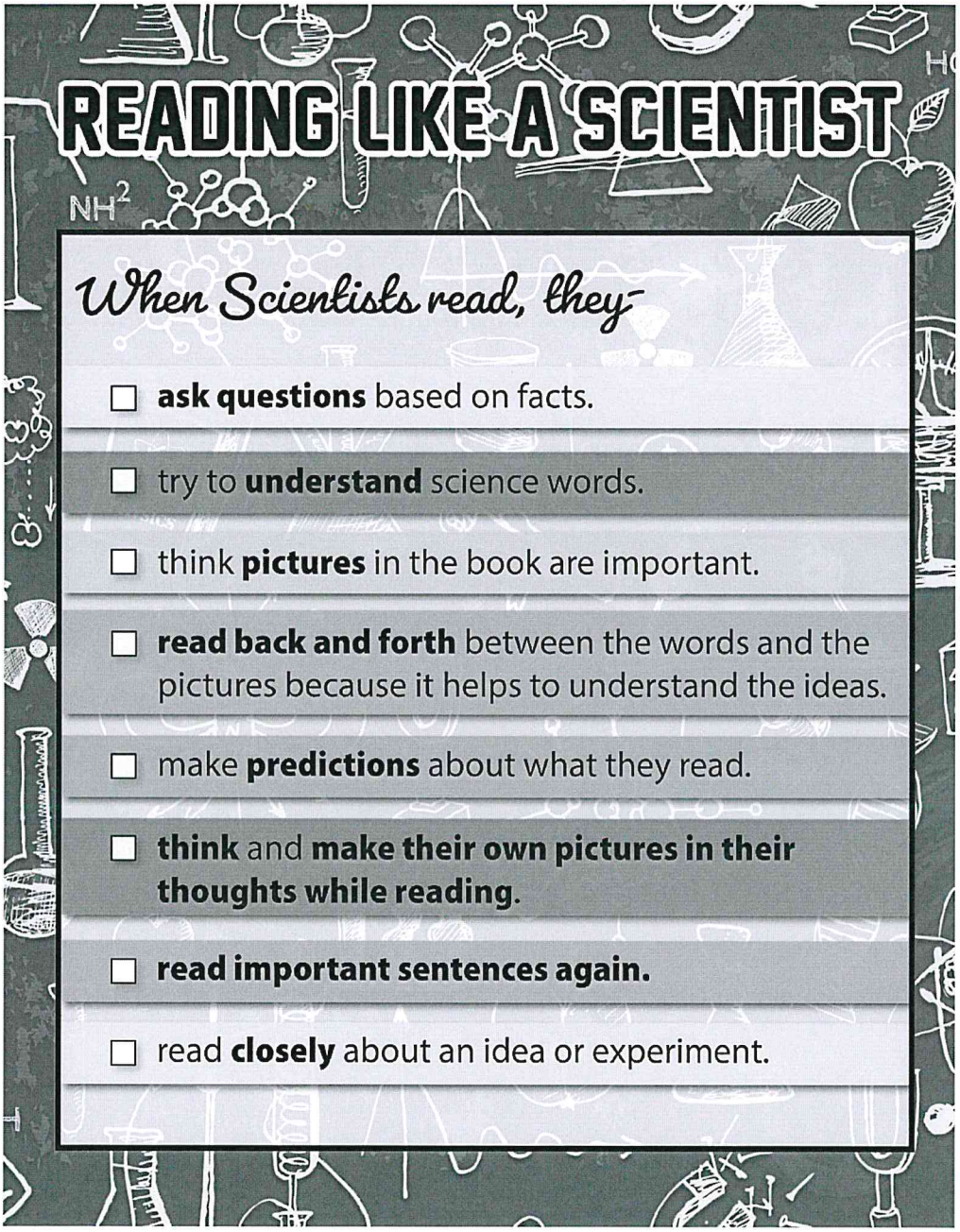
KS3 READING BOOKLET



Lent 2 LOWER LEVEL

- You can use the information on the next 2 pages to help you enhance and practice your skills of how to read like a scientist.
- We have carefully selected these real scientific journals to help you develop key scientific skills.

You can and are encouraged to:

1. Annotate the articles like you do in English.
2. Write questions around the article and ask more questions
3. Go to the website found at the bottoms of the article pages to watch the video's that help you on this.
4. Type up your answers/write them up neatly as this is showing you to be 'Be like Bede'
5. Have fun as you read, read with a parent/carer/adult/sibling and then further research what you read about.

Date W/C	Article	Completed Yes or No	Score

Different outlook about the goal of reading

How do scientists view reading?

- As an act of inquiry
  - They annotate (makes notes around), the text.
  - Ask further questions
  - Pick out key parts

Paleontologists have set up their campsite in between these giant rocks at Wadi Al Hitan. The rocks were once connected, but over millions of years, strong winds eroded the rock, leaving this large open space.

A long bumpy car ride from the busy modern city of Cairo, Egypt takes you into the empty silence of the "Western Desert". In the dry and windy spot, you will find an amazing place called Wadi Al Hitan, or the Valley of the Whales. Looking at the dry, cracked ground, it's hard to believe that this place was once covered by water. However, the traces of extinct plants and animals found here tell us that the area looked very different about 40 million years ago. It was part of a shallow ocean, called the Tethys Sea. When the ancient sea creatures that lived in the Tethys Sea died, some of their bones were preserved in layers of sand and rock at the bottom of the ocean. Over millions of years, the substance that made up their bones changed. It became more like rock than bone. The fossilized remains of sea turtles, manatees, sharks, crocodiles, swamp trees, and their relatives have been uncovered at Wadi Al Hitan.

This picture shows fossils of an ancient whale-like creature found at Wadi Al Hitan.

Wadi Al Hitan is considered the best place in the world to see the fossil evidence of ancient whales. Scientists have found more fossils of ancient whales here than in any other place on Earth. Scientists are especially interested in these fossils because they provide

Different purposes for reading

Why do students read?

- Because the teacher assigned a reading
- To learn information

Why do scientists read?

- To situate their research
- To interpret others' data and critique their findings
- To find specific information to support their own investigations
- To learn about others' procedures and experiments
- To learn what other scientists are learning

Different approaches to reading

How do students read?

- From beginning to end

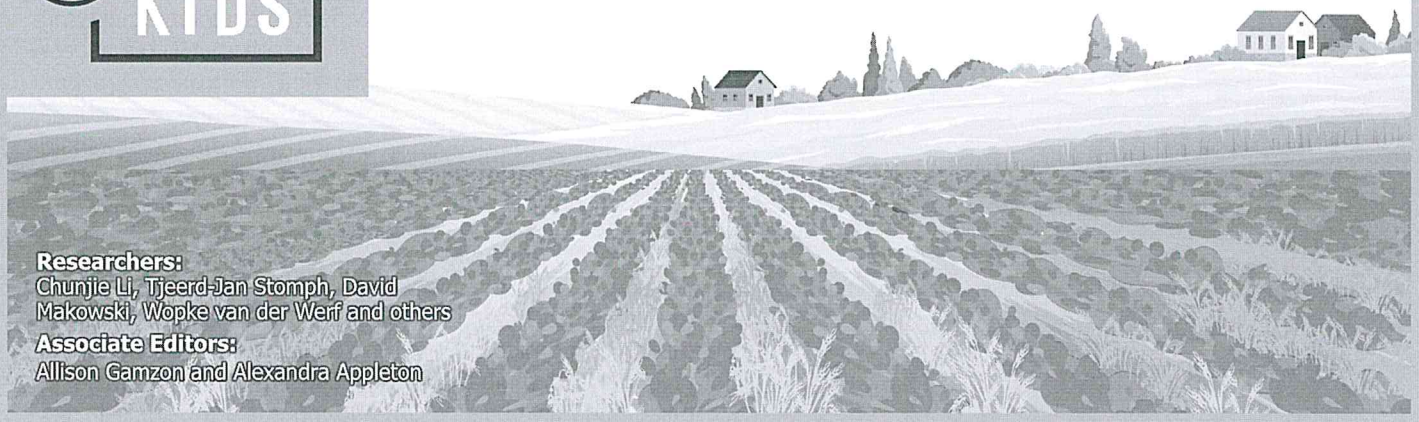
How do scientists read?

- Skip around
- Use headings
- Read captions
- Compare text descriptions to visual representations
- Check their understanding

ENVIRONMENTAL SCIENCE JOURNAL FOR KIDS

JANUARY 2024

What are the benefits of growing multiple crop species together?



Researchers:
Chunjie Li, Tjeerd-Jan Stomph, David Makowski, Wopke van der Werf and others

Associate Editors:
Allison Gamzon and Alexandra Appleton

Abstract

LOWER READING LEVEL

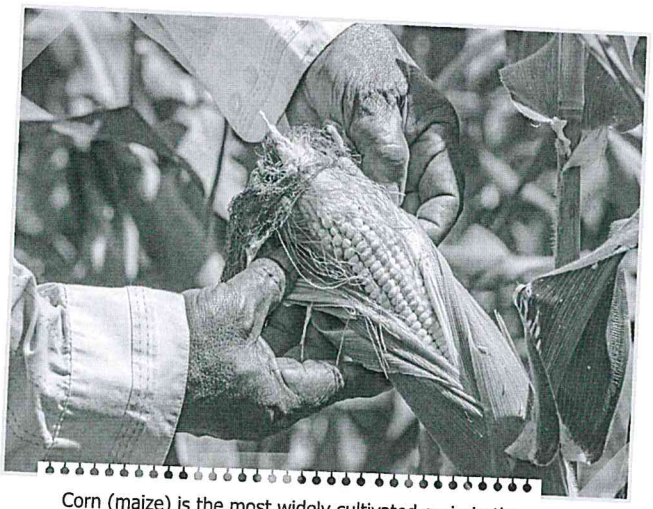
Did you know there are different ways to grow food? Two ways are sole cropping and intercropping. Farmers sole crop when they plant a field with only one crop. Farmers intercrop when they plant two or more crops in the same field. We wanted to compare sole cropping and intercropping. We found that intercropping produces less of each type of crop on a field. But intercropping produces more food choices. It also can save land space and reduce the amount of fertilizer needed to grow food. That is why intercropping is an important method for farmers to consider using in the future.

Introduction

Farmers grow a lot of the food you eat. Farmers have two main goals. The first goal is to grow enough food to meet the needs of a growing population. The second goal is to grow this food in a **sustainable** way. How can farmers grow large amounts of food without using too many natural resources? There are two main methods: **sole cropping** and **intercropping**. Sole cropping is when only one plant species grows in a field. Intercropping is when two or more plant species are grown in the same field at the same time. During intercropping, a grain crop and a **legume** crop are often grown together.

Intercropping increases crop **diversity**. Crop diversity can protect fields from **pests**, diseases, and weeds. For example, if one plant becomes infected with a pest, it can spread to plants of the same species. With intercropping, the mixture of plants prevents the pest from spreading. Intercropping can also affect the amount of fertilizer used by a farm. Using less fertilizer is important. Then the farmer needs to use fewer resources. So, it lowers the cost of growing the food. Lower fertilizer use can also reduce the amount of **nitrogen pollution** in rivers and the ocean.

Most farmers use sole cropping, not intercropping. We wanted to compare these two farming methods. Our goal was to provide information to farmers and policy makers. We used the results of field experiments to compare these two methods.



Corn (maize) is the most widely cultivated grain in the world. People can eat it directly, but also use it for animal feed, corn starch, corn syrup, and biofuels.
Photo: Frank Meriño on Pexels.

Methods

We analyzed a global set of data. It included the results of over two hundred experiments. These experiments investigated intercrops that included a grain and another crop type. The second crop was either a legume or **oilseed** crop. We focused on experiments that used the same methods to grow the intercrop and the sole crop.

From the experiments, we worked out several things:

1. the amount of grain that could grow on a field,
2. how much grain could grow on the same field with a second crop,
3. how much nitrogen fertilizer the fields needed, and finally
4. **land use efficiency** and **protein content**.

Results

Intercropping produces less grain than sole cropping. Imagine two identical fields. A farmer plants only corn (**maize**) on Field 1. The farmer plants Field 2 with half corn and half soybeans. At the end of the growing season, Field 1 produces 10 tons of corn. Field 2 only produces 8 tons.

But intercropping produces more food than sole cropping. (Fig. 1). Imagine our farmer needs to grow both corn and soybeans. To do that, the farmer can plant Field 1 with corn and Field 2 with soybeans. If they do, they get 10 tons of corn and 4 tons of soybeans. But the farmer could also plant both fields half with corn and half with soybeans. If they do, they get 16 tons of corn and 4 tons of legumes.That is a total of 20 tons, compared to 14!

We also found that intercropping requires less nitrogen fertilizer. It also produces either the same amount or a higher amount of protein.

How much more food does intercropping produce compared to sole cropping?

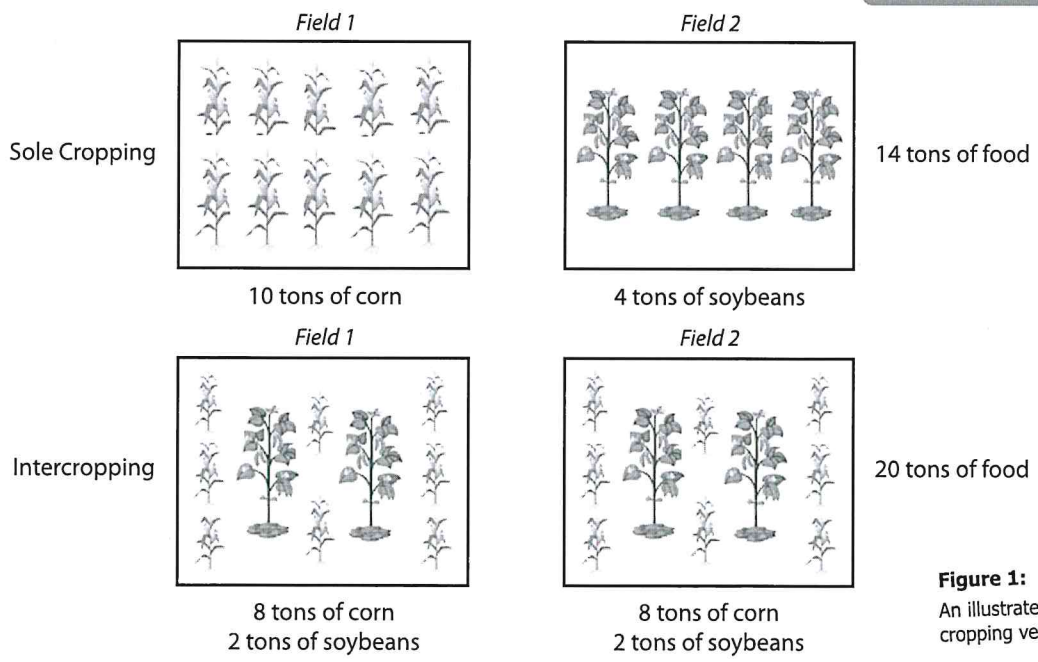


Figure 1:
An illustrated comparison of sole cropping versus intercropping.

Discussion

Is intercropping the best farming method? The answer to this question depends on the goal of the farmer. If the goal is to produce the largest amount of a single crop, then sole cropping is the better method. If the goal is to produce many types of food, then intercropping is the better method. With intercropping, farmers cannot grow as much of each individual crop. But, by growing two crops together, the land produces many food types.

Intercropping can also increase land **productivity**. If a farmer plants a field with half corn and half soybeans, we expect to grow half as much of each. Think back to Field 1 and Field 2. If the farmer uses intercropping, we predict that 5 tons of corn and 2 tons of soybeans will grow. But, the farmer actually grew 8 tons of corn and 2 tons of soybeans. Why? The corn and soybeans grow in alternating rows. Growing the different plants next to each other helps them grow better. That's because each crop has different needs. A corn plant growing next to another corn plant will fight over the resources it needs to grow. It doesn't have to fight as much next to a soybean plant.

We also learned that intercropping often decreases nitrogen fertilizer use. That means intercropping is a more sustainable practice. It reduces the amount of resources needed to grow food. It also helps reduce the impact of farming on the environment. Nitrogen fertilizer is a common water pollutant. Less fertilizer use means less nitrogen enters rivers and the ocean.

Our research showed that intercropping is a good choice for farmers. We found that there are many benefits to intercropping. That is why farmers need to think about using this method in the future.

Conclusion

Intercropping is an example of how important diversity is to an ecosystem. The more diverse an area, the more able it is to survive disease, pests, and extreme weather events. You can help keep your local ecosystem stable. Try planting a diverse set of plants in your yard or garden. This diversity can maintain the health of the soil. It can provide habitats for many organisms, such as insects and birds. Which plants are best to grow in your area? Do some research or ask for guidance when purchasing plants to grow in your yard or garden.

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Acknowledgment: This article's adaptation was supported by the Moderna Charitable Foundation.

Glossary of Key Terms

Diversity - the state of having more than one type of something.

Intercropping - the farming practice of growing two or more crop species in a field at the same time.

Legumes - family of flowering plants that produce protein-rich edible seeds. Crop species include lentils, peas, broad beans, chickpeas, soybeans, common beans, lima beans, and peanuts.

Land use efficiency - a measurement of how much crop can be grown per unit of land. A more efficient method produces more crop on a small amount of land.

Maize - the agricultural term used for corn.

Nitrogen pollution - when too much nitrogen is washed off the land and carried to rivers, lakes, and the ocean. Too much nitrogen causes large amounts of algae to grow. The breakdown of this extra algae lowers oxygen levels in rivers, lakes, and the ocean. Lower oxygen levels cause fish and other animals to die.

Oilseed crop - a crop grown to produce oil. Examples include soybeans, cottonseed, sunflower seed, canola, rapeseed, and peanuts.

Pest - an insect or other small animal that damages crops.

Productivity - the ability of the land to grow crops.

Protein content - the amount of protein a food contains. Protein is a main component of a healthy diet. Proteins are used to build muscle, bone, and skin. They are needed to keep the body healthy.

Sole cropping - the agricultural practice of growing only one crop species in a field at the same time.

Sustainable - avoiding an overuse of natural resources so that a practice can continue into the future.

Check your understanding

1. How does the amount of grain farmers can grow using sole cropping compare to the amount of grain they can grow using intercropping?

2. What are three benefits of intercropping?

3. Why is this research important for farmers and policy makers?

4. Farmers must know the needs of the crops before they decide to intercrop them. With a partner, brainstorm at least two needs of a crop like corn or soybeans that farmers need to know before planting them.

5. Write a letter to a local farmer persuading them to use intercropping on their farm. Make sure to include evidence and reasoning to support your argument.

ASTRO SCIENCE JOURNAL FOR TEENS

JANUARY 2024

How does dark energy affect galaxies?

Authors:
David Bernisty, Anne-Christine Davis, and N. Wyn Evans

Associate Editors:
Saskia Hagan-Fellowes and Tanya Dimitrova

Abstract

Scientists have known for a while that the universe is expanding, and it's doing so faster and faster. This strange phenomenon is caused by something we call dark energy. To understand this better, we need to think about a special number called the Cosmological Constant. It helps us describe how things move in space.

In our research, we aimed to uncover how dark energy causes objects like stars and galaxies to interact. As an example, we've been studying our neighbor galaxy – Andromeda. By looking at how it moves and at its mass, we can see how dark energy affects it.

Introduction

Imagine the universe as a gigantic balloon that just keeps growing and growing. You know how the air inside a balloon makes it get bigger? Well, our universe has something called dark energy, and it's a bit like that invisible air inside the balloon.

Think of dark energy as the opposite of gravity, or "anti-gravity". This is because while gravity normally works to pull things together, dark energy pushes them apart. Dark energy makes our universe expand, but we can't see or touch it because it's "dark" and very tricky to understand. We think up to 2/3 of the universe may be made up of this type of energy.

Our solar system is part of the Milky Way Galaxy. The Milky Way and its neighbor the Andromeda Galaxy are both part of a larger group of galaxies in space (Fig. 1). In this Local Group, dark energy is like an invisible force gently influencing how galaxies move.

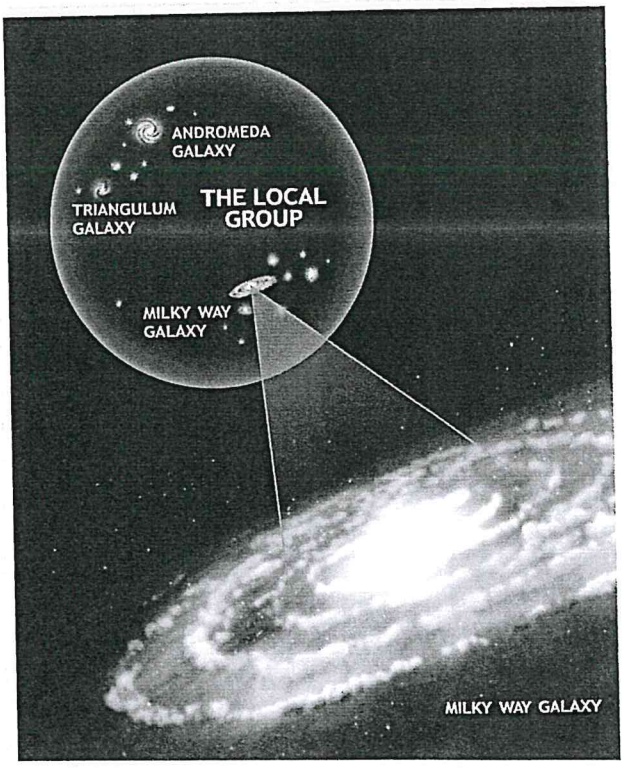

Figure 1: :The Milky Way is not an island universe, but a member of a small cluster of galaxies called the Local Group. The Local Group contains about three dozen known galaxies, clumped in two subgroups around two massive spiral galaxies: the Milky Way and the Andromeda Galaxy. In several billion years it is possible that the Milky Way and Andromeda will collide and merge to form one huge elliptical galaxy. (Image: NASA/Chandra X-Ray Observatory/M.Weiss)

Other galaxies are moving away from us due to the universe's expansion. But Andromeda is actually coming closer to us. We're on a collision course with Andromeda, but don't worry; it won't happen for billions of years! By studying Andromeda's **mass** and how it moves, we hope to see the effect dark energy is having on it.

One big clue in solving the mystery of dark energy comes from Albert Einstein. He came up with an idea called the **Cosmological Constant**. It is a vital clue in the dark energy mystery. It can help us understand how strong this mysterious force is and why the universe is expanding.

Methods

We focused on the Local Group of galaxies. These galaxies are pulled together by gravity. But they are also pushed apart by dark energy in our expanding universe. As a result, they have complex close **orbits**. We used **mathematical models** and simulations to see how dark energy and the Cosmological Constant affect their orbits.

Results

We calculated the maximal value on the Cosmological Constant only based on Andromeda's motion. It is 5 times greater than the value we measure from faraway galaxies. The result agrees with our known value of the Cosmological Constant. But it also opens new possibilities to test the Cosmological Constant in nearby galaxies.

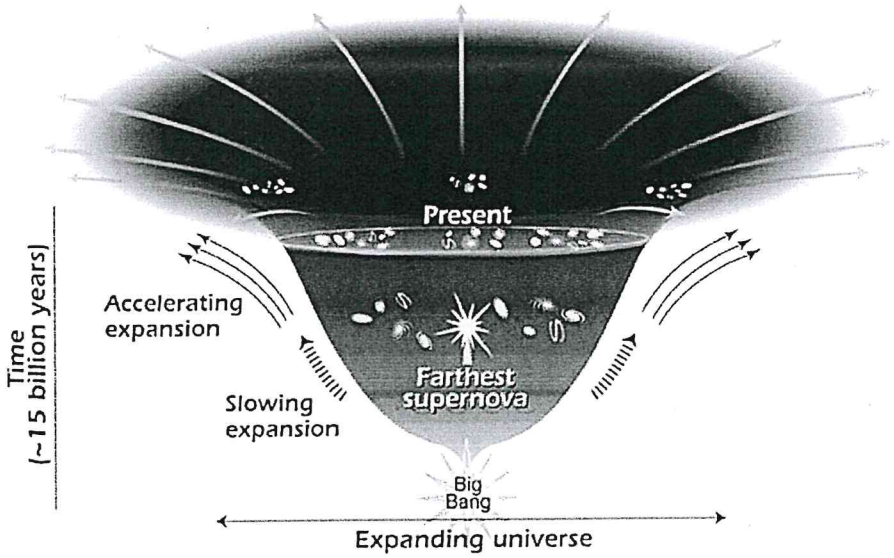

Figure 2:
We can see how fast the universe is expanding as it ages by using estimates of how much dark energy was in the universe at each time. We can see the universe got a lot bigger about 7.5 billion years ago. Dark energy may be speeding up this expansion. (Image: NASA/STSci/Ann Feild)

Discussion

We found that dark energy plays a major role in the galaxies' movement in our Local Group. Dark energy has a big impact on how objects move in space. Our method opens new directions to test the impact of dark energy, even from nearby galaxies in our local universe (Fig. 2). These findings provide us with valuable insights into how the entire universe operates and how it changes over time.

Conclusion

The universe's accelerating expansion and the role of dark energy are intriguing puzzles. It is truly amazing that we even have the capacity to think about these questions. After all, we are inhabitants of just a single planet in just one of the star systems in just one of the galaxies! A scientist's job is to ask interesting questions and design tests that can help answer them. What are you curious about? How can you learn more about it?

Glossary of Key Terms

Albert Einstein - a famous physicist who helped develop the theoretical physics behind our expanding universe.

Cosmological Constant (aka Λ, the Greek letter lambda) - a special number used to describe the value of dark energy in mathematical terms. Albert Einstein came up with this term. He thought it described a universe that does not expand. Later, when scientists discovered the universe was getting bigger, Einstein called it his "biggest blunder."

Dark energy - an invisible force that makes up approximately 68% of our universe. We can't see it, but we know that it's there because of measurements showing the universe started expanding faster about 7.5 billion years ago.

Expansion of the universe - our universe is getting bigger, and the space between galaxies is actually growing!

Galaxy - a large group of stars, planets, gas, and dust bound together by gravity. Galaxies come in various ages, shapes, and sizes.

Local Group - a group of nearby galaxies including the Andromeda Galaxy, the Milky Way, and the Triangulum Galaxy.

Mass - a measure of how much matter (that is, the total number of atoms) that are in an object. It is a fundamental property that does not change regardless of what forces are acting on it. It is different from "weight", which depends on gravity and other forces.

Mathematical models - a set of equations and rules that show how things in our universe (like stars and galaxies) move and behave. We can use models to make predictions about the universe and understand the physics behind certain astronomical events.

Milky Way - the galaxy we live in. It includes our solar system and hundreds of billions of other stars.

Orbit - the path of celestial objects moving in space

Acknowledgment: This article's adaptation was supported by the Goggio Family Foundation.

Check your understanding

1. What is dark energy and how is it different from gravity?

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2. What were the key findings about the impact of dark energy on nearby galaxies like Andromeda?

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3. What causes galaxies to have complex orbits?

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4. How did Albert Einstein's concept of the Cosmological Constant contribute to understanding dark energy?

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5. How do you think studying dark energy and its influence on galaxies could benefit our understanding of the universe's evolution? Discuss potential advancements.

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ENVIRONMENTAL SCIENCE JOURNAL FOR KIDS

NOVEMBER 2022

Can a spray make our crops better?

Authors:
Keiji Numata,
Chonprakun Thagun,
Yoko Horii, and others

Associate Editors:
Elitsa Panayotova
and Rachel Watson

Abstract

LOWER READING LEVEL

Did you know the first genetically modified crop was a tomato with delayed ripening? Genetically modified organisms (GMOs) have been around for decades now. And they offer a lot of benefits. For example, they may grow more food or be more resistant to diseases. But there are a few downsides as well. Producing GMOs takes a lot of time and is often expensive. Plus, many people think they are unsafe. This is because they have some foreign DNA. But what if we can change the crops without changing their DNA?

We tried using special molecules. They can change cell activity. First, we have to insert them into plant cells. For this, we tested sprays with nanocarriers. It turned out to be a success! Many nanocarriers were able to enter the plant cells. Then, we tried spraying nanocarriers with the special molecules. This was also a success! So, we could make the cell do what we wanted.

Introduction

You might have heard of **genetically modified organisms** (GMOs). But do you know how scientists make them? It usually takes 4 steps:

1. They look for a trait that can improve the **organism**. For example, resistance to **drought** or disease. Then they find another organism that already has that trait. They also find the **DNA** responsible.
2. They copy the desired DNA.
3. They insert the DNA into the organism they wish to change. So, the organism, for example a plant, has some foreign DNA. It makes the plant cells do what the scientists want. The modified DNA also carries on to future generations.
4. Finally, the scientists grow the new organisms, for example plants that are resistant to diseases, drought, insects, etc.

GMOs can definitely be very helpful. But there are some downsides. For one, GMOs take a long time to make. They can also be quite expensive. Plus, many people think GMOs are harmful to our bodies and the environment.

We wondered: what if we can change a plant to have the desired traits without changing its DNA? So that it won't take so much time to produce and it would be cheaper? And much easier to do? This is what we wanted to achieve.

Methods

Some molecules (for example, DNA) can adjust cells' activity. So we can insert such molecules to control the cells. This way we won't actually change the DNA. It sounds simple enough. But achieving it is not easy! Plus, we wanted an easy application method – one that people can use in agriculture. We decided to try *spraying* these molecules on the plants.

We considered different **nanocarriers**. Maybe they could insert the special molecules into the cells?

We performed three separate experiments.

Experiment 1: Do nanocarriers work as a spray? Which one would be best at entering the plant's cells? To find out, we tagged the nanocarriers with glowing yellow dye. Next, we sprayed this complex (nanocarrier + dye) on the plants' leaves. We then measured the glow.

Experiment 2: We wanted to test if these nanocarriers could insert DNA into the cells. So, we combined them with a special DNA complex. If the DNA entered the plants' cells we would see blue spots.

Experiment 3: We wanted to see if we could switch off some **genes**. Our test subject was a modified plant that glows in yellow. We sprayed it with nanocarriers and a special molecule. This molecule should try and block the glow. So if we succeed, we should see no (or less) glow.

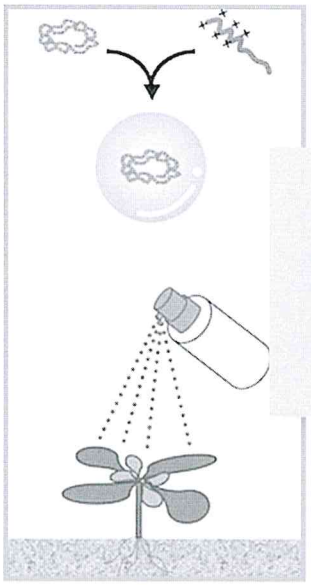
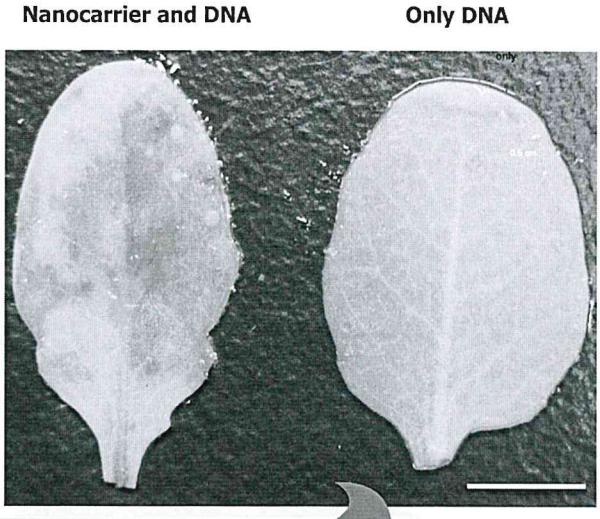


Figure 1:
Spraying the leaves with a nanocarrier with bioactive molecules (DNA or RNA).

Results

Our experiments showed us that:

1. The various nanocarriers showed glows with different levels of brightness. So, some nanocarriers were better than others at entering the plants' cells.
2. When we sprayed the plants with the carrier + DNA, there were blue spots. When we sprayed the plants with only DNA, there were no blue spots. (See Fig. 2.) That means the DNA can't enter on its own.
3. Spraying the glowing plant with only the nanocarrier didn't stop the glow. But when we sprayed it in combination with the special molecule, there was less glow.



Why are there blue spots in the left image and no blue spots in the right one?

Figure 2:
On the left, we sprayed the plants' leaves with the nanocarrier and DNA complex. On the right, we only sprayed them with the DNA. The blue spots show that the DNA has entered the plants' cells.

Discussion

Our results are quite promising! We were able to control the cells with sprays. Many natural nanocarriers were able to enter the leaves. The brighter the glow in Experiment 1, the better the carrier enters the cells. They were also able to deliver DNA to the plants' cells. This is what the blue spots in Experiment 2 tell us.

We were also able to switch off some genes. Sometimes, this is as important as inserting new genes. In Experiment 3, we first sprayed the glowing plant with a nanocarrier. But the glow didn't change. We then sprayed it with a nanocarrier + a special molecule. This molecule should switch off the gene which makes the plant glow. And indeed, the glow was not as bright!

Conclusion

We were able to change a plant without changing its DNA. Plus, we were able to do so for a lot less time and money! And even better, we found a very easy way of doing it. A handheld spray!

This doesn't mean we should ignore GMOs, though. Do some research to find out what genetically modified crops are grown in your country. What are their benefits? What about their downsides?

Glossary of Key Terms

DNA (DeoxyriboNucleic Acid) – a molecule that carries genetic information. All living organisms read this information for growth, development, function, and reproduction.

Drought – a long period with unusually little rain, causing there to be not enough water.

Gene – a small section of DNA with the instructions for characteristics of the organism.

Genetically modified organism (GMO) – an organism whose DNA has been changed intentionally (in the lab).

Nanocarrier – a very tiny material that can transport other substances, such as special molecules, and drugs.

Organism – an individual living thing, like a plant or animal.

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https://kids.kiddle.co/Nanotechnology

National Geographic: Genetically Modified Organisms
https://education.nationalgeographic.org/resource/genetically-modified-organisms

Check your understanding

1 What is the difference between GMOs and the plants we changed with special molecules?

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2 In Experiment 3, there was less glow after we sprayed the nanocarrier + special molecule. Why?

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3 In the same experiment (3) we switched off a gene responsible for the glow. This is not a very important trait. Can you think when switching off a gene can be useful?

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4 Positive traits in crops include resistance to drought or diseases. Can you think of any other positive traits?

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5 Do you support GM crops? Why or why not? Consider how they have helped to address global hunger as well as the risks they present to humans and the environment. Discuss this in small groups in class, or do some research online!

Acknowledgment: This article's adaptation was supported by the GM Foundation.