container or several old lunchroom trays work well.)
A watering can

Key Terms

producer, metric system, volume (milliliter, liter),), graph, meter stick, graphs, charts,

diagrams, data, results, procedure, materials, investigation , measure, observation, area, formula, and square unit of measurement (cm^2, m^2, $in.^2$, $ft.^2$, $yd.^2$)

Standards / Objectives

Montana State Standards:
Science: Content Standard 1: Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations. Benchmarks 1.1, 1.2,1.3 Content Standard 3: Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment. Benchmark 3.1 Math: Content Standard 1: Number Sense and Operation Benchmark 1.5 Content Standard 3: Geometric Reasoning Benchmark 3.5

Understanding(s) /Big Ideas:	Essential Question(s):
Students will grow quick developing vegetable plants in classroom garden boxes. Students will understand the process from seed to food. Students will understand the key elements of growing food and be able to replicate this process outside the classroom setting.	What elements are necessary to grow food? Can vegetables be grown indoors? Where does food come from?
Students will know: Vocabulary terms related to plant growth for food. Students will know the parts of the sum equal the whole.	Students will be able to: Select appropriate measuring tool and use geometric reasoning. Students will be able to explain the system of producing food from plants.

Performance / Observations

Performance Task(s):	Other Evidence:
Geometric divisions of gardening box on graph paper. Observation of plant growth and identification crop results from planting. Journal plant growth in sequence. Evaluate production of food from seeds.	Students will receive a grade based on their participation and completion of the projects.

Learning / Inquiry Activities

Introduction: In this lesson students will perform science inquiries and geometric reasoning. Changes in plant growth will be the subject of measurement practice and observation skills. The goal is to have students understand that much of the food they eat originated as a seed, and that seeds rely on soil, water, and light for growth. Producers grow food for us, which is then sold to markets for purchase by consumers. Inform students that they will be observing growth of plants for salad and will essentially be food producers.

Learning / Inquiry Activities:

1. Introduce the math concept behind the garden box by having students measure the inside and outside diameters of the box. Ask students to find the depth of the box.

(When appropriated for grade level, ask students to find the volume of the garden box.) Ask students to record their data in their journals.

Next ask students to find inside area in square feet (See formulas if need in appendix C): The inside area of the **Grow and Know Your Food** garden box is 24" x 18" or 432 sq. inches. Students will determine the area in square feet by dividing the total number of square inches by 144. The answer is 3 square feet. Ask your students to repeat the investigation for area using the metric system and a meter stick. Record this data in the journal.

2. Pass around the packets of seeds and ask students about their knowledge of planting any of the seed varieties. Divide students into 4 groups and ask them to come up with a diagram on graph paper of how they would like to plant/design the garden using the seeds. The garden will be based on 3 square feet of planting area. Ask students to color in their graphed garden areas. Students should include seed varieties and the illustration should be in color. See Appendix A for an example.

3. For advanced students teach the extra concept on geometry in Appendix B. Crop circles are a result of farmers using pivot irrigation systems, which are based on geometric circles and radius of sprinkler systems. A photo is seen at:

http://www.valley-ae.com/userfiles/image/Center%20Pivots/crop%20circles%20in%20Alamosa.jpg

4. Ask the class to vote and choose a planting layout from one of the groups. The winning group will plant the garden box according to their layout. (See planting directions and plant care in the **Grow and Know Your Food** guide, and planting instructions on the back of the seed packet.) All students should sketch and journal the chosen layout and seed variety planting of the garden box at this time. It is always a good idea to record the seed producer or company information as well from the seed packet. Example: Burpee, Fire 'N Ice radishes, packed for 2011.

5. Over the next few weeks take care of the garden using the guidelines in the **Grow and Know Your Food** guide. Ask students to journal their observations at least twice a week for the next 8 weeks. Students should measure the growth of one example of each of the varieties in both metric and standard measurements. Compare which vegetable germinates fastest, which grows fastest, and which matures fastest. If your class has planted radishes, pull one each week and observe and record the data. Plot and graph the data to show the results of the data collection on vegetable growth.

6. Provide opportunities to rethink and revise their understandings and work. Share the results with other classes and let them view the mature plants in the garden box. Ask students to explain how they could replicate this process at their home. Ask students to explain how producer's salad ingredients started in a producer's field. Check your schools food safety policy. If the policy allows you to make a salad with the vegetables from your garden follow their directions on washing hands, fruits, and vegetables. Make a salad and have the students enjoy their harvest. Many careers are available to

those who have an interest in agriculture and science. See Appendix D.

Extensions for this lesson:

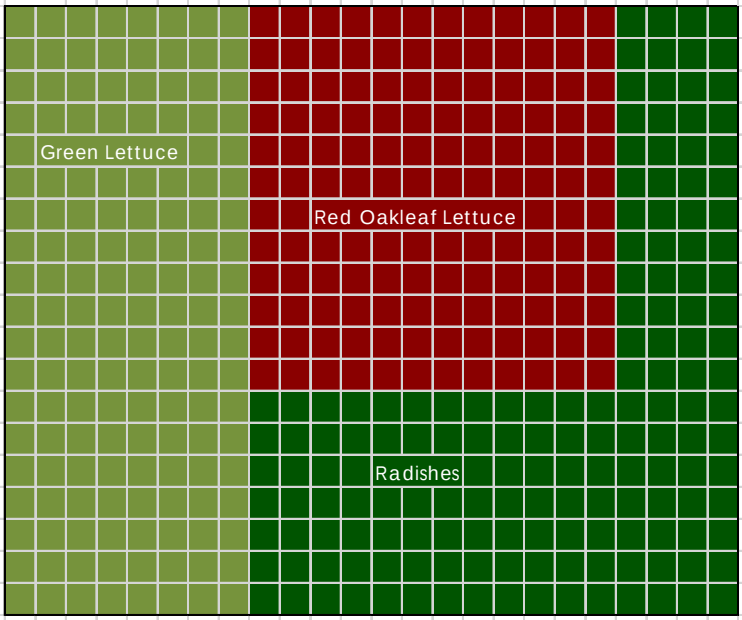
Ask each student to come up with a drawing on grid paper of a 3 sq. ft. garden using triangles, squares, rectangles, etc., for planting patterns.

Ask each student to determine in weight (both metric and standard) how much weight a seed produced in crops, estimate the number of seeds planted and the total food weight that was harvested.

Appendix A

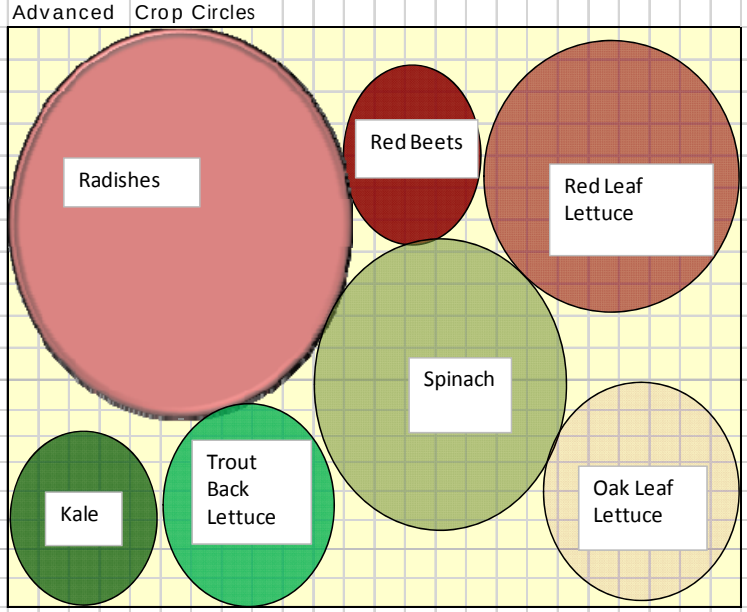
First example is a basic design for beginning students. Second example is circular advanced design for advanced students, pre-teach Appendix B prior to using circular design concept for more hands on geometric reasoning.

Basic



Each square represents 1 sq inch Each crop area = one square foot

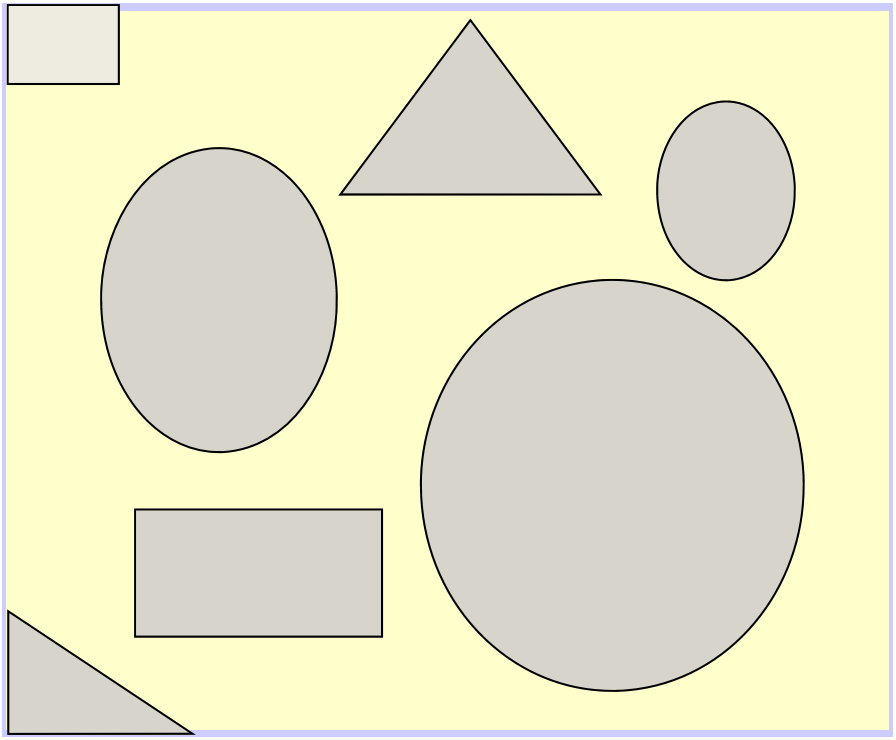
Advanced Crop Circles



When using the crop circles ask students to calculate the area which is planted into each crop, and the area that is not planted. Circles are used by farmers with pivot irrigation, which is an efficient use of water, but some land is not farmed. Irrigation is expensive, but is necessary for plants to grow. Ask students to discuss the pros and cons of leaving some land unfarmed in order to use a more efficient watering system.

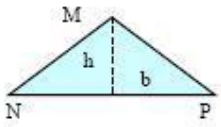
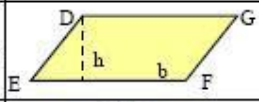
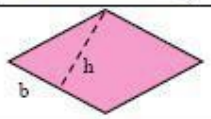
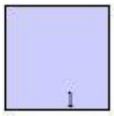
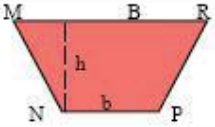
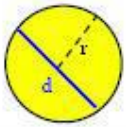
Appendix B

Pre-teach this exercise prior to advanced lesson on crop circles.



1. Find total area by measuring the whole sheet. Appendix C has the formulas required.
2. Cut out and remove various geometric shapes from the whole sheet.
3. Find area of each of the circles, squares, and other geometric shapes which were removed from the whole sheet.
4. Add areas of all geometric shapes together.
5. Subtract this number from the total area of sheet found in step 1. The amount of space left is the area of the negative space as seen in yellow above.
6. This type of geometric math is used by farmers to determine the setup of irrigation systems and crop plantings.

Appendix C

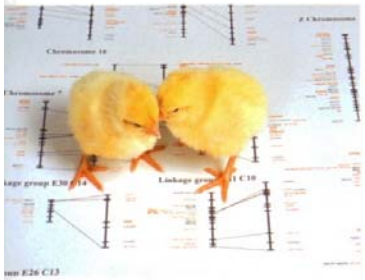
NAME	FIGURE	AREA	PERIMETER CIRCUMFERENCE
TRIANGLE		$A = \frac{b \times h}{2}$	$P=MN+NP+PM$
PARALLELOGRAM		$A = b \times h$	$P=DE+EF+FG+GD$
RHOMBUS		$A = b \times h$	$P = b+b+b+b$ $P = 4b$
RECTANGLE		$A = L \times w$	$P = L+w+L+w$ $P = 2L+2w$
SQUARE		$A = l^2$	$P = l+l+l+l$ $P = 4l$
TRAPEZOID		$A = \frac{(B+b) \times h}{2}$	$P=MN+NP+PR+RM$
CIRCLE		$A = \pi r^2$	$C = 2\pi r = \pi d$

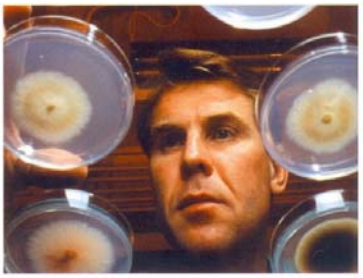
Appendix D

www.agriculture.purdue.edu/USDA/careers/

USDA Living Science

Food, Agricultural and Natural Resources Careers





Agricultural Economist
Agricultural Engineer
Agricultural Science and Business Teacher
Agronomist
Animal Geneticist
Animal Nutritionist
Animal Physiologist
Animal Well-Being Specialist
Aquaculturist
Biochemist
Biological Engineer
Biometrician
Biotechnologist
Botanist
Climatologist
Conservation Biologist
Ecologist
Entomologist
Environmental Scientist
Fisheries Scientist
Florist
Food Process Engineer
Food Safety Specialist
Food Scientist
Forest Engineer
Forester
Horticulturist
Hydrologist
Marine Scientist
Molecular Biologist
Nanotechnologist
Naturalist
Nematologist
Nutritionist/Dietitian
Plant Geneticist
Plant Pathologist
Plant Physiologist
Range Manager
Remote Sensing Specialist
Renewable Energy Specialist
Science Writer
Soil Scientist
Toxicologist
Turf Scientist
Veterinarian
Virologist
Viticulturist
Weed Scientist
Wildlife Biologist
Wood Scientist

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Montana Department of Agriculture
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