WISCONSIN
FAST PLANTS

Investigating Plant Physiology with Wisconsin Fast Plants™

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Materials in the Wisconsin Fast Plants™ Hormone Kit

- 1 pack of Standard Wisconsin Fast Plants™ Seeds
- 1 pack of Rosette-Dwarf Wisconsin Fast Plants™ Seeds
- 100-ppm Gibberellic Acid (4 oz)
- 1oz pelleted fertilizer
- 2 watering trays
- 2 watering mats
- wicks (package of 70)
- 1 packet anti-algal square (2 squares per packet)
- 8 watering pipettes
- 1 L potting soil
- 1 package of dried bees
- four 4-cell quads
- 16 support stakes
- 16 support rings
- Growing Instructions

For additional activities, student pages and related resources, please visit the Wisconsin Fast Plants' website at www.fastplants.org

Investigating Plant Physiology with Wisconsin Fast Plants™

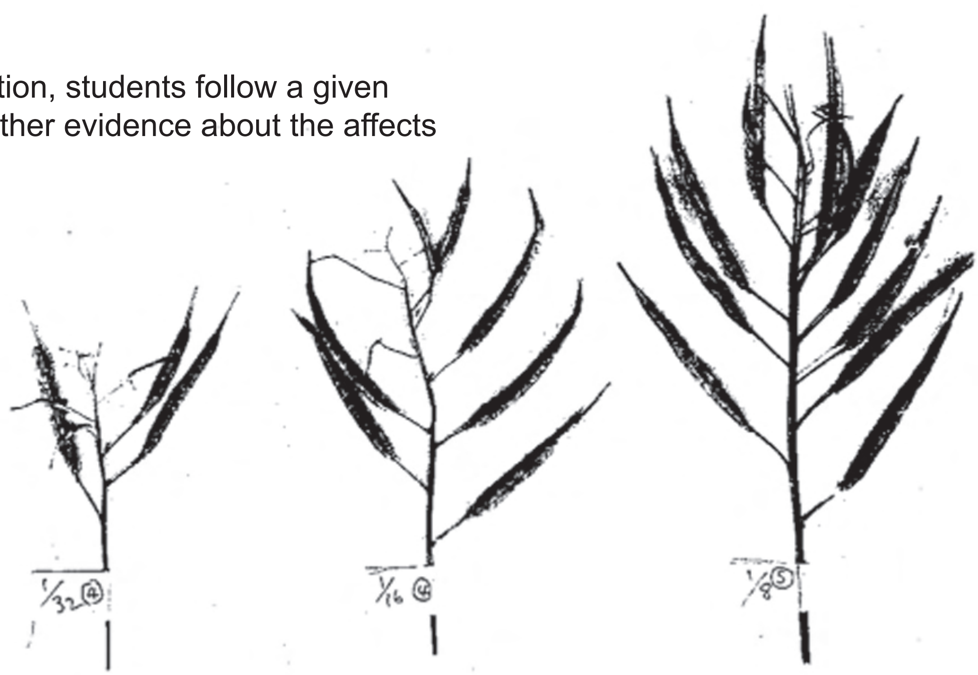
Plant physiology is the study of how plants function. The activities and background information in this booklet are designed to support investigations into three primary areas of plant physiology: Nutrition, Tropism, and Hormone Response (using gibberellin).

Fundamental to the study of physiology is understanding the role that environment plays in the functioning and appearance (phenotype) of individual organisms. The phenotype of an individual is the result of the genetic makeup (genotype) of that organism being expressed in the environment in which the organism exists. Components of the environment are physical (temperature, light, gravity), chemical (water, elements, salts, complex molecules), and biotic (microbes, animals and other plants). Environmental investigations in this booklet focus on the influence of nutrients, gravity, and a growth-regulating hormone.

Investigating Nutrition with Wisconsin Fast Plants

In this investigation students conduct an experiment to examine the question, “Is more fertilizer better for Wisconsin Fast Plants™?” ***Better***, of course, depends on your perspective, which is the crux of the exploration.

In this investigation, students follow a given procedure to gather evidence about the affects of nutrition on plant growth, development, and/or reproduction. Students grow and observe Wisconsin Fast Plants™ that have received varied amounts of fertilizer pellets.



Growing Tips

(See ***Growing Instructions*** for complete guide)

- Plant four fertilizer treatments per quad—a different treatment for each cell.
- Be sure that students understand that the lighting, moisture and potting mix must be the same in all quads for a controlled experiment.

Background Information

What is food? Food is fuel, nourishment. Food is essential for the survival of any living organism. But is more food better? Humans and other animals need to take in food, but sometimes humans go on diets to reduce the amount of food eaten. Is more food better? What about plants?

Plants make their own food through a process called photosynthesis, using energy from the sun and matter from the air and water. Plants also use nutrients that they obtain from the soil to live. If you have ever added fertilizer to a houseplant or garden, then you were adding nutrients to help a plant. If nutrients are used by plants, and fertilizers are used to help plants be healthier, are more nutrients better? If you want a plant to be really healthy, should you add all the fertilizer you can to its soil?

Farmers face this question each growing season. If farmers double the amount of fertilizer normally applied to their crops, will the yield be increased enough to cover the costs of the additional fertilizer? Fertilizer is expensive, and overuse may not be cost effective. In addition, there are potentially harmful environmental impacts caused by over-fertilization. For example, when the excess nutrients are washed into lakes it can cause eutrophication that leads to algal blooms. On the other hand, malnourished plants may not produce well, and the crop yield from under-fertilized crops may not be cost-effective for farmers to grow. Choosing the optimum amount of fertilizer to apply to crops is a critical decision that farmers and gardeners must make.

Wisconsin Fast Plants™ have been selectively bred to grow under specific nutrient conditions as well as particular light, moisture, soil, and space conditions. They grow best with continuous fluorescent light of certain intensity, a constant water supply, a sterilized potting mix medium and four to five fertilizer pellets per cell.

The four to five fertilizer pellets provide the optimum amount of nitrogen (N), phosphorus (P) and potassium (K). Fewer pellets produce shorter plants with pale yellow or reddish leaves and few flowers. Addition of six to eight pellets produces taller plants with more foliage, lateral branching and slightly delayed flower production. Addition of sixteen or more pellets can result in a severely stunted plant or death due to the buildup of toxic salt concentrations in the soil. Plants will produce a maximum yield of seed under optimal fertilizer levels.

Notes on Fertilizer and Nutrients

Plants require an array of nutrients for growth, repair, and proper function. A nutrient is considered essential to growth if the plant cannot complete its life cycle without it, and the nutrient forms part of any critical molecule or constituent of the plant. Though micronutrients are important to healthy plant growth and function, the major nutrients needed by Wisconsin Fast Plants™ are nitrogen (N), phosphorus (P), and potassium (K).

Nitrogen A component of amino acids, proteins, nucleic acids, and chlorophyll.
Optimum: Plants are rich green and protein content increases.
Deficient: Plants are stunted and light green in color; lower leaves are yellow, stem is slender.
Excessive: Plants have very lush foliage with sappy, soft stems; flowering is delayed.

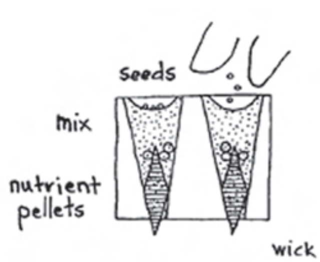
Phosphorus A component of the energy-mediating compounds ADP and ATP, nucleic acids, and phospholipids.
Optimum: P stimulates root formation and growth, giving the plants a vigorous start; P also stimulates flowering and aids in seed formation.
Deficient: Plants have slower growth and delayed flower and pod development; leaves are dark green and dull; root system is poor with little branching; stem is slender.
Excessive: Plants have very lush foliage with sappy, soft stems; flowering is delayed.

Potassium Involved in protein synthesis and in the opening and closing of stomata; essential to the formation and translocation of starches and sugars.
Optimum: K imparts increased vigor and disease resistance.
Deficient: Leaves can be mottled or chlorotic; small necrotic spots may appear between veins or near leaf tips and margins; flowers do not achieve vibrant yellow color; stem is slender.
Excessive: Plants have dark foliage and stiff stems and leaf branches.

Osmocote Fertilizer Pellets

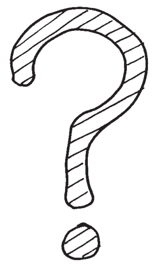
Osmocote (NPK pellets) is a time-released plant food that many professional growers use for flowers, vegetables, houseplants, patio plants, and bedding plants. The nutrients are combined in small, compact pellets that are suited for mixing with the soil. Nutrients released from Osmocote are affected by changes in soil temperature and moisture. Upon moistening, the pellets begin to dissolve. The release rate of each pellet increases as the soil warms, when plants are growing rapidly. The release rate decreases as the soil cools, when there is less plant growth.

When used as recommended, there is virtually no risk of over-fertilizing or “burning” the plants from excess nutrients. The Osmocote pellets have an N-P-K (nitrogen, phosphorous, and potassium) ratio of 14-14-14 or 20-20-20 with trace elements included. The advantage of Osmocote is that it eliminates the need to worry about fertilizing throughout the life cycle of the plant. Osmocote must be added when filling the container with soil. They should be positioned at approximately half of the depth of your potting system. The number of pellets used depends on the volume of soil, and thus on the potting system used. If using a standard quad, use 3-4 pellets.



Investigating Plant Nutrition Activity

QUESTIONS



- What is the ideal amount of fertilizer pellets to add to Wisconsin Fast Plants™?
- Will Wisconsin Fast Plants™ produce seed when a lot of fertilizer pellets are added?
- Will Wisconsin Fast Plants™ produce seed without the addition of any fertilizer pellets?

Key Concepts

- Specific amount of nutrients (nitrogen, phosphorus and potassium) are needed for optimal growth of plants.
- The absence or excess of essential nutrients may hinder growth and development or prevent plants from completing their life cycle (forming viable seeds).

Activity Overview

Students experiment during this activity to test the effect of varying the amount of fertilizer on Wisconsin Fast Plants™. The experiment is conducted by the whole class, with pairs of students assigned to grow one quad of Wisconsin Fast Plants™ with four different fertilizer levels. They use quad growing systems under standard lighting conditions, with Osmocote NPK pellets placed in each quad cell as the fertilizer.

Partners plant their quads with the fertilizer distributed as indicated in the table below (number of fertilizer pellets per cell). Guide the students to recognize that growing one cell of Wisconsin Fast Plants™ at the standard recommended 3-4 pellet fertilizer level is important because that is the recommended condition for comparison to the experimental levels. Be sure that students label each cell with a permanent marker.

0	2
3 - 4	10

Work with your class to determine what measurements and observations every partner group will record when observations are taken three times per week. For instance, some students may consider the production of seeds as the benchmark for which Wisconsin Fast Plants™ do best; other students may decide to count the number of flowers or measure leaf area. The observations and measurements chosen are the traits that your class determines are good criteria for determining which plants are doing "best." We recommend that students observe and measure plant height, number of days to flowering, and number of seeds produced per plant at a minimum.

After the plants have grown and observations are complete, collect the results from all the partners in your class. Then, students can compare substantially more evidence to support an explanation for an optimum nutrient (fertilizer) amount for growing Wisconsin Fast Plants™. This finding can then be related to real world agricultural situations to show how understanding the physiology behind fertilization is significant for crop production, gardening, and lawn care.

Students can take the plants as far through the life cycle as they need to gather the data they have chosen or you determine will be collected (for example, number of flowers produced might be one measure of which plants do "best," or number of seeds produced could be the measure).

NOTE: *Remember to pollinate on days 14–17 and take the plants off of the water 20 days after the final pollination to allow them to dry down if students are to harvest seed for their investigations.*

When varying the level of nutrient provided to the plants, you might expect to see:

Amount of Fertilizer	Typical Observations
0 pellets	stunted, delayed growth; shorter, yellowed plants with lots of purple pigment expressed
10 pellets	robust, deep green plants with thick stems; after 2–3 weeks the leaf edges will turn yellow-brown and crispy due to the buildup of salts

Procedure

Materials

Each pair of students will need:

- 1 growing quad, seeds, and soil mix
- Osmocote NPK fertilizer pellets

1. Work with a partner to predict what you think the answer to the following questions may be. Be sure to explain your answer.

a. If nutrients (provided in the form of fertilizer) are important for Wisconsin Fast Plants™ to grow, develop, and reproduce, is there some particular amount of fertilizer that is **best** for Wisconsin Fast Plants™?

b. Do you think that there is a minimum amount of fertilizer that Wisconsin Fast Plants™ must have to grow, develop, flower, and produce seed that is healthy and will germinate?

• How would you find out that amount?

c. If fertilizer is good for Wisconsin Fast Plants™, is more fertilizer always better?

• How would you find out?

2. Discuss with your partner and class what you will measure and observe about Wisconsin Fast Plants™ to determine which plants in a group are doing ***best***.
- Brainstorm ideas about measurements that can be made when Wisconsin Fast Plants™ grow. Be sure to include *plant height*, *number of days to flowering*, and *number of seeds produced per plant* in your observations.

3. Develop a data table for recording the observations and measurements you will take as your Wisconsin Fast Plants™ grow.
- Include in your data table the measurements and observations you make for plant height, number of flowers, number of seeds, and any other observations you and your class decide to record as the Wisconsin Fast Plants™ grow to determine which plants are doing the best.

4. To investigate how the amount of fertilizer given to Wisconsin Fast Plants™ affects them, you will conduct an experiment as a class. Each pair of students will grow Wisconsin Fast Plants™ with a different fertilizer amount and compare class results.

5. Follow the *Wisconsin Fast Plants™ Growing Instructions* and your teacher's directions to plant your Wisconsin Fast Plants™.
- **Work with your partner to carefully add the assigned amount of fertilizer to the soil as you plant.**
- **Be sure to carefully label your quad and cells so that you know which quad is yours and the amounts of fertilizer in the cells.**

6. Record observations in your data table as your teacher directs.
- Be prepared to share your results with your class.

7. Use your class' evidence to again answer the questions that you made predictions about at the start of this experiment.
- **a.** If nutrients (provided in the form of fertilizer) are important for Wisconsin Fast Plants™ to grow, develop, and reproduce, is there some particular amount of fertilizer that is **best** for Wisconsin Fast Plants™?
- **b.** Do you think that there is a minimum amount of fertilizer that Wisconsin Fast Plants™ must have to grow, develop, flower, and produce seed that is healthy and will grow?
  - How would you find out that amount?
- **c.** If fertilizer is good for Wisconsin Fast Plants™, is more fertilizer always better?
  - How would you find out?

8. How have your answers changed as a result of the experimental evidence your class collected? What new questions do you have about nutrition and plant growth?

Introduction to Tropisms

Tropism is directional plant growth that is determined by a response to the direction of an environmental factor, such as light, gravity, or touch. Understanding tropisms is important because they are examples of plants' abilities to change their growth response to their environment.

The two tropisms that are studied in these activities are gravitropism and phototropism.

- **Gravitropism** refers to the direction that plants grow as determined by the direction of the force of gravity.
- **Phototropism** refers to the direction that plants grow as determined by the direction of light received by the plant.

Investigating Tropisms with Wisconsin Fast Plants™

Background Information

Plants may appear to be fixed in position to the casual observer; however, plants have sophisticated ways of responding to factors in their environment. Tropisms are one kind of physiological response. Tropisms involve plant growth, which involves cell division and cell enlargement. These processes are regulated by growth-promoting hormones and growth-inhibiting chemicals. As the plant grows, the balance between hormones and inhibitors is continually changing.

The plant's response to gravity is known as gravitropism (the old term was geotropism). The response of the growing shoot to grow away from gravity is called **negative gravitropism**. The response of the root, to grow toward gravity, is called **positive gravitropism**. Downward growth of roots and upward growth of the shoot make sense for a plant to survive. How plants do this is just beginning to be understood.

Growing Tips

(See ***Growing Instructions*** for complete guide)

- Set up the experiment on a Monday morning, and make observations on Thursday or Friday.
- Use the circle grid from Black-line Master Ruler Disk Master as a tool for quantifying seedling response to gravity.
- Forceps for placing seed can be made from a plastic milk container. Placing black vinyl electrical tape on the inside of one tip of the forceps prevents seeds from slipping, or, instead of using the tape, the forceps tips can be dipped in water before picking up seed.

The gravitropic response in plants is largely controlled by a group of growth promoting hormones called auxins and by inhibitors of auxins. This effect can be seen by turning a plant on its side. Auxins stimulate cell elongation in the cells on the lower side of the shoot causing it to bend up (away from gravity), but in the roots, cells on the upper side elongate causing the roots to grow down (toward gravity).

A similar response causes the shoot of the plant to bend toward light. This response is called **phototropism**. An unequal distribution of auxins and inhibitors on the side of the plant away from the light stimulates cell enlargement on the “dark” side of the plant, resulting in the plant bending toward the light. The growth of a plant toward light (sun) is an advantageous response in a photosynthetic organism.

Tropism Activity

QUESTIONS

- How does a plant grow up?
- Why does the shoot grow up and the root down?

Key Concepts

- Plants of all ages respond to gravity and light.
- The growing shoot of a plant has a negative response to gravity.
- Root tips have a positive response to gravity.
- The growing shoot of a plant has a positive response to light.

Activity Overview

During this investigation, students investigate how Wisconsin Fast Plants™ seeds and seedlings respond to changes in their orientation towards gravity. In this investigation, students observe Wisconsin Fast Plants™ seed germinating and growing for four or five days in a Petri dish. During the time of the experiment the following are observed:

- germination and swelling
- seed coat splitting
- root emergence and downward orientation
- growth of root hairs
- shoot emergence and upward orientation
- cotyledon emergence

On days four or five, when the students investigate the affects of changing the Petri dish position, they observe how roots and shoots bend when they are reoriented with respect to gravity.

Procedure

1. In this investigation, you will explore how Wisconsin Fast Plants™ seeds and seedlings respond to changes in their orientation towards gravity. Predict what you think will happen to a seedling growing in a Petri dish if you turn the dish to change the direction of the force of gravity. Explain your prediction.

2. Cut two layers of paper towels to fit in the cover (larger half) of a Petri dish.
- With a pencil, label the bottom of the paper towel with your name, the date and the time.

Materials

Each pair of students will need:

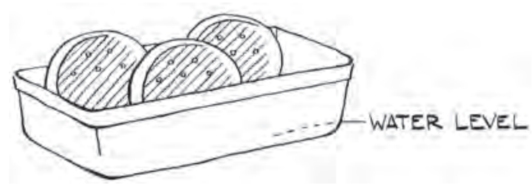
- Petri dishes
- Wisconsin Fast Plants™ seeds (12 per group)
- paper toweling or filter paper
- water dish (use a small tray or the base from a 2-liter soda bottle, with black electrical tape covering the holes)
- 1 Transparency-plastic Ruler Disk, cut out (see Black-line Master)

3. Place a Transparency-plastic Ruler Disk in the cover of the germination Petri dish; place the paper circle on top. (The ruler will show through the paper circle once it is wet.)

4. On a Monday or a Tuesday morning, moisten the towels in the Petri dish with an eyedropper.

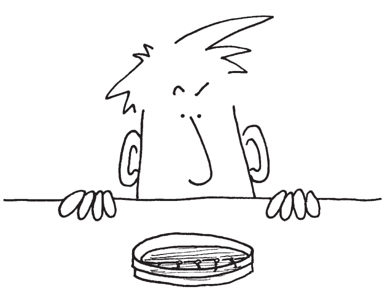
5. Place two rows of six Wisconsin Fast Plants™ seeds (12) on the top half of the towel and cover with the bottom (smaller half) of the Petri dish.

6. Place Petri dish at an angle in shallow water in the base of a two-liter soda bottle or in a tray so that the bottom 2 cm of the towel is below the water's surface.



7. Set experiment in a warm location (optimum temperature: 65-80°F). Record the day and time of setting up the experiment.
- Over the next 3-4 days check the water level to be sure the paper toweling stays wet.

8. After initial observations on Day 4 or 5, rotate the dish 180°. Place back in tray as shown above. Water should not be touching the plants.

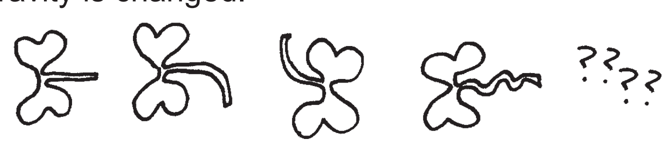


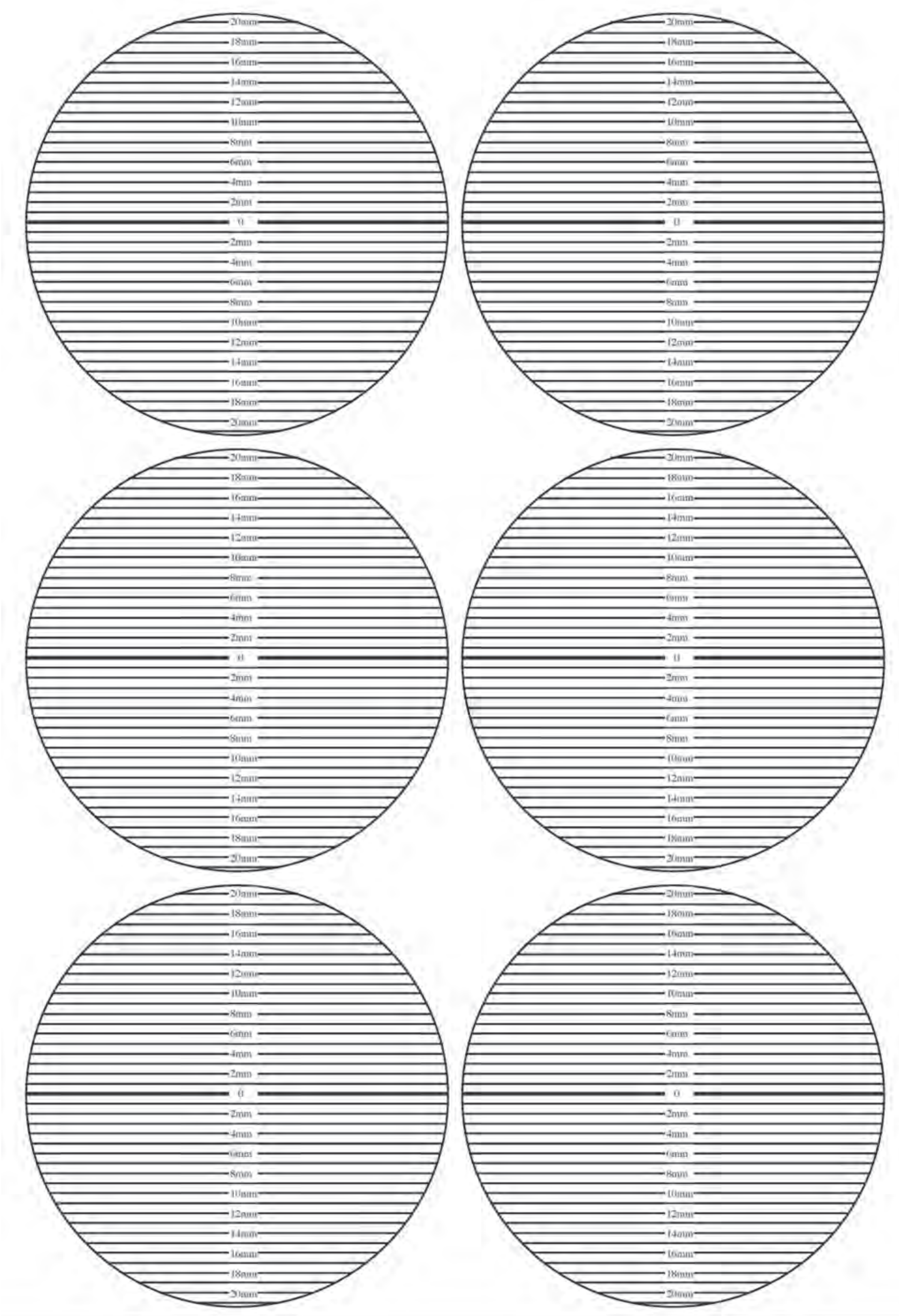
9. Record observations after one hour.

10. Keeping the lid on the Petri dish, place the dish flat on a table. After one hour, record observations.

11. Finally, turn the dish upside down on the flat surface. After one hour, record observations.
- Think and record, what other Petri dish position arrangements could you try?

12. Using evidence from your experiments, develop an explanation for how Fast Plant seedlings respond when their orientation with respect to gravity is changed.
- Why are the responses that you observed useful for the plant?





Black-line Master: Transparency-plastic Ruler Disk (copy onto transparency sheet)

Investigating Phototropism

As an extension to the gravitropism investigation, you may wish to have students explore how orientation with respect to light affects Fast Plant seedlings. In addition, students can explore how different colors of light affect the seedlings.

Some questions students can investigate include:

- Without light, would plants grow up?
- If a plant's orientation toward light is changed, will its root system continue to grow the same direction?
- Do plants prefer certain colors of light?

The procedure used for gravitropism can be modified and used to investigate these questions.

To isolate the direction that light strikes the Petri dish, the dishes can be placed inside a box with a hole in one end where the light source is located. Keep in mind that to investigate the affect of light color, the light source must be filtered through a gel rather than a colored transparency. Gels, like those used in theatrical productions, allow only the designated light color wavelength to be transmitted. Gels are available through science supply companies as well as theater suppliers.

Students investigating light can find the following results:

Red light is for growth...

- opening of cotyledons
- greening and pigmentation
- photosynthesis
- flowering

Blue light is for guidance...

- phototropism (the bending response mediated by plant hormones, auxins, which affect cell elongation)

The Effects of Gibberellin: A Plant Growth-Regulating Hormone

In this activity, students investigate over a period of 25 days the role of one class of hormones, the gibberellins. During the investigation, students treat two varieties of Wisconsin Fast Plants™, one with a mutation that inhibits production of gibberellin, with gibberellic acid (GA) and observe the results.

Background Information

The effects of gibberellins were first investigated in connection with the "foolish seedling disease" of rice (caused by the fungus *Gibberella fujikorio*). Plants infected with the fungus grew very rapidly, became much taller than normal, and fell over. It was found that extracts of the fungus mimicked the disease. The effect was due to the fungus producing an excess of a chemical that is normally present in the plants in minute amounts as a growth-regulating hormone. This chemical belongs to a group of growth-regulating substances named gibberellins.

Growing Tips

(See ***Growing Instructions*** for complete guide)

- Be sure that students understand that the lighting, moisture and potting mix must be the same in all quads for a controlled experiment.

Many dwarf or bushy plants are gibberellin-deficient and will grow tall when gibberellin is supplied because of its effects on cell division and elongation. Gibberellins are also involved in flowering, seed germination, and the breaking of seed dormancy. Gibberellins interact with the other hormones; many growth-regulating effects are due to the balance between levels of different hormones.

There are many gibberellins known – all have the same basic structure but differ in side chains or substitutions. Assorted plants have different types of gibberellins. Although the different gibberellins have similar effects, in many cases a particular species is sensitive only to the gibberellins it produces.

Gibberellins are synthesized in different parts of the plant, especially in the actively growing areas such as embryos and meristematic or developing tissues. They seem to move freely in the plant, and their transport and distribution is not polar, as with auxins.

Gibberellins are used commercially in agriculture for a variety of purposes. Grape flowers can be treated with a gibberellin to induce seedless fruit, loosen clusters (from stem elongation), and increase fruit size. Gibberellin is also used to increase petiole length (and thus yield) of celery and rhubarb, to break dormancy of seed potatoes, and to delay fruit maturity in fruit crops to extend harvest (Bidwell, 1974).

Gibberellin Activity

Normal plant development depends on the interplay of a number of internal and external factors. Principle internal factors that regulate growth and development in plants are the hormones. Hormones are organic substances produced in one tissue and transported to another tissue, where their presence results in a physiological response. Hormones are active in very small quantities.

The rosette-dwarf stock originated from a naturally occurring mutation, discovered early in the development of Wisconsin Fast Plants™. The rosette phenotype in Wisconsin Fast Plants™ is conditioned by a single gene mutation that, in the homozygous condition ros/ros, results in 4 to 10 times less gibberellin in the tissues. The internodes of rosette plants do not elongate, and the leaves lie flat against the soil. The leaves are a deep, green color. Rather than the hypocotyl lifting the cotyledons above the soil 1-2 days after the seeds are sown, the cotyledons push their way out, emerging up to 4 days after planting. Leaf development and flowering are delayed by a few days.

7-day-old plant Rosette-Dwarf (*ros/ros*) 16-day-old plant Rosette-Dwarf (*-/ROS*)

The flowers cluster above the leaves, forming an extremely dwarf plant. Normal flower development is retarded and production of seeds is severely limited. With care, they can be pollinated. The resulting seed pods are short and stubby because the carpels do not elongate normally.

Activity Overview

During this activity, students grow two types of Wisconsin Fast Plants™ to investigate the effect of applying GA to a mutant-dwarf variety. Each student pair grows one quad of plants with the two varieties, one each that receives the GA treatment and one each that is treated with water. The treatment begins on Day 7 after planting and is repeated on Day 10. By Day 17, the effects of the GA are clearly visible.

By combining class data, students can graph averaged results and produce a growth curve for the rosette and wild type plants. From these graphs, analysis of the evidence shows that GA causes the rosette type to grow as if it were wild type.

Key Concept

- Plant development is ultimately controlled by gene action, and hormones are part of the control mechanism, affecting the geno type and the development of the plant phenotype.

Procedure

1. To investigate the role of one class of hormones, the gibberellins, on plant growth and development, you will be treating plants with gibberellic acid (GA) and ob serving the results. The two types of Wisconsin Fast Plants™ that you will grow and treat with GA are rosette and wild type.
   - Rosette is a low-growing type of Wisconsin Fast Plant™ with the genotype *ros/ros*
   - The wild type is the standard Wisconsin Fast Plant™ variety with the genotype *ROS/ROS*

2. Predict how the two types of plants will respond if GA is applied to the leaves on Day 8 after planting. Explain the reasoning for your prediction.

Materials

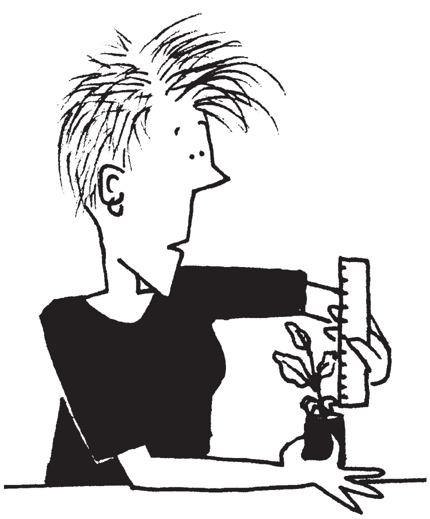
The class will need:

- Hormone Kit
- Fluorescent light bank or Plant light house

Each student team of two will need:

- 6 rosette – dwarf seeds (ros/ros)
- 6 wild type seeds (ROS/ROS)
- 1 growing quad, seeds, Osmocote NPK fertilizer pellets, and soil mix
- 2 disposable pipettes
- rulers

3. Think about what plant responses you plan to measure while you conduct this experiment. Make an appropriate data table for recording your observations and measurements
   - For example, you could measure plant height, internode length (distance between leaf or flower axils), development time (for leaves, flowers, or seed pods), seed pod length, seed number, or seed size. (Keep in mind that you'll have to pollinate the plants with a beestick if you plan to produce seeds.)



4. Following the growing instructions outlined in the handout *Fast Plant Growing Instructions: Testing the Effects of Gibberellic Acid*, work with your partner to plant two cells of your quad with rosette and two with wild type Fast Plant seeds.
   - Label your quad cells as pictured:

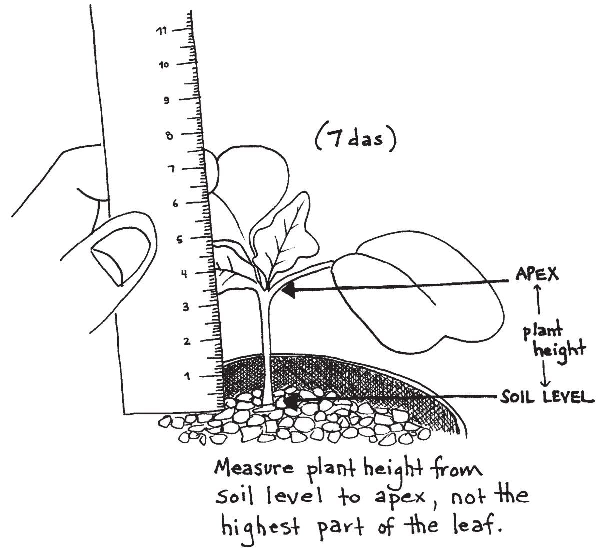
ros H_2O	ros GA
Wild H_2O	Wild GA

5. Starting on Day 7 and repeating on Day 10, follow the procedure below:
   i. Obtain and label your two pipettes. Label one "water" and the other "GA."
   ii. According to your labels, apply a single drop of GA or water to each leaf (not the cotyledons) on your plants using the proper pipette

6. Record your measurements on days 7, 10, and 17 (or other appropriate days, as your teacher directs).

7. On the last day of your investigation, analyze your data and compare your results to your prediction. Use your experimental evidence to explain how your plants responded to the GA treatment.

8. Pool the class data and calculate the class averages for each date. Using class averages, construct two growth curve graphs, one for the wild type plants and one for the rosette plants. Graph time on the horizontal axis and height on the vertical axis.



9. Using the combined experimental evidence from your class, what do the results show about the following:
   - **i.** The effect of GA on plant growth in the rosette mutant?
   - **ii.** The effect of GA on plant growth in a wild type Wisconsin Fast Plant™?

10. Explain your interpretation of the results and additional questions this investigation has raised as you discuss and analyze the data with your class.

Glossary

Auxin A growth hormone which influences cell elongation and is involved with gravitropic and phototrophic responses. In unequal amounts, auxin causes a curvature of the tissue in stems and roots by causing cells to elongate differentially.

Gibberellins a group of growth-regulating substances best known for increasing the elongation of stems.

Hormone A chemical substance produced, usually in minute amounts, in one part of an organism and transported to another part of the same organism, where it has a specific effect.

Internode The region of a stem between two successive nodes (points where the leaves attach).

Meristem The undifferentiated plant tissue from which new cells arise.

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