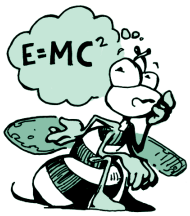
Are We Having FUNGI Yet?

Helping Young Trees to Grow

Meet Dr. Debbie Dumroese:

"I like being a scientist because I love learning about how different soils grow unique forest plants and fungi, and I like working on ways to continue harvesting timber without damaging the soil. The other reasons I like science are the opportunity to work with some especially gifted people, and to continue learning about the world."

Dr. Debbie Dumroese



Thinking About Science...

Scientists often use math to help them do their work. Can you guess why? When scientists do experiments or conduct research, they often measure the amount of something. Then, they compare the measurements to look for similarities or differences. Scientists also use numbers and words to present their results to other scientists. You can see that math and science are closely related. Can you guess what other subject is necessary to scientists? Think about *The Natural Inquirer*. Besides understanding numbers, what else do you need to do to learn about science? What are you doing right now?

Thinking About the Environment...

Scientists have discovered that certain fungi grow on the roots of plants, to the benefit of both the fungi and the plant. The fruiting bodies of fungi are mushrooms, but most of the organism lives underground. This *mutually beneficial* relationship between plants and fungi is called mycorrhiza (my koe rye' zuh). The fungi absorbs nutrients from the soil and provides them to the plant, and the plant provides *nutrients* to the fungi. Everybody wins! This is like many relationships in nature, where different kinds of

Figure 1. Ectomycorrhiza fungi growing on tree roots.

organisms work together so that they all remain healthy. This relationship works best when the organisms are all *native* to the area in which they are growing. The scientists in this study were interested in the fungi that grow on the outside of tree roots *(Figure 1)*. They call this ecto- (meaning outer) mycorrhiza fungi.

Introduction

In the Western United States, shallow, rocky soils and a dry climate often make it hard for new trees to grow on areas that have been harvested of older trees. Sometimes, areas that have been harvested grow back quickly in other types of plants. These plants compete with young trees for moisture and nutrients. This makes it hard for new trees to grow. Often before planting *seedlings*, foresters will clear an area of competing plants by setting fires and burning the plants. This does not always work well because the plants grow back quickly and again compete with the seedlings.

The scientists in this study wanted to test a different way of reducing the competition for soil nutrients and moisture. They did this by applying two different types of chemicals. One chemical was applied directly to the soil to kill the plants. The other chemical was applied directly to the seedlings, before the seedlings were planted. This was done to kill the non-native fungi that might be growing on the seedlings' roots. The scientists *hypothesized* that if the new seedlings were cleared of nonnative fungi before being planted, the native ectomycorrhiza fungi would spread from nearby forested areas and grow on the young seedlings' roots. This would help the seedlings to get nutrients, to grow faster and stronger.

Reflection

- What problem are the scientists trying to solve?
- If foresters do not plant seedlings on the harvested areas, what do you think will happen to the areas? Why do foresters want to plant seedlings in harvested areas?
- Why do you think native ectomycorrhiza fungi are better for the seedlings than nonnative fungi?

Methods

The scientists applied one kind of chemical to the soil before planting the seedlings. This procedure is called *fumigation* and involves pouring a liquid chemical onto the ground, then covering the ground with plastic *(Figures 2 and 3)*. The plastic keeps the chemical from escaping into the air. Why do you think that it is important to cover the ground with plas-

Glossary:

fumigation: (fyôo'me gâ'shen) a method used to kill weeds, insects, and disease organisms in soil, usually with a liquid or a gas

fungicide: (fun'ji sîd') a chemical used to destroy fungi

harvest: (här'vist) to gather or take a crop

hypothesize: (hî poth'i sîz') to propose an explanation in light of known facts

mutually beneficial: (myôô'chôô el'lê ben'e fish'el) each having and gaining advantage from the other or others

native: (nâ'tiv) living or growing naturally in a particular region

nursery: (nûr'se rê) a place where young trees or plants are grown

nutrient: (nôô'trê ent) something containing food

seedling: (sêd'ling) a young plant grown from a seed

timber: (tim'bêr) trees or their wood

Figure 2. Pouring liquid onto the ground.

Figure 3. Covering the ground with plastic.

tic? (Hint: Think about your health, and also about the loss of chemicals from the ground.) The plastic was removed from the ground 2 weeks before planting the seedlings.

The scientists also applied a fungicide directly to some of the seedlings in the *nursery* before planting them outside. The fungicide was applied to kill the fungi that grow on the seedlings' roots in the nursery. Some of these seedlings were planted in areas that had not been fumigated. That way, the scientists could find out whether fumigation affects the seedlings' growth. They could also find out if the application of a fungicide affects the seedlings' growth.

The scientists measured the growth of the seedlings every year for 2 years. They measured the seedlings' height, analyzed their nutrient content, and counted the number of seedling roots that had ectomycorrhiza fungi growing on them. (The scientists expected the native ectomycorrhiza fungi to begin growing on the roots, even though the roots had been exposed to fungicide.) In this way, they used numbers to compare the use of fungicide alone on seedling and ectomycorrhiza growth. They compared this with the use of fungicide and soil fumigation together on seedling and ectomycorrihiza growth.

Reflection

- Why did the scientists plant some seedlings in areas that had not been fumigated?

- Do you think the ectomycorrhiza fungi were able to begin growing on the seedlings' roots? Why or why not?

Results

The scientists found that when they fumigated the soil in the spring, the seedlings grew more than when they fumigated in the fall. They also discovered that the seedlings not treated with fungicide grew larger than those that had been treated with fungicide.

They found that the use of the fungicide resulted in a greater amount of ectomycorrhiza fungi growing on the seedlings' roots by the second year. When you think about all of these findings, you will see that the presence of more ectomycorrihiza fungi does not always mean that seedlings will grow larger, even though the fungi are providing nutrients to the seedlings.

Reflection

- If you want to grow the biggest seedlings, which treatment would you use? Would you use just the fumigation, just the fungicide, or both?

- Do you think the scientists were surprised to find that ectomycorrhiza fungi did not make the seedlings grow larger? Why or why not?

Implications

If foresters want their seedlings to grow successfully and quickly, they should fumigate the soil in the spring before they plant the seedlings. Unfortunately, soil fumigation is expensive. The scientists therefore recommend that fumigation only be used on areas where seedlings have a lot of competition from other plants.

Reflection

- What are some of the advantages and disadvantages of soil fumigation?

- This study pointed out examples of competition and cooperation in natural systems. Where was the competition? Where was the cooperation? What are other examples of competition and cooperation in nature?

- Even though the native ectomycorrhiza fungi did not help the seedlings grow larger, do you think the native ectomycorrhiza fungi are beneficial to the seedling? Why or why not?

From: Page-Dumroese, Alan E. Harvey, Martin F. Jurgensen, and Michael J. Larsen (1996). Ponderosa pine seedling response to planting-site soil fumigation and fungicide application, *Northwest Science, 70(2)*, 139–147.

Discovery FACTivity

Bring in a small bag of sterilized potting soil, and similar amounts of soil from the woods, a garden, and from an area with a lot of weeds or other types of plants. Think about the sterilized potting soil. What does sterilized mean? Why would people want to buy sterilized potting soil? Compare the sterilized potting soil with the other soil. Besides the color, what are the differences? Can you find any animal or plant life in the sterilized soil? How might that be an advantage or disadvantage to house plants?

Further Discovery

Plant a house plant using the sterilized potting soil, and one in each of the other soils. Treat them all the same. Over a period of months, observe what happens in each of the pots. Is there a difference between the pot with the sterilized soil and the other pots? What is the difference? Why is there a difference?

For more information, see: http://forest.moscowfsl.wsu.edu/