Name: _____ Date: _____

Peas, Beans, and the Nitrogen Trade

Circle group

Plants need nitrogen to grow, just as people need food. Nitrogen is part of the proteins and green color in plants. The air is mostly nitrogen, but plants cannot use it from the air. They must get it from the soil through their roots. If a farmer grows the same crop for years, the soil can run low.

Peas, beans, lentils, peanuts, and clover are legumes. Legumes have a special partner. Tiny bacteria live on their roots in small lumps called nodules. The bacteria take nitrogen from the air in the soil. They change it into a kind the plant can use. The plant gives the bacteria sugar from its leaves. Both sides gain.

Farmers saw long ago that fields did better after legumes. So they use crop rotation. They plant different crops in a plan, year after year. A field might grow wheat one year and clover the next. When the legumes die, some nitrogen goes back into the soil for the next crop.

Rotation helps in other ways too. Insects and diseases that like one crop lose their food. Many farms still rotate crops today.

Questions

1. Why can plants not use the nitrogen in the air?

_____

_____

2. What are nodules?

_____

_____

3. What does the plant give to the bacteria?

_____

_____

4. What is crop rotation?

_____

_____

5. Why might a farmer plant clover after wheat?

_____

_____

6. How does rotation help against insects that like one crop?

_____

_____

Words to know

nitrogen: a gas in air that plants need to grow
legume: a plant family that includes peas and beans
nodules: small lumps on roots that hold helpful bacteria
rotation: changing the crop in a field in a planned order

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Peas, Beans, and the Nitrogen Trade

Triangle group

Plants need nitrogen the way people need food. It is a main ingredient in the proteins and green pigments that plants build as they grow. Air is mostly nitrogen, but plants cannot use it in that form. They must take it up from the soil, in chemical forms that roots can absorb. After a few seasons of growing the same crop, the soil on a farm can run low.

Peas, beans, lentils, peanuts, and clover belong to the legume family, and they have a remarkable partnership. On their roots, tiny bacteria move in and form small lumps called nodules. The bacteria take nitrogen from the air spaces in the soil and change it into a form the plant can use. In return, the plant feeds the bacteria with sugars made in its leaves. Both sides benefit, which scientists call a mutualism.

Farmers noticed long ago that fields did better after legumes. Many learned to practice crop rotation, planting different crops in a planned order across the years. A field might grow wheat one year, then clover or beans the next. When the legume plants die and decay, or are plowed under, some of the nitrogen they collected goes back to the soil, ready for the next crop.

Rotation also helps in other ways. It can interrupt the life cycles of insects and diseases that prefer a single crop. Because of these benefits, many farms still rotate their crops today, even though they can also buy fertilizer.

Questions

1. Why can plants not use the nitrogen that is in the air?

_____

_____

2. What are nodules?

_____

_____

3. What does the plant give to the bacteria in return?

_____

_____

4. What is crop rotation?

_____

_____

5. Why might a farmer plant clover after a crop of wheat?

_____

_____

6. How can rotating crops help against insects that prefer one crop?

_____

_____

Words to know

nitrogen: a gas in air that plants need to grow
legume: a plant family that includes peas and beans
nodules: small lumps on roots that hold helpful bacteria
mutualism: a partnership in which both sides gain
rotation: changing the crop in a field in a planned order

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Peas, Beans, and the Nitrogen Trade

Square group

Plants require nitrogen in much the same way that people require food, because it is a principal ingredient in the proteins and green pigments that plants manufacture as they grow. Although air is mostly nitrogen, plants cannot make use of it in that form. Instead they must absorb it through their roots from the soil, in chemical forms that dissolve readily, and after several seasons of growing a single crop, the soil on a farm can become depleted.

Peas, beans, lentils, peanuts, and clover all belong to the legume family, and they have formed a remarkable partnership. Tiny bacteria take up residence on their roots, where they create small lumps known as nodules. The bacteria capture nitrogen from the air spaces in the soil and convert it into a form the plant can use. In exchange, the plant nourishes the bacteria with sugars produced in its leaves. Because both partners benefit, scientists call the arrangement a mutualism.

Farmers observed long ago that fields performed better after legumes, and many learned to practice crop rotation, planting different crops in a planned order across the years. A field might grow wheat one year and then clover or beans the next. When the legume plants die and decay, or are plowed under, a portion of the nitrogen they gathered returns to the soil, ready for the following crop.

Rotation offers further advantages as well. It can disrupt the life cycles of insects and diseases that favor one particular crop. Because of these benefits, many farms continue to rotate their crops today, even though fertilizer is available for purchase.

Questions

1. Why are plants unable to use the nitrogen that makes up most of the air?

_____

_____

2. What are nodules, and where are they found?

_____

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3. What does the plant provide to the bacteria in exchange for nitrogen?

_____

_____

4. How would you define crop rotation?

_____

_____

5. Why might a farmer follow a crop of wheat with clover?

_____

_____

6. How does rotation protect a field from insects that prefer a single crop?

_____

_____

Words to know

nitrogen: a gas in air that plants need to grow
legume: a plant family that includes peas and beans
nodules: small lumps on roots that hold helpful bacteria
mutualism: a partnership in which both sides gain
rotation: changing the crop in a field in a planned order

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: Peas, Beans, and the Nitrogen Trade

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: Peas, Beans, and the Nitrogen Trade

Easier · 187 words · Flesch-Kincaid grade 3.6

1. It is not in a form they can use, so they need it from the soil.
2. Small lumps on legume roots where helpful bacteria live.
3. Sugar from its leaves.
4. Planting different crops in a plan, year after year.
5. The clover puts nitrogen back into the soil for the next crop.
6. The insects lose their favorite food, so their life cycle is broken.

Triangle: Peas, Beans, and the Nitrogen Trade

This passage · 246 words · Flesch-Kincaid grade 6.7

1. It is not in a form they can use; they need nitrogen from the soil.
2. Small lumps on legume roots where helpful bacteria live.
3. Sugars made in its leaves.
4. Planting different crops in a planned order over the years.
5. The clover puts nitrogen back into the soil for the next crop.
6. The insects lose their favorite food, so their life cycles are interrupted.

Square: Peas, Beans, and the Nitrogen Trade

Harder · 265 words · Flesch-Kincaid grade 10.1

1. It is not in a form they can use, so they must take it from the soil.
2. They are small lumps on the roots of legumes, where helpful bacteria live.
3. Sugars produced in its leaves.
4. Planting different crops in a planned order across the years.
5. The clover returns nitrogen to the soil for the next crop.
6. The insects lose their favored food, which disrupts their life cycles.