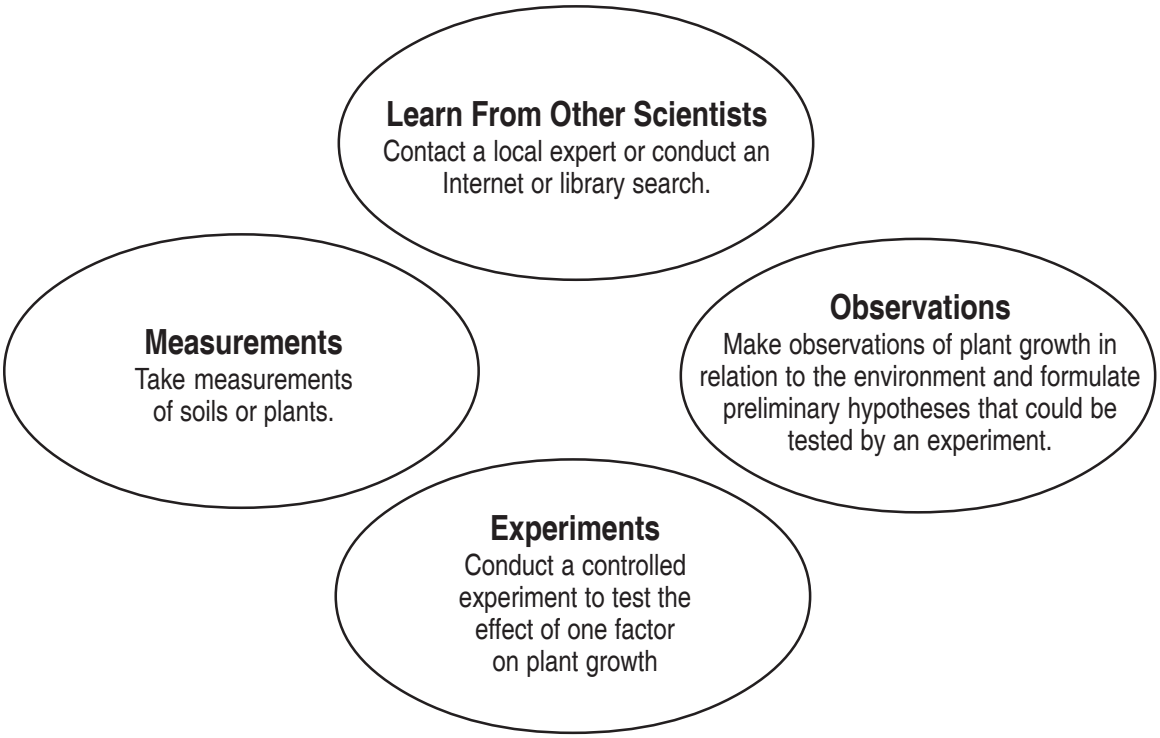
Garden Research Action Projects

In the Garden Research Action Project, youth conduct research to answer a question that the gardeners or youth raise during the ***i·m·science investigations***. You can help the youth decide which questions and methods are best, given the gardeners' interests, and time and other constraints of your program. The focus of the Garden Research Action Projects can be on plants, soils, water, light, or insects or other animals in the garden. Although the examples come from community gardens, you should be able to adapt them for home or school garden or other youth programs.

Youth can conduct observations, take measurements, or learn from other scientists to answer any number of questions. Alternatively, they may want to conduct a longer-term research project involving an experiment. Experimental research usually incorporates the three other types of research.

Often an experiment begins with observations in a garden. For example, youth may observe that collard plants growing in the shade seem to have fewer leaves than collards growing in the sun. This may lead to a question that the youth want to investigate further: What is the effect of sunlight on growth of collards? The youth may form a hypothesis: Collards growing in the sun are more productive than collards growing in the shade. The first step in testing their hypothesis would be to conduct background research, or learn from what other scientists have already discovered. This can be done either by talking with scientists or reading about their work, often on university or government agency websites. Based on what they learn from other scientists, the youth may want to refine their question and hypothesis. They likely also will learn about methods for testing their hypothesis. Conducting the experiment can involve taking measurements and making additional observations.

Types of Garden Research Action Projects



If they are conducting research on a practice the gardeners are using, the youth need to be aware of issues related to gardener knowledge and scientific knowledge. Gardeners generally use practices that they feel give desired results, but there may not be any scientific research to back their claims. For example, many gardeners use companion planting to reduce pests, but there is little research that shows this is effective. The youth need to be aware that experiments conducted under controlled conditions are one form of knowledge, but that the knowledge of gardeners based on many years of experience is also important. You will need to work with the youth so they present their research results but also are respectful of the gardeners' knowledge. The youth should also be open to further research where their results may conflict with what the gardeners believe is true from experience.

Example Projects

Following are examples of each of the types of Garden Research Action Projects. Our intent here is to give you a range of possibilities, using different research methods and resulting in different actions. We hope these examples prove useful as you help youth develop their own project.

Learning from other Scientists

Youth can use the Internet or library to research a question that comes up during the *i·m·science investigations*. They should be aware of the source of information on the Internet. If a website is developed by university or government scientists, you can generally count on the scientific information being accurate. Commercial and other websites sometimes promote a product or point of view rather than present unbiased information.

Example Learning from other Scientists Project: Insecticide Safety

During the *i·m·science investigations*, the gardeners express concern about the safety of an insecticide they are using. The youth decide to research the question: "What are the safety risks of this insecticide?" They decide to use the Internet and local experts to answer their research question. They search for sites describing the pesticide and its risks, and compile information from university and government websites. They next ask an entomologist to come to the garden to discuss insecticide uses and risks. They present their results in a poster for the gardeners. They also laminate the poster and post it along the fence in the garden for others to read, and report their results to the Garden Mosaics website using the online *Action Project Form*.

Ideas for "Learning from other Scientists" Action Projects

- What are the health risks of a pesticide used by the gardeners?
- How do farmers and gardeners in other cities grow taro?
- What lead levels in soil are dangerous to children?
- Does using treated lumber in raised beds contaminate the soil?
- Are marigolds effective in protecting plants from soil insects?
- What varieties of collards are resistant to whiteflies?
- How do the "beneficial" insects attracted to cilantro benefit other plants?
- What varieties of trees grow well in urban gardens?

Measurements

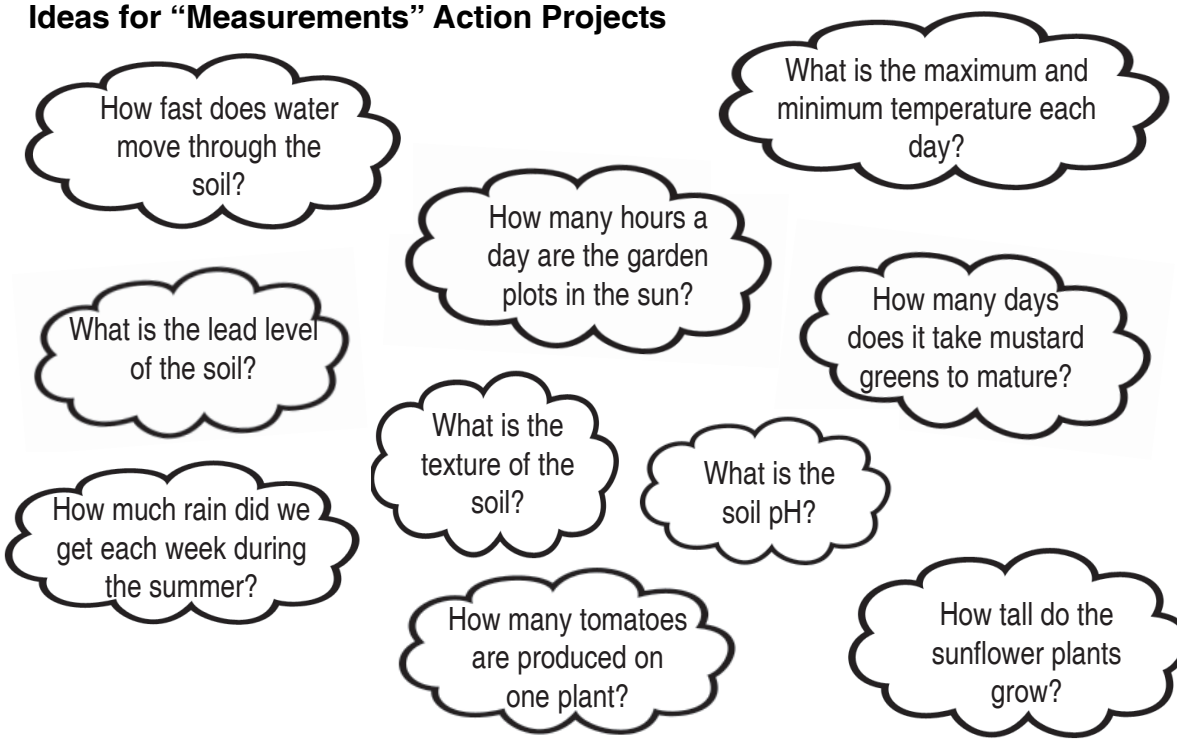
Some questions can be answered by taking measurements on soil or plant samples. Whenever youth take measurements, they need to decide where and when to sample. This is because the plants and soils may vary depending on where they are in the garden. The research question should guide decisions about where and when to sample. For example, if the gardeners want to know whether lead is a problem in soils, the youth would need to ask if they are concerned about soils only in the plots with vegetables or also where flowers and other ornamentals are grown.

In some cases, the youth may collect samples and send them to a lab for testing. For example, youth could measure plant height or soil pH, but they will need to send plant or soil samples to the lab to be tested for lead or other contaminants. Check university and other website guidelines for collecting and sending in samples, and for costs associated with different analyses.

Example Measurements Project: Soil Percolation

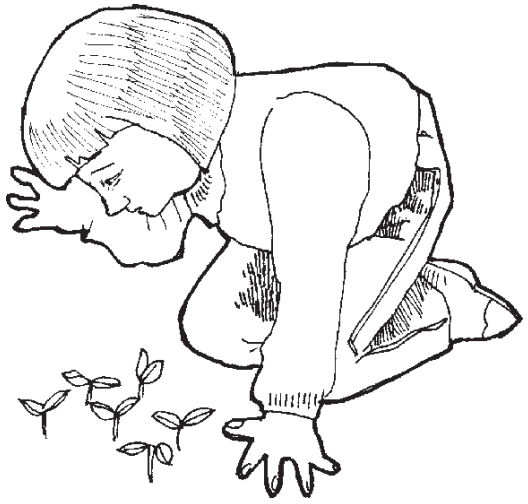
During the *i·m·science investigations*, the youth observe that the soils look very hard and that water seems to collect on top of the soils. They decide on their research question: "How fast does water move in soils in each plot in the garden and in the paths between the plots?" They next read the *Water in the Garden* and *Watering Garden Plants* Science Pages to gain background understanding for their research. They discuss their question with the gardeners to get their input and to explain what they will do. They use the "Soil Perc" test to measure the soils in each plot and along the paths (see Try This, *Water in the Garden* Science Page). They discover that water percolates very slowly in some plots, so they contact their Cooperative Extension agent to learn how to reduce soil compaction. The youth and gardeners conduct a workshop for other gardeners to share the results, demonstrate the Soil Perc test, and discuss ways to enhance water movement in soils. They also send photos of their project and report their results to the Garden Mosaics website using the online *Action Project Form*.

Ideas for "Measurements" Action Projects



Observations

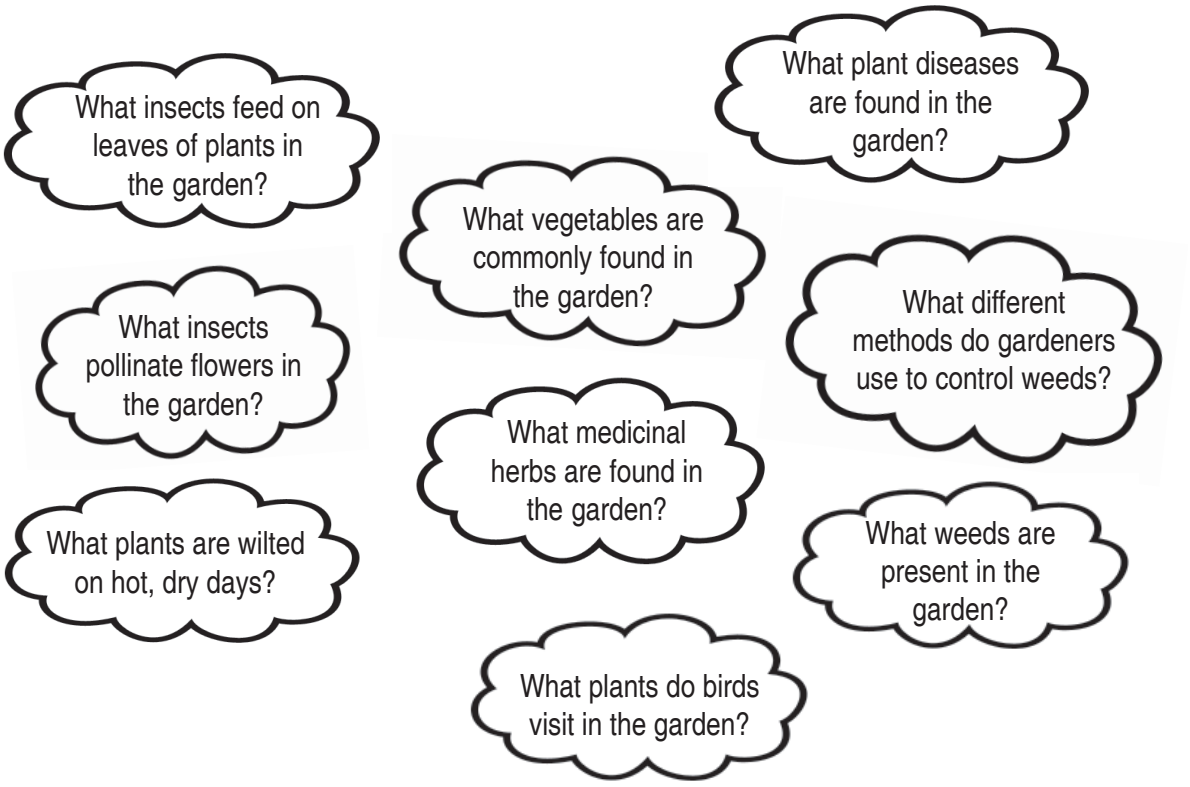
Youth can conduct observations in the garden and compile them into reports that are useful to the gardeners.



Example Observations Project: Plant List

The youth realize that the Hmong gardeners use names for insects in their own language but aren't always familiar with the English names. The youth decide to answer the question: "What are the English and Hmong names of all the plants in the garden?" Working with the gardeners and a horticulturalist from a nearby university, the youth observe and compile a list of the plants growing in each plot. They also take photos of each plant they observe. Throughout the observations, they refer to the Science Pages to learn more about the plants. They then develop a table of the English and Hmong names of each plant. They create a poster with the names and a photograph of each plant and present it to the gardeners. They also add their plant list to the *Community Garden Inventory Form* that they submitted to the Garden Mosaics website. Finally, they report their results, including photos, to the Garden Mosaics website using the online *Action Project Form*.

Ideas for "Observations" Action Projects

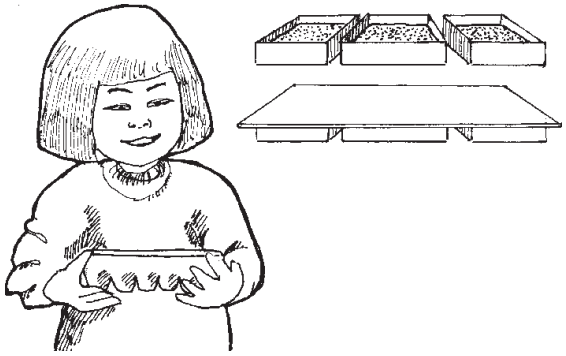


Experiments

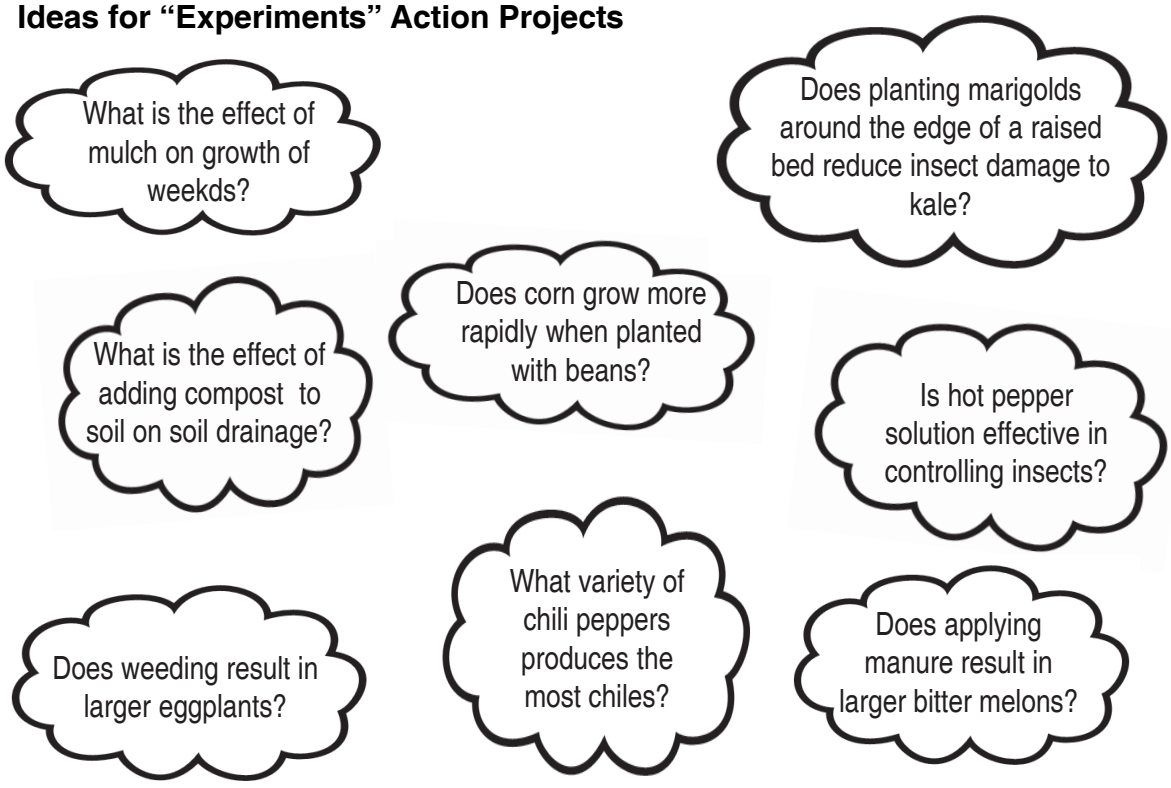
Experiments usually involve all three research methods we have discussed so far: learning from other scientists, taking measurements, and making observations. Youth conducting experiments define a hypothesis in addition to defining a research question. The hypothesis makes a prediction about what the results will show. For example, youth in Chicago may hypothesize that a variety of a plant developed for northern climates will grow better than a variety developed for the south.

When conducting an experiment, the youth should vary only one factor at a time. For example, if they test two varieties of a plant, the only factor they should vary is the plant variety. (The plant variety is called the "treatment.") Everything else, including soils, watering, and light, should be kept the same for both varieties. If two or more factors are varied at the same time (e.g., amount of fertilizer and plant variety), then it will be very difficult to say which factor caused any differences in plant growth.

It is much easier to control all factors except for the "treatment" in a greenhouse than in a garden. For example, when comparing plant growth in two different plots in a garden, it may be impossible to find plots that receive exactly the same amount of sunlight. Youth will need to find plots as similar as possible, and consider the possible effect of any factors they can't control when interpreting their results.



Ideas for "Experiments" Action Projects



Example Experiments Project: Use of Homemade Sprays to Deter Insects

During the *i·m·science investigations*, youth learn that gardeners use a homemade soap spray to deter insects on amaranth. The youth define their research question: "Is the soap spray effective in controlling insects on amaranth?" They use the *Controlling Insects* and *Conducting an Experiment* Science Pages to gather background information. They then ask the gardener if they can conduct a controlled experiment in the garden. They decide what measurements they will take (e.g., number of insects observed during 15 minutes in the morning and afternoon five days/week over a two-week period, number of leaves with insect damage). They create a data form for taking the measurements. They also choose two plots with amaranth, making sure that other factors (soil, sunlight, water) are the same for both plots. The youth next apply soap solution to amaranth in one plot and leave the amaranth in the other plot alone. They record the number of insects they observe and the amount of damage done to the leaves in both plots. To analyze their results, the youth average the measurements for each plot. They then summarize the results by making bar graphs of the average number of insects and average number of leaves with insect damage for each treatment (plants sprayed and not sprayed). In presenting the results to the gardeners, the youth are sensitive to the fact that if their results do not show an effect of the soap solution, this does not necessarily mean the gardeners are wrong in all cases. The educator leads the youth in a discussion of what other factors might affect their results (e.g., unusually dry or wet weather), and of the importance of years of experience versus an experiment. The educator asks the youth how they might conduct further research to determine the effectiveness of the spray. They report their results, including photos, to the Garden Mosaics website using the online *Action Project Form*.