



Teacher-to-Teacher

Video Series
for Secondary Educators

TITLE: The Pickle “Dill”emma

PRIMARY SUBJECT AREAS: Biology and Environmental Science

GRADE LEVEL: 9-12

OVERVIEW: Students learn about a problem in their local farming community regarding a pickle factory, and the class is asked to help determine if the pickle factory is the source of a seed germination problem. The students formulate a hypothesis about the source, and they test their hypothesis and gather data by making measurements of seedling length, pH, and temperature of the environment and by making photographic images. The students identify questions and concepts that guide their scientific investigation. They then design and conduct a scientific investigation using technology and mathematics to improve their communication and to enhance their gathering and manipulation of data. They learn about the different stages of embryological development in plants, explore how humans can impact the ecosystem, learn how pollutants can affect living systems, and evaluate the relationships between the quality of life and environmental quality.

Following their investigations, they prepare a PowerPoint Presentation for the farmers and the managers of the pickle factory that includes a description of the problem, a summary of the investigation procedure, a graph of their results and recommendations to the farmers and the managers. They analyze how individuals are capable of reducing or reversing their impact on the environment through thinking, planning, education, collaboration, and action and they demonstrate that the most important factor in prevention and control of pollution is education. Students develop an awareness of personal responsibility as stewards of the local and global environment by helping the farmers solve their seed germination problem that is associated with the pickle factory.

APPROXIMATE DURATION: four 50-minute class periods and four-20 minute class periods

LOUISIANA CONTENT STANDARDS:

<http://www/DOE/assessment/standards/SCIENCE/pdf>

Science as Inquiry

Benchmarks:

- SI-H-A1 identifying questions and concepts that guide scientific investigations;
- SI-H-A2 designing and conducting scientific investigations;

- SI-H-A3 using technology and mathematics to improve investigations and communications;
- SI-H-B3 communicating that scientist rely on technology to enhance the gathering and manipulation of data;

SI GLEs:

1. Write a testable question or hypothesis when given a topic (SI-H-A1)
2. Describe how investigations can be observation, description, literature survey, classification, or experimentation (SI-H-A2)
3. Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls (SI-H-A2)
4. Conduct an investigation that includes multiple trials and record, organize, and display data appropriately (SI-H-A2)
5. Utilize mathematics, organizational tools, and graphing skills to solve problems (SI-H-A3)
6. Use technology when appropriate to enhance laboratory investigations and presentations of findings (SI-H-A3)
9. Write and defend a conclusion based on logical analysis of experimental data (SI-H-A2) (SI-H-A6)
14. Cite examples of scientific advances and emerging technologies and how they affect society (e.g., MRI, DNA in forensics) (SI-H-B3)

Life Science

Benchmark:

- LS-H-D4 exploring how humans have impacted the ecosystem and the need for societies to plan for the future;

LS GLEs:

- Biology GLE 27. Analyze positive and negative effects of human actions on ecosystems (LS-H-D4) (SE-H-A7)

Science and the Environment

Benchmark:

- SE-H-A11 understanding how pollutants can affect living systems.

SE GLE:

- Environmental Science GLE 12. Give examples and describe the effect of pollutants on selected populations (SE-H-A11)

EDUCATIONAL TECHNOLOGY GUIDELINES:

Technology Communication Tools

Students use a variety of media and formats to communicate and present information and ideas effectively to multiple audiences.

INTERDISCIPLINARY CONNECTIONS:

- D-2-H recognizing data that relate two variables as linear, exponential, or otherwise in nature (e.g., match a data set, linear or non-linear, to a graph and vice versa)
- P-1-H modeling the concepts of variables, functions, and relations as they occur in the real world and using the appropriate notation and terminology
- M-4-H demonstrating the concept of measurement as it applies to real-world experiences

OBJECTIVES:

1. The student will explain the function of all seed parts in the germination process.
2. The student will identify pollution sources in their environment and describe their relationship to germination.
3. The student will germinate seeds.
4. The student will collect and analyze data with average values and bar graphs.
5. The student will capture and manipulate digital images.
6. The student will construct a living graph.
7. The student will use PowerPoint as a presentation tool to communicate the results of their investigation.

LESSON MATERIALS AND RESOURCES:

Materials per set up

1 quart jar of dill pickles	10 100 ml beakers
1 liter of distilled or spring water	1 millimeter ruler (12" long)
80 corn seeds	1 marking pen
80 mustard seeds	1 roll of pH paper (Range 1-11)
1 roll of Bounty paper towels	1 thermometer (range at least 0 – 100° C)
16 sandwich size sealable plastic bags	1 roll of masking tape
1 12"x18" cookie sheet	Attachments 1-8

TECHNOLOGY TOOLS AND MATERIALS:

Hardware: digital camera or disposable film camera with processing to a digital format (disk or CD), 1 computer capable of supporting MS PowerPoint, 1 MS PowerPoint (found in most computers with MS Word)

Software: 1 Floppy Disk

BACKGROUND INFORMATION:

This is an introductory lesson and does not require much prior knowledge. It would be helpful if the students have prior knowledge of the basic part of monocot and dicot seeds, the process of germination and general knowledge of the pH range of acids and bases. It would also be helpful if they know the basics of how to use a computer and the very basics of PowerPoint.

LESSON PROCEDURES:

1. Preparation of Solutions: Make a series of solutions of pickle juice diluted varying amounts with water: Get the pickle juice by draining the juice out of a jar of dill pickles into an empty jar.
 - A. Make 5% pickle juice by mixing 5 ml of pickle juice with 95 ml of water.
 - B. Make 10% pickle juice by mixing 10 ml of pickle juice with 90 ml of water.
 - C. In a similar way make 20%, 40%, 60%, and 80% pickle juice.
 - D. Use the remaining undiluted juice for 100% pickle juice.
 - E. Use plain water for 0% pickle juice.
2. View the video on the Results and Living Graph at:
<http://www.classtech2000.com/biolvhs/pickle/piclivg.mpg>.

This video will help to explain the concept of the living graph and the expected results. The video may take a while to download. Please be patient.

Student Procedure

1. Read the introductory story, “**The Farmers and the Pickle Factory**” (Attachment 1 or <http://www.classtech2000.com/biolvhs/pickle/farmpap.htm>)
2. Read and study **Seeds and Germination** (Attachment 2 or <http://www.classtech2000.com/biolvhs/pickle/germ/seedgerm.htm>)
3. Place 2 sheets of paper towel into each of 16 resealable bags.
4. Label two bags each as 0, 5, 10, 20, 40, 60, 80, and 100 to correspond to the pickle juice dilutions.
5. Place 10 corn seeds in each bag of one set of 8 bags (one of each dilution) and label the bags “Corn.”
6. Place 10 mustard seeds in each bag of the other set of 8 bags and label the bags “Mustard.”
7. Wet the paper towel in each bag with 10 ml of the dilution of pickle juice corresponding to its label (e.g., 10 ml of water in bag 0, 10 ml or 5% in bag 5, etc.)
8. Do not seal the bags. Seal only the corners to prevent evaporation.
9. Lay the bags on the cookie tray grouped according to %pickle juice.
10. Cover the bags with newspaper so no light reaches the seeds
11. After 24 hours, open each bag and count the number of seeds that have germinated in each bag. Measure in millimeters the length of the seedling from tip to tip using a piece of thread or dental floss. Record your results in the **Seed Germination Table Attachment 3** or <http://www.classtech2000.com/biolvhs/pickle/germtab.htm>.) For each concentration determine the average total length of the seedling. Each bag has 10 seeds. Those seeds that do not germinate have the length of the seed only. Record the data for each seed and concentration on the Seed Germination Table.
12. Take pictures and record the picture number shown on the camera plus the description of the specimen in the picture.
13. Repeat steps 11 and 12 at 48 hours and 72 hours and after 7 days. Record data each time on table provided. (Note that a different Seed Germination Table is required for each day of data collection.)
14. On the 7th day look at the seeds at each of the concentration of pickle juice. Select the seedling that is the longest in total length. Then on a piece of graph paper lay out the seedlings from 0% - 100% pickle juice. You are making a living graph. Lay the paper long ways and make a line for the x-axis (% pickle juice) Every 4 cm will represent 10% Pickle Juice. [A picture of an example of this is available in **The Pickle “Dill” emma PowerPoint How To** (Attachment #4 or <http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm>)]. Make markers on the paper. The Y-axis is total length of the seedling. Arrange the seedlings and then take a picture of your graph. You will notice that the seeds are very crowded in the graph between 0% and 20%. Now make another graph and only plot 0%-60%. Now you can spread out the x-Axis more. Do your best to spread out the axis. Take a picture of the

living graph. Try to zoom in as close as possible. Repeat making a living graph for each type of seed.

*(Please note that adequate results can often be determined in 3 days if there is adequate growth. If there is adequate growth, you can take the pictures for the living graph on the third day, and the lesson takes less time.)

15. Use MS PowerPoint to present an analysis of the data you obtain so that you can make a final report to the farmers and pickle factory managers. Use **The Pickle “Dill”emma PowerPoint How To** (Attachment 4 or <http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm>) to create your PowerPoint presentation. Include the following slides:
 - Title Slide
 - Summary of Problem
 - Description of Investigation Procedure
 - Graph of total lengths and number germinated vs. Pickle Juice Concentration Results
 - Picture of Living Graph with Caption.
 - Conclusion/Recommendation to farmers
(Including how citizens can help solve or prevent the problem)

The Student Handout for The Pickle “Dill”emma is [Attachment 7](http://www.classtech2000.com/biolvhs/pickle/proced.htm) or <http://www.classtech2000.com/biolvhs/pickle/proced.htm>)

Closing:

A group discussion or critique of students’ recommendations to farmers should follow the group presentations. The teacher, using the rubric in attachment six, should evaluate student presentations.

ASSESSMENT PROCEDURES:

Completion of the Seed Germination Tables on the days of data collection will be evaluated using a rubric. The Seed germination Table requires the students to accurately count germinated seeds, measure the length of the seedlings and to calculate the average length of the seedlings. The Seed Germination Rubric is Attachment 5 or <http://www.classtech2000.com/biolvhs/pickle/ablerub.htm>.

Upon completion of the lesson, use MS PowerPoint to present an analysis of the data you obtain so that you can make a final report to the farmers and pickle factory manager. Pickle “Dill”emma Power Point How To, Attachment 4. the PowerPoint presentation will be evaluated with a rubric. The Pickle “Dill” emma PowerPoint Rubric is Attachment 6 or <http://www.classtech2000.com/biolvhs/pickle/pptrub.htm>.)

ACCOMMODATIONS/MODIFICATIONS:

For students with dexterity problems have larger bags for the specimens and voice command software (dictation software) to help create the presentation for the farmers. These students may need to prepare their presentation in MS Word instead of PowerPoint. Working in groups allows for accommodations.

REPRODUCIBLE MATERIALS:

Attachment #1: [The Farmers and the Pickle Factory Story](http://www.classtech2000.com/biolvhs/pickle/farpap.htm)
(<http://www.classtech2000.com/biolvhs/pickle/farpap.htm>)

Attachment #2: [Seeds and Germination](http://www.classtech2000.com/biolvhs/pickle/germ/seedgerm.htm)
<http://www.classtech2000.com/biolvhs/pickle/germ/seedgerm.htm>)

Attachment #3: [Results Seed Germination Table](http://www.classtech2000.com/biolvhs/pickle/germtab.htm)
(<http://www.classtech2000.com/biolvhs/pickle/germtab.htm>)

Attachment #4: [PowerPoint How To for Pickle "Dill"emma](http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm)
(<http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm>)

Attachment 5: [Seed Germination Rubric](http://www.classtech2000.com/biolvhs/pickle/ablerub.htm)
(<http://www.classtech2000.com/biolvhs/pickle/ablerub.htm>)

Attachment 6: [The Pickle "Dill"emma PowerPoint Rubric](http://www.classtech2000.com/biolvhs/pickle/pptrub.htm)
(<http://www.classtech2000.com/biolvhs/pickle/pptrub.htm>)

Attachment 7: [The Student Handout for The Pickle "Dill"emma](http://www.classtech2000.com/biolvhs/pickle/proced.htm)
(<http://www.classtech2000.com/biolvhs/pickle/proced.htm>)

Attachment 8: Teacher Preparation

EXPLORATION AND EXTENSION:

This is a safe lab that has readily available materials. The students can extend the investigation by separating the pH and salt factors of the pickle juice and testing these factors separately. They can also look at other variables that influence germination. The Pickle "Dill"emma makes one wonder about the effects of acid rain. The students should be interested in the factors that influence plant growth and development. The following Web sites provide reference information about growing plants, looking at the parts of the plant and exploring the problems of growing plants. These interactive Web sites are good extension exercises for students to do by themselves and these sites will spark thoughts on extended lab activities.

The Great Plant Escape
<http://www.urbanext.uiuc.edu/gpe/gpe.html>

Acid Rain WebQuest
<http://www.swlauriersb.qc.ca/english/edservices/pedresources/webquest/rainwq.htm>

Acid Rain
<http://www.epa.gov/airmarkets/acidrain/>

Acid Rain Experiments
<http://www.epa.gov/airmarkets/acidrain/experiments/index.html>

Rhizobium to the Rescue
<http://www.ars.usda.gov/is/kids/environment/story3/rhizobium.htm>

Hold the Chemicals and Pass the Mold Please

<http://www.ars.usda.gov/is/kids/environment/story4/sugarbeetbattle.htm>

Ozone Spells “Ouch” for Some Plants

<http://www.ars.usda.gov/is/kids/environment/story5/ozoneframe.htm>

Sci4Kids: Plants

<http://www.ars.usda.gov/is/kids/plants/plantsintro.htm>

LESSON DEVELOPMENT RESOURCES:

All materials in this lesson were created by the author. No outside materials were used.

REFLECTIONS:

I have done inquiry germination labs for many years. The real-life farmer's problem with the pickle factory has made the lab much more meaningful and interesting. The students feel a purpose in doing the lab and gain experience at doing an investigation. Real-life issues, such as the well being of their community, are highly engaging for students. They see a purpose in sharing their findings in the power point presentation. The Pickle "Dill"emma scenario has allowed me to easily integrate the community goals of doing investigations and to integrate technology into the lesson.

CONTACT INFORMATION:

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Attachment 1

The Farmers and the Pickle Factory

by Jewel Reuter
La Virtual School



"Adelle," shouts Pierre, "The corn seeds still haven't all germinated and its been two weeks since we planted. We're having the same problem that we did for the past two years. I don't know what the problem is. I am ready to quit farming and go fishing for a living."

"I've talked to the other farmers and everybody along the bayou is having the same problem. They are ready to give up too." said Pierre.

"Pierre, before you hitch the boat to the truck why don't you go to the high school and let the science department see what's wrong. It might be something contaminating the soil or the air that is causing the problem." said Adelle.

"If it is pollution what can we do?" asked Pierre.

"We will decide what to do when we know what the is causing the problem. You should go see Mrs. Coty Ledon and ask her to analyze the seeds and tell her what is happening."

Pierre goes to the high school and sees Mrs. Ledon. She asks Pierre to bring a sample of the soil and water from the area. Mrs. Ledon takes out a strip of pH paper and finds that the soil and the water are below pH 6. This means that the soil and the water are acidic. Pierre sees this and thinks for a moment.

"The pickle factory! The came here three years ago and that's when the trouble started. We use the water from the bayou to irrigate or water the crops. I wonder if the pickle factory is dumping excess pickle juice into the bayou." said Pierre.

So Pierre told the other farmers and they stormed into the plant manager's office at the pickle factory. They all told him about the problems. The plant manager told them that the pickle factory is not dumping any pickle juice into the bayou or anywhere else and even if it were, pickle juice is harmless.

Pierre demands, "It is a pickle juice problem. You are killing our crops!"

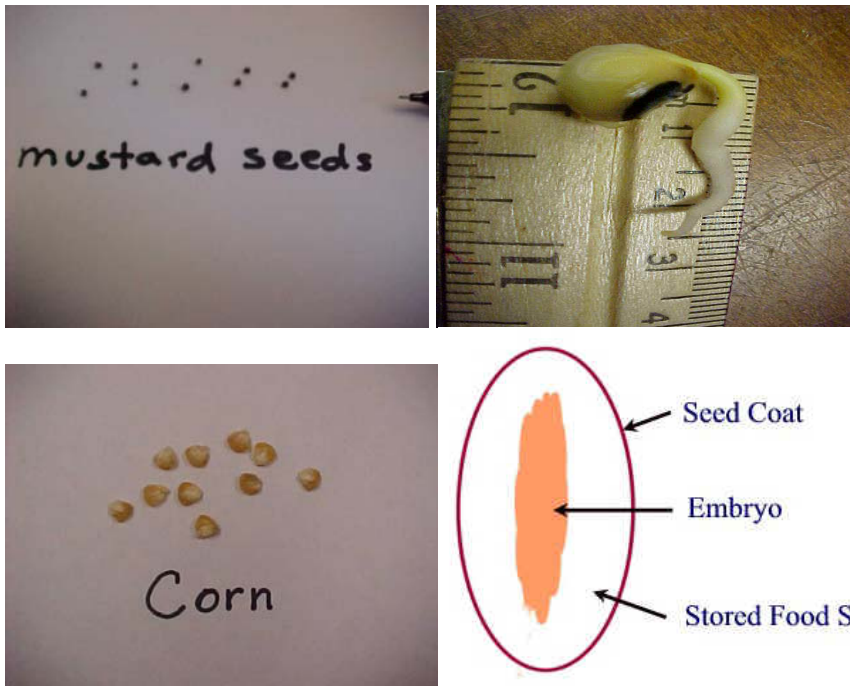
"Well you will have to prove that accusation, sir." said the plant manager.

So Pierre went back to Mrs. Coty Ledon at the high school and told her about the meeting at the pickle factory.

Mrs. Ledon said, "Well we will just have to do a little experiment to prove it to the pickle factory, Pierre."

"What kind of experiment will you do?" asked Pierre.

Attachment 2
Seeds and Germination
by Jewel Reuter, LA Virtual School



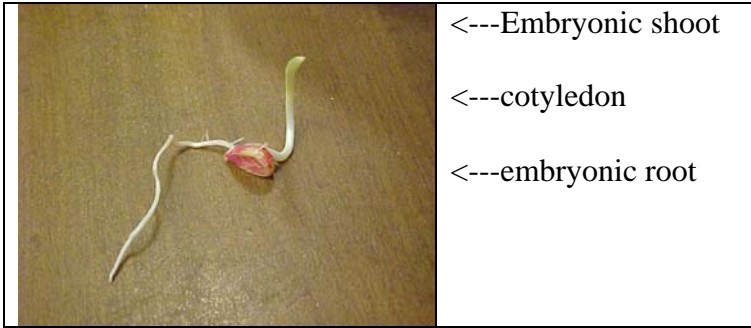
A seed is an embryo of a plant that is encased in protective covering surrounded by a food supply. The embryo is the early developmental stage of the plant. The seed's food supply provides nutrients to the embryo as it grows. The seed coat protects the embryo. The embryo often stops growing and become dormant while it is contained in the seed until the conditions are just right. The embryo can remain dormant for long periods of time. When conditions become right, it begins to grow it uses the nutrients in the seed.

Environmental conditions such as temperature and moisture can cause the seed to end dormancy and to germinate, to sprout. Seed germination is the early stage of growth for the embryo.

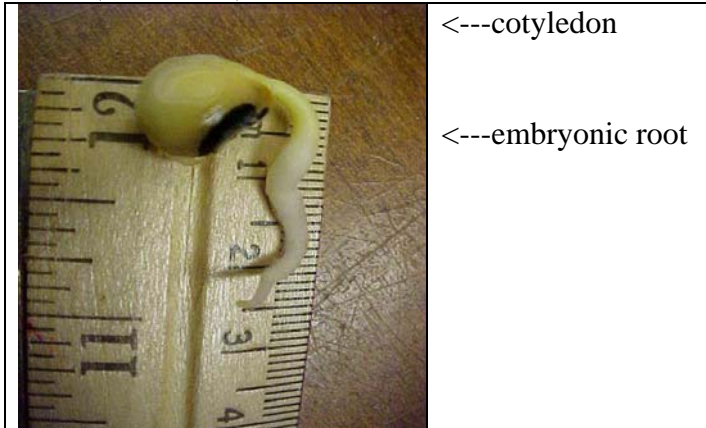
There are monocot (has one seed leaf seeds) and dicot (has two seed leaf seeds) plants. Another name for seed leaf is cotyledon. An example of a monocot plant is corn and a dicot is beans. The leaves on the shoot of the monocot are narrow and the leaves of the shoots of the dicot are broad and they have an embryonic root called a radical. In many monocots the cotyledon remains in the seed and the growing shoot emerges. In many dicots the cotyledons grow up above the ground and protect the emerging foliage, but some remain under the ground.

Changes in the environment can influence the rate of germination and the growth of the plant. Various pollutions have caused problems with seed germination.

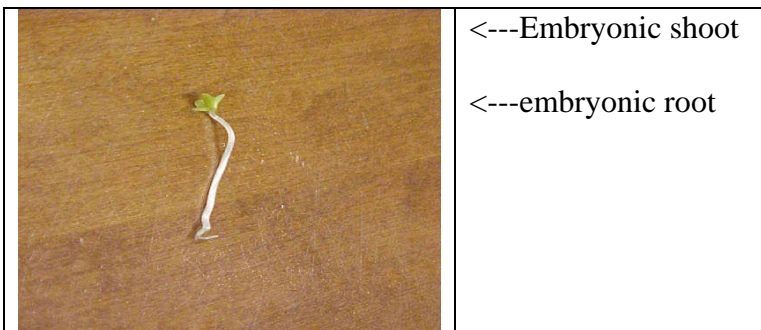
Images of Seeds As They Germinate



Corn (a monocot)



Black Eye Pea (a dicot)



Mustard (a dicot)

Seed Germination Table

SEED GERMINATION TABLE																Time: _____	
Seed	0%		5%		10%		20%		40%		60%		80%		100%		
	# Ger	avg. mm	# Ger	avg. mm	# Ger	avg. mm	# Ger	avg. mm	# Ger	avg. mm	# Ger	avg. mm	# Ger	avg. mm	# Ger	avg. mm	
Corn																	
Mustard																	

Example for calculating Average Length (avg. mm)

10% Pickle Juice with Mustard seeds might be:

seeds Length (mm) Time _____

- 1 15 mm
- 1 17 mm
- 2 14 mm
- 3 12 mm
- 3 4 (Not germinated--just length of cotyledon)

Average length = $\frac{\text{total length}}{\text{Total \# seeds}}$

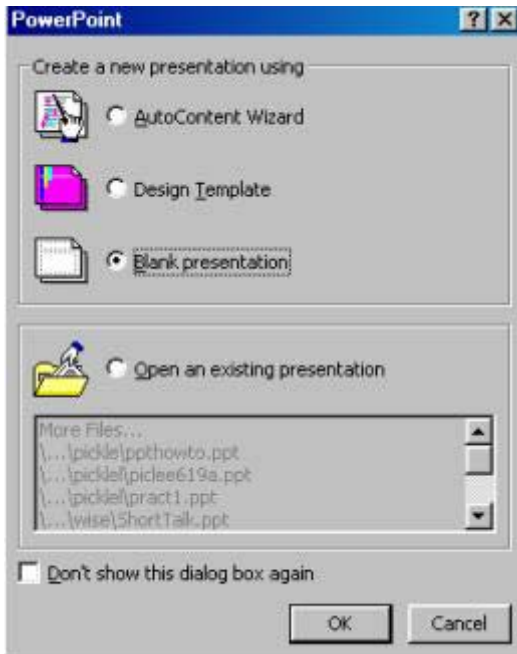
$$\text{Average Length} = \frac{15\text{mm (1 seed)} + 17 (1 \text{ seed}) + 14\text{mm (2 seeds)} + 12\text{mm (3 seeds)} + 4\text{mm (3 seeds)}}{10 \text{ seeds}} = \frac{108 \text{ mm}}{10 \text{ seeds}}$$

= 10.8 mm/seed is the average length of 10 seeds

Pickle "Dill"emma -
PowerPoint 2000 How To Basics
Attachment 4
by Jewel Reuter
LA Virtual School

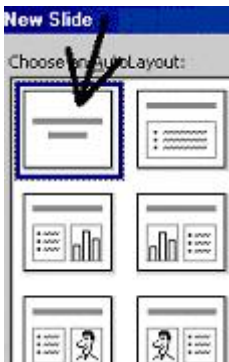


- Start-->Programs--PowerPoint
- Select Blank Presentation (OK)

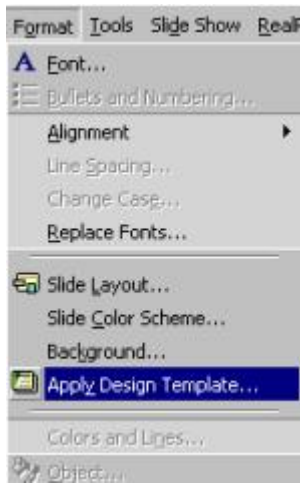


Slide 1: Title

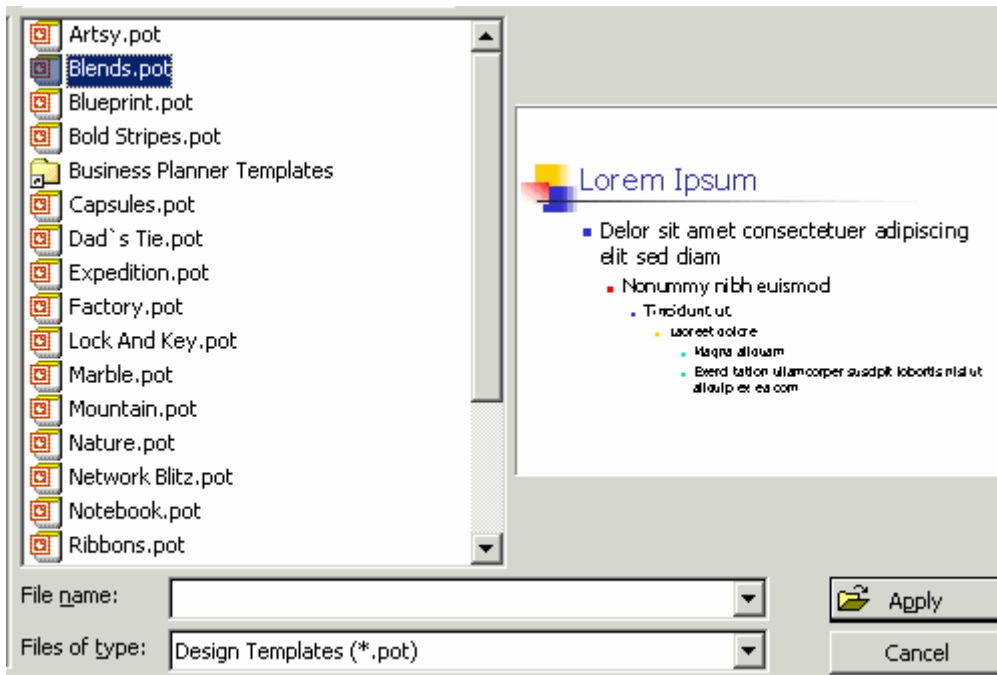
Click on Blank presentation and then Click on OK.
On the New Slide window.
Choose an AutoLayout.
Select Title Slide for the first slide.



>Format
Apply Design Template



>Select Blends.pot or something simple.
Then Apply



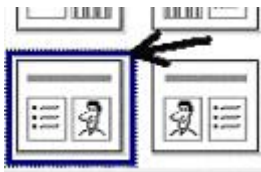
- On the Title Slide click on Title Field.
Add Title of Project: The Pickle "Dill"emma.



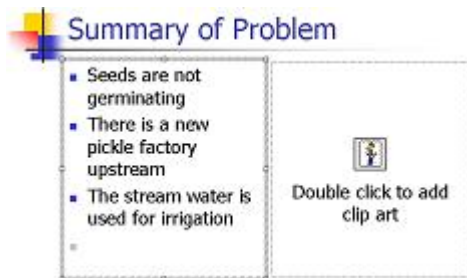
- Then click on the lower field.
Add Your Name, School, Date and for whom the project is prepared:
The Louisiana Farmers Assn.



- **Slide 2: Summary of the Problem**
Go to Insert.
- Choose New Slide.
- Choose a Text and Clip Art slide and click OK.

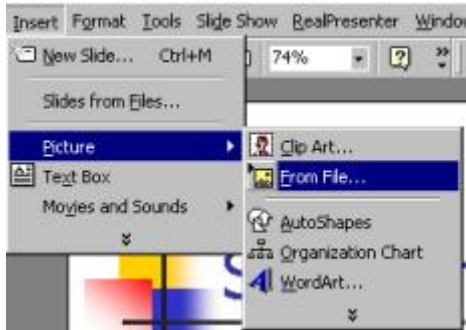


- Click on the Title Block and type: Summary of the Problem.
- Click on the text box and write the summary.



- Double click on Clip Art box and insert a picture.
- To use the Clip Art File, search for clips either by using the drop down file or Clip Art Gallery.
- Clip Art Gallery:
- You can search for pictures by topic, and select the picture that is most appropriate.

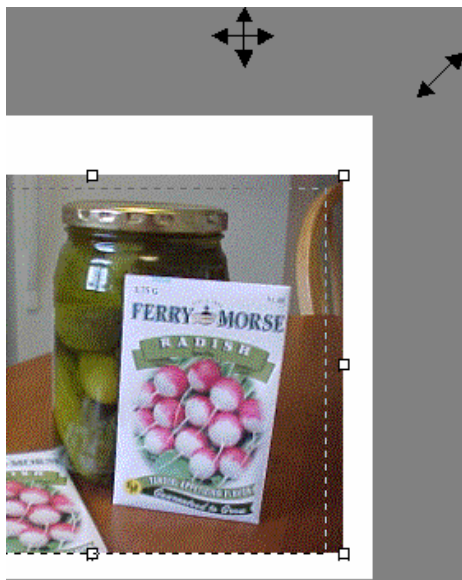
▶ To insert a picture from a file, click on From File and click on the drive and directory where it is located.



▶ In this case our picture is on the Floppy A-drive.

▶ Click on the file and click on Insert at the bottom right of the window.

▶ To edit the size of the picture click on the corner box and drag the picture to the desired size.



After the picture is edited the slide is complete.

Summary of Problem

- Seeds are not germinating
- There is a new pickle factory upstream
- The stream water is used for irrigation



➤ Slide 3: Description of Investigation Procedure

➤ Go to Insert.

Choose New Slide.

➤ Choose Text and Clip Art slide and click OK

➤ Click on Title Block and type: Description of Investigation Procedure.

➤ Click on the text box and write the description of the procedure.

➤ Double click on Clip Art box and insert picture to select the Floppy A drive if that is where your digital image is located. Follow the procedure used in Slide 2 above.

➤ Slide 4: Graph of Results

Go to Insert New Slide and select Chart and text and click OK.



➤ Click on the Title Box and add Graph of Results.

➤ Click on the Text Box to add text.

➤ When you Double Click on the Chart to add the Graph a Data Sheet will appear immediately adjacent to the graph

➤ Edit first row to change x-axis.

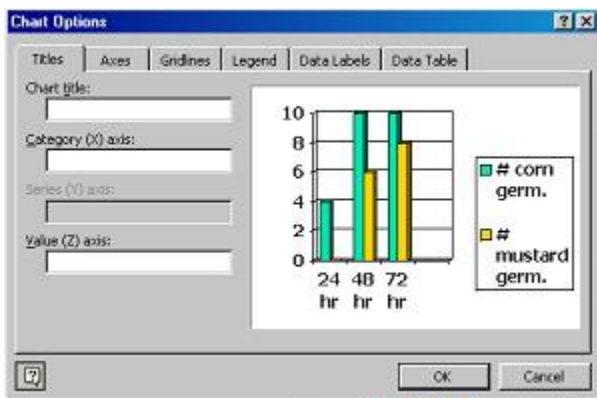
➤ Edit first column to change y-axis.

➤ Edit numbers in chart to change values on graph. The magnitude of the values in the table will establish the values on the graph.

➤ To edit name of axes right click on white portion of graph and go to chart options.

	A	B	C	D
	24 hr	48 hr	72 hr	
1	# corn germ.	4	10	10
2	# mustard germ.	0	6	8
3				
4				

➤ The graph of results will appear as Data Sheet as modified.



✔ Click on text box to add description of the data.

✔ Slide 5: Live Graph

✔ Go to Insert New Slide.

Choose a Text and Clip Art slide and click OK.

✔ Click on the Title Block and type: Picture of Live Graph with Caption.

Click on the text box and write the summary of the results.

✔ Double click on Clip Art box and insert picture to select the Floppy A drive if that is where your digital image of the Live Graph is located.



✔ Slide 6: Conclusion/Recommendation

Go to Insert New Slide.

✔ Choose a Text and Clip Art slide and click OK.

Click on the Title Block and type: Conclusion/Recommendation

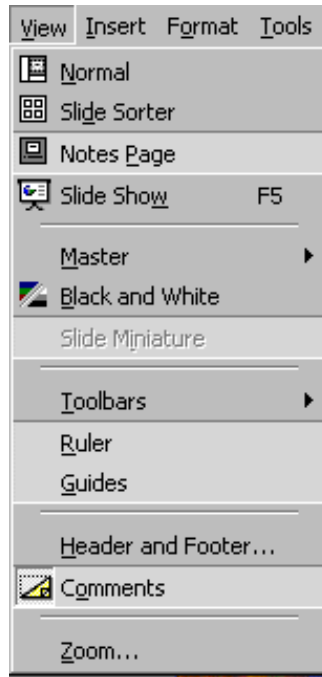
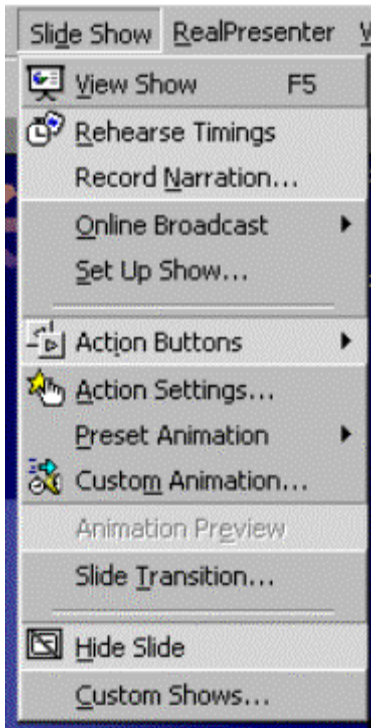
Click on the text box and write the summary.

Double click on the Clip Art box to insert pictures if any.

✔ Slide Editing:

✔ For slide transitions, animations and recording narrations go to: Slide Show

✔ View as you work and present.



In View:

- 1) Click on Normal to make a Slide and to use the outline.
- 2) Click on Outline View to see the text of all slides.
- 3) Click on Slide View to see only the slide and to make slides.
- 4) Click on Slide Sorter for mini view of all slides and ability to drag to a position.
- 5) Click on Slide Show to see it as a presentation.

The views are also available on the left side of the task bar near the Start button.

1 2 3 4 5



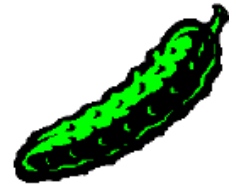
Attachment 5
Seed Germination Rubric Table

Component Criteria	Points Awarded (maximum of 20 points each)	Explanation of Points
Time recorded		
Number of germinated seeds is recorded		
Accurate calculation of total length		
Accurate calculation of average length		
Completed table properly		
	Total Points:	

Attachment 6
Pickle “Dill”emma PowerPoint Rubric

Component	Points (5 each)	Explanation of Points
Title Slide Student Name, School, Date Who the project is prepared for: (The Louisiana Farmers Assn.)		
Summary of Problem <ul style="list-style-type: none"> • Problem of seed germination is stated • The pickle factory is hypothesized to be the source of the problem. 		
Description of Investigation Procedure Includes: <ul style="list-style-type: none"> • type of seeds • concentrations of pickle juice • method of measurement • use of pictures • making graph of data 		
Graph of total lengths and number of seeds germinated vs. pickle juice concentration results Criteria: <ul style="list-style-type: none"> • types of seeds are labeled • percentages of pickle juice are labeled • number of seeds germinated is labeled • length of seeds is labeled 		
Picture of Living Graph <ul style="list-style-type: none"> • graph has % pickle juice labeled • graph has length (mm) labeled • seedlings are placed in proper order of concentration • graph has a caption • quality of picture 		
Conclusion/Recommendation to Farmers Criteria: <ul style="list-style-type: none"> • general summary of results (What is the effect of pickle juice on seed germination?) • includes recommendation of how to solve problem to farmers and how citizens can help solve or prevent the problem 		
	Total Points	

Attachment 7
Student Procedure for The Pickle “Dill”emma
by Jewel Reuter, LA Virtual School



1. Read the introductory story, "The Farmers and the Pickle Factory"
[Attachment #1](#) or <http://www.classtech2000.com/biolvhs/pickle/farmpap.htm>
2. Read and study **Seeds and Germination** ([Attachment #2](#) or <http://www.classtech2000.com/biolvhs/pickle/germ/seedgerm.htm>)
3. Place 2 sheets of paper towel into each of 16 resealable bags.
4. Label two bags each as 0, 5, 10, 20, 40, 60, 80, and 100 to correspond to the pickle juice dilutions.
5. Place 10 corn seeds in each bag of one set of 8 bags (one of each dilution) and label the bags “Corn.”
6. Place 10 mustard seeds in each bag of the other set of 8 bags and label the bags “Mustard.”
7. Wet the paper towel in each bag with 10 ml of the dilution of pickle juice corresponding to its label (e.g. 10 ml of water in bag 0, 10 ml of 5% in bag 5, etc.).
8. Do not seal the bags. Seal only the corners to prevent evaporation.
9. Lay the bags on the cookie tray grouped according to % pickle juice.
10. Cover the bags with newspaper so no light reaches the seeds.
11. After 24 hours, open each bag and count the number of seeds that have germinated in each bag. Measure in millimeters the length of the seedling from tip to tip using a piece of thread or dental floss. Record your results in the **Seed Germination Table** ([Attachment #3](#) or <http://www.classtech2000.com/biolvhs/pickle/germtab.htm>). For each concentration determine the average total length of the seedling. Each bag has 10 seeds. Those seeds that do not germinate have the length of the seed only. Record the data for each seed and concentration on the Seed Germination Table.
12. Take pictures and record the picture number shown on the camera and the description of the specimen in the picture.
13. Repeat steps 11 and 12 at 48 hours and 72 hours and after 7 days. Record data each time on table provided. (Note that a different Seed Germination Table is required for each day of data collection.)
14. On the 7th day look at the seeds at each of the concentration of pickle juice. Select the seedling that is the longest in total length. The on a piece of graph paper lay out the seedlings from 0% - 100 % pickle juice. You are making a living graph. Lay the paper long ways and make a line for the X-axis (% Pickle Juice). Every 4 cm will represent 10% Pickle Juice.
[A picture of an example of this is available in **The Pickle "Dill"emma PowerPoint How To** ([Attachment #4](#) or <http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm>)].

Make markers on the paper. The Y-axis is total length of the seedling. Arrange the seedlings and then take a picture of your graph. You will notice that the seeds are very crowded in the graph between 0% and 20%. Now make another graph and only plot 0% - 60%. Now you can spread out the x Axis more. Do your best to spread out the axis. Take a picture of the living graph. Try to zoom in as close as possible. Repeat making a living graph for each type of seed.

(Please note that adequate results can often be determined in 3 days if there is adequate growth. If there is adequate growth, you can take the pictures for the living graph on the third day, and the lesson takes less time.)

15. Use MS PowerPoint to present an analysis of the data you obtain so that you can make a final report to the farmers and pickle factory managers. Use **The Pickle "Dill"emma PowerPoint How To** ([Attachment #4](#) or <http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm>) to create your PowerPoint presentation.

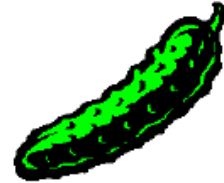
Include the following Slides:

- Title Slide
- Summary of Problem
- Description of Investigation Procedure
- Graph of total lengths and number germinated vs. Pickle Juice Concentration Results
- Picture of Living Graph with Caption.
- Conclusion/Recommendation to farmers (Including how citizens can help solve or prevent the problem)

Teacher Preparation for Pickle "Dill"emma Lesson

Teacher Laboratory Preparation:

1. *Preparation of Solutions:* Make a series of solutions of pickle juice diluted varying amounts with water: Get the pickle juice by draining the juice out of a jar of dill pickles into an empty jar.
 - A. Make 5% pickle juice by mixing 5 ml of pickle juice with 95 ml of water.
 - B. Make 10% pickle juice by mixing 10 ml of pickle juice with 90 ml of water.
 - C. In a similar way make 20%, 40%, 60%, and 80% pickle juice.
 - D. Use the remaining undiluted juice for 100% pickle juice.
 - E. Use plain water for 0% pickle juice.



Materials per set up:

- 1 quart jar of dill pickles
- 1 liter of distilled or spring water
- 80 corn seeds
- 80 mustard seeds
- 1 roll of Bounty paper towels
- 16 sandwich size resealable plastic bags
- 1 12"x18" cookie sheet
- 10 100 ml beakers
- 1 millimeter ruler (12" long)
- 1 marking pen
- 1 roll of pH paper (Range 1-11)
- 1 thermometer (range at least 0 – 100° C)
- 1 roll of masking tape

2. Make copies of the following attachment for students.

- Attachment 1 - [The Farmers and the Pickle Factory Story](http://www.classtech2000.com/biolvhs/pickle/farmpap.htm)
(<http://www.classtech2000.com/biolvhs/pickle/farmpap.htm>)
- Attachment 2 - [Seeds and Germination](http://www.classtech2000.com/biolvhs/pickle/germ/seedgerm.htm)
(<http://www.classtech2000.com/biolvhs/pickle/germ/seedgerm.htm>)
- Attachment 7- [Student Procedure](http://www.classtech2000.com/biolvhs/pickle/proced.htm)
(<http://www.classtech2000.com/biolvhs/pickle/proced.htm>)
- Attachment 3 – [Seed Germination Table](http://www.classtech2000.com/biolvhs/pickle/germtab.htm)
(<http://www.classtech2000.com/biolvhs/pickle/germtab.htm>)
- Attachment 4 – [Power Point How To Basics](http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm)
(<http://www.classtech2000.com/biolvhs/pickle/ppt/pptpick.htm>)

3. Gather all materials

4. If fungus treated corn is used, use gloves and goggles.