COMPOST AND PLANT GROWTH

Performance Standards 12E/11A/13A.H

Students will apply the processes of scientific inquiry and/or technological design to examine Earth's resources and how living things function accordingly:

- *Knowledge*: understand plant nutrition and how it correlates with plant growth and metabolism.
- *Application*: conduct an investigation on how composted nutrients can affect plant growth.
- *Communication*: report the findings of the investigation and generate possible societal applications for these findings.

Procedures

1. ***In order to know and apply concepts that describe the features and processes of the Earth and its resources (12E); the concepts, principles and processes of scientific inquiry (11A); and the accepted practices of science (13A),*** students should experience sufficient learning opportunities to develop the following:
   - Generate inquiry questions for scientific inquiry investigations to test how compost affects growth in various plant species.
   - Research available resources for pertinent foundational and quantitative information about composting, fertilizers and plant nutrition.
   - Design and conduct a scientific inquiry investigation to test class questions about effect of composted materials on plant growth.
   - Determine appropriate materials, equipment and data-collection strategies, procedural sequence, success criteria and safety precautions to test the posed hypothesis or design proposal.
   - Use consistent metric measuring and recording techniques with necessary precision.
   - Graph data appropriately according to the variables: nutrient source (compost or chemical fertilizer) and plant growth (and others, if applicable.)
   - Analyze results and interpret trends.
   - Report the results of individual and group investigations regarding compost's effect on plant growth.
   - Review experimental procedures or explanations for possible faulty reasoning or unproven statements.
   - Compare findings from other presentations to consider consolidation of procedures, explanations or results for future investigations.

   Note to teacher: This activity relates to knowledge associated with Standard 12E, while addressing the Performance Descriptors for Stage H within Standards 11A or 11B and 13A. An extension of this activity is directly associated with the Performance Descriptors for 13B. Classroom assistance for composting resources is available from the Illinois Department of Commerce and Community Affairs:

   http://www.commerce.state.il.us/ho_recycling_energy.html

   As the world population continues to grow, so will the creation of waste. While researching this problem, agriculture students need to realize that the composting process can help to reduce the amount of solid waste that requires disposal and that compost is very useful as a soil additive, potting soil component and natural fertilizer. This assessment aligns with the Illinois Workplace Skills H1 (Solving Problems and Critical Thinking/Identify the problem), H2 (Solving Problems and Critical Thinking/Clarify purposes and goals), H3 (Solving Problems and Critical Thinking/Identify solutions to a problem and their impact), H4 (Solving Problems and Critical Thinking/Employ reasoning skills), H5 (Solving Problems and Critical Thinking/Evaluate options), H6 (Solving Problems and Critical Thinking/Set priorities), H7 (Solving Problems and Critical Thinking/Select and implement a solution to a problem) and H8 (Solving Problems and Critical Thinking/Evaluate results of implemented option).
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Begin the investigation of compost's effectiveness as a soil additive with foundational questions about prior knowledge of the composting process, plant nutrition, soil characteristics and the materials which can or must be involved. Determine the capabilities of the school or potential home settings for the successful completion of this assignment. Set the stage for the variety of investigations, which can be incorporated into this unit. Students will be asked to conduct an investigation about compost as a soil additive and its potential as a substitute for chemical fertilizers. Students may investigate which specific composted organic material (i.e.,

grass clippings, coffee grounds or food scraps) adds the most nutrients to soil. Others may investigate how compost impacts plant growth in comparison to plants that receive no added nutrient source. Determine the parameters for this investigation through class discussion. The class should decide all controlled variables (plant species grown, procedural requirements such as amount of water added to soil, temperature, amount of light, etc.), data-collection requirements and degradable materials (only leaves, only certain kinds of leaves, grass clippings or not, specific food scraps, etc.) Individuals or groups of students should propose their own design for testing compost's effect on plant growth as it compares to chemical fertilizers. They may test how compost ingredients, amount of compost, amount of fertilizer or different plant species determines growth depending on class decisions. They need to:

- Create individual or group investigation designs with all procedural steps, safety precautions, necessary materials and equipment, data-collection tables and applicable sketches.
- Maintain a log of all activities, observations and results.
- Inspect plant growth regularly to collect data.
- Analyze the results of plant growth for each of the plant species and the variables they tested.
- Present findings, describing and explaining the results of the experiment.
- Prepare graphic tables or charts that compare the variables of nutrient source and plant growth from their investigation.
- Compare findings, procedures and data to generate further investigation possibilities.

4. Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:
   - *Knowledge*: The explanation of plant nutrition and how it affects plant growth was complete and correct.
   - *Application*: The observations and procedures for the investigation were thorough, well organized and well detailed.
   - *Communication*: The findings from the student investigation were well focused, well detailed and thoroughly compared and explained the variables that were tested.

Examples of Student Work

- **Meets**
- **Exceeds**

Time Requirements

- Three to five weeks
- Five to eight minutes for each presentation

Resources

- Notebook or journal for each student
- Composting supplies, facilities and equipment (thermometers, beakers for delivery of constant moisture, trowels, shovels, etc.), composted residue
- Plant trays, flats or pots, potting soil, chemical fertilizer, plant seeds
- Science Rubric

Special notes for consideration when developing compost to be used with this assessment:

1. It will be more preferable to start this project in October or March. Winter conditions of lowered temperatures and precipitation (snow, ice) will inhibit the necessary entry of oxygen into the compost system.
2. It is suggested that the optimum temperature within the compost system range from 150 – 175 degrees F, if vegetative materials (yard wastes, food scraps, etc.) are used.
3. Turning the compost involves variables that should be considered:
   - If turned too often, decomposition slows.
   - Turn only when the system's temperature has stabilized – to redistribute nutrients and decomposition processes.
   - Generally, turn weekly in the first two weeks to initially distribute materials (to prevent odors) and keep the system stable for approximately three weeks without turning.
4. It may not be necessary to add any moisture at all, depending on the decomposing materials. If food wastes are included, less moisture is necessary. If the system is too wet, the process is slowed.
5. For possible school composting grant funding: http://www.commerce.state.il.us/com/recycling/school_recycling_grants.html

SCIENCE RUBRIC

Exceeds - must receive no more than one 3 and the rest 4s in the other areas of the rubric.
Meets - may receive no more than one 2 and a combination of 3s and 4s in the other areas of the rubric.
Approaches - may receive no more than one 1 and a combination of 2s, 3s or 4s, in the other areas of the rubric.
Begins - must receive at least a 1 in all 3 areas of the rubric.

	KNOWLEDGE Knows and understands scientific terms, facts, concepts, principles, theories and methods.	**APPLICATION** Applies scientific knowledge, skills and methods to manipulate, analyze, synthesize, create and evaluate.	**COMMUNICATION** Communicates scientific knowledge and applications through writing, speech and visual displays.
4	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct.	• Applications are thorough, appropriate and accurate.	• Written, oral and/or visual communication is well organized and effective.
3	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct.	• Applications are mostly thorough, appropriate and accurate.	• Most of the written, oral and/or visual communication is well organized and effective.
2	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct.	• Applications are somewhat appropriate and accurate.	• Some of the written, oral and/or visual communication is organized and effective.
1	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present or correct.	• Applications are minimally appropriate and accurate.	• Little of the written, oral and/or visual communication is organized and effective.
0	• All descriptions of scientific terms, facts, concepts, principles, theories and methods are missing and/or incorrect.	• All applications are missing and/or incorrect.	• All of the written, oral or visual communication is missing and/or lacks organization.
Score			