CASFER
Center for Advancing Sustainable and Distributed Fertilizer Production
An NSF Engineering Research Center

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MICHAEL AND THE MAGNIFICENT MANURE MACHINE

HOW CASFER HELPS FARMERS AND THE EARTH



NIKKI RIOJAS AND NATHAN CABALLERO

ILLUSTRATED BY JAKE SAZON

A NOTE FOR PARENTS AND EDUCATORS

This story helps young readers discover:

- How farms can turn waste into valuable resources
- What a "circular economy" means through Michael's farm
- How science solves real-world problems
- Why sustainable farming saves money and helps the Earth
- How everyday farm activities connect to protecting our planet

Look for discussion questions and activities at *www.casfer.us*

Reading Level: Grades 1-3 (Ages 6-9)

FROM THE AUTHORS

To all the curious young minds who ask "why?". Your questions today will lead you to the solutions of tomorrow. And to the dedicated scientists, farmers, and educator working tirelessly to create sustainable solutions for our planet. Your innovation inspires us daily.

With heartfelt gratitude to our CASFER Scholar Advisory Panel: Daniela Ferreira-Garcia, TTU; Terril Vallikalam, Case Western Reserve University; Melanie Gut, MIT; Zaida Gracia, Senior Director of Workplace Development at CASFER; Dr. Ozhan Gecgel for his poster that inspired this project, and special thanks to Dr. Gerri Botte for her vision and dedication to starting CASFER.

—NIKKI RIOJAS AND NATHAN CABALLERO

CASFER'S MICHAEL AND THE MAGNIFICENT MANURE MACHINE



On a sunny farm in Texas lived Michael, the farmer, and his clever dog, Max. They spent their days growing sweet golden corn and looking after their cows, pigs, and chickens. Every morning, they would walk together to feed all their farm friends.



"Time for breakfast, everyone!" Michael called out, as Max trotted alongside him. All of the animals perked up at the sight of their favorite duo. But something stinky was starting to worry Michael.

You see, Michael had a big problem. His farm animals made lots and lots of poop! There was cow poop. And chicken poop. And pig poop, too! It was too much poop! "What do we do with all this poop?" Michael scratched his head. Max wrinkled his nose and hid behind Michael's legs.



Michael tried turning it into dirt for his garden, but that took too many months, and the pile just kept growing. He tried storing it in big tanks, but that wasn't safe for the water nearby. He even tried taking it away on his truck, but they were running out of space to put it.



"I need a solution that works fast, keeps everything safe, and doesn't need so much space." Michael sighed, looking at the mountains of **manure**.

One morning, while eating breakfast and watching the news, Michael saw something that almost made him spill his drink. His good friend, Dr. Gabi, and her team from a group called **CASFER** had made a special machine.

Dr. Gabi is a brilliant **scientist** and **engineer** who loves helping farmers solve **agriculture** problems. "Max, look!" said Michael. "Dr. Gabi has invented something wonderful!"



Michael called Dr. Gabi right away. He wanted to learn more about her invention. She explained that it wasn't just any machine; it was a magnificent manure machine that could turn yucky farm **waste** into super plant food!

"But how does it work?" Michael asked.

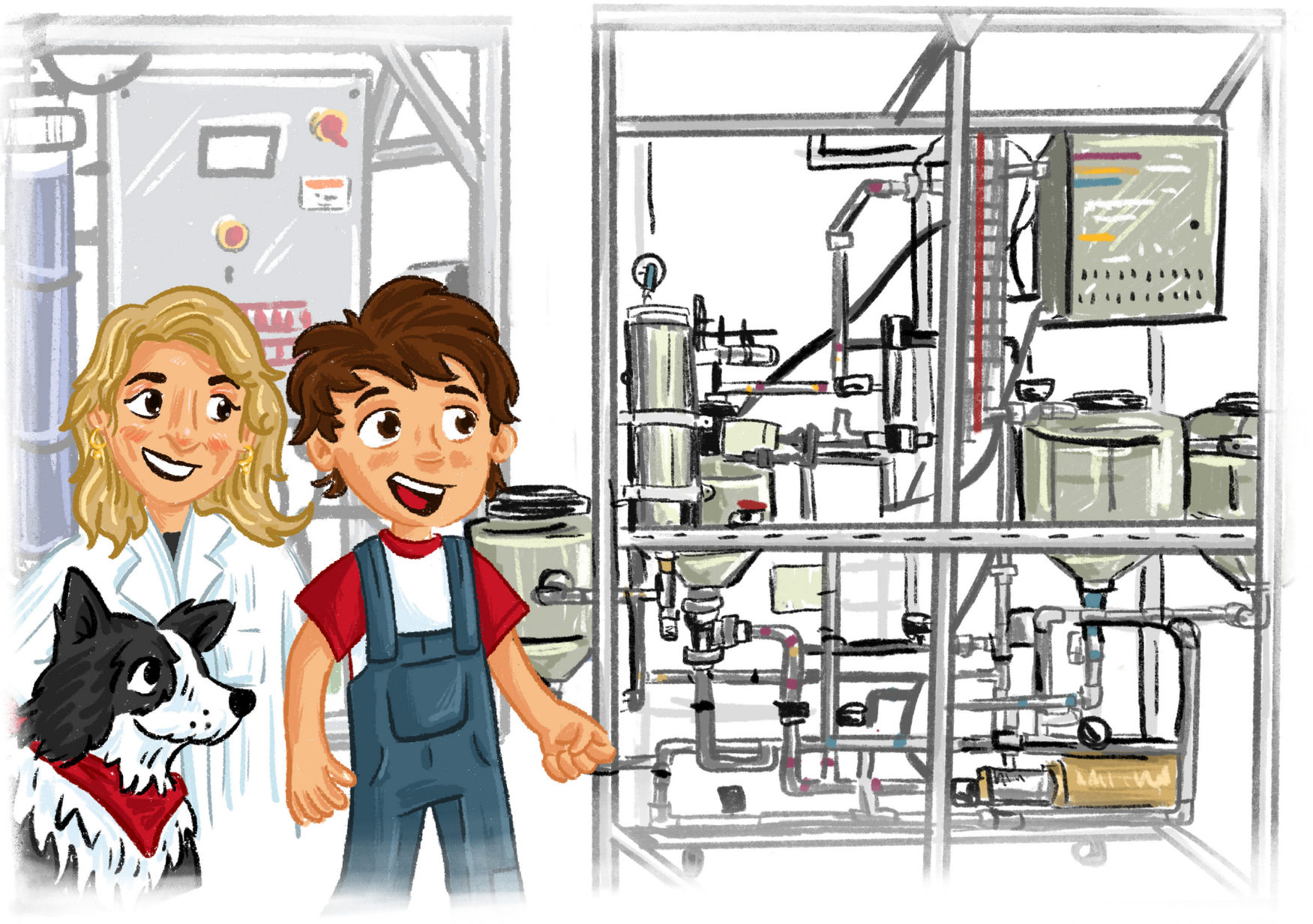


"Let me show you!" Dr. Gabi said with a bright smile. "Science can help us turn problems into solutions!"

Dr. Gabi showed Michael how the machine could be pulled behind his pickup truck like a trailer. “This way,” she explained, “you can move it anywhere on your farm where plants need food to grow.”

“That’s perfect!” Michael said. “With this machine, I can help the plants grow tall and strong in all of my fields!”





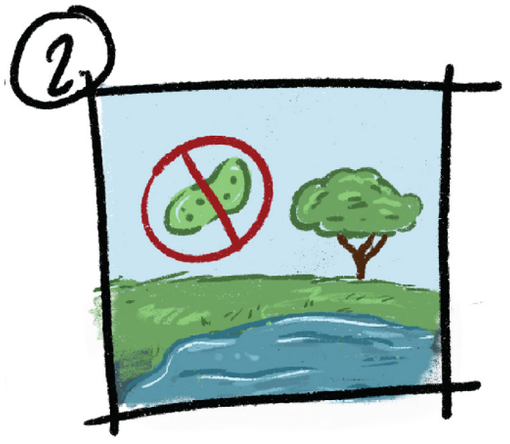
Together, Michael and Dr. Gabi connected the machine to the waste tank. Inside the machine, something wonderful happened. Dr. Gabi explained that it used a process called **electrolysis**; that's when electricity helps change one thing into another thing.

The machine hummed and whirred as it worked. Max watched with curiosity as Dr. Gabi told Michael all about the magnificent manure machine.

"The machine solves all three of your problems." Dr. Gabi explained with a smile.



"First, it quickly turns the waste into plant food called **fertilizer**, so no more waiting for months."



"Second, it makes everything safer by cleaning out the harmful germs, protecting our water and land."



"And third, it helps protect the Earth by using less space and keeping our planet clean!"





When the machine finished, Michael had fresh, clean fertilizer. He and Dr. Gabi carefully spread it over the cornfields while Max bounded through the rows and checked over their work.

The plants loved it! They grew taller and stronger than ever before. Their leaves turned a beautiful green, and soon golden corn started blooming.



When it was time to pick the corn, Michael couldn't believe his eyes. This was the best corn he had ever grown! The ears were big and full of sweet, yellow kernels.

"The magnificent manure machine really works!" he told Dr. Gabi excitedly, "And I don't have to spend so much money on fertilizer anymore. Now I can finally fix our leaky barn roof!"



Michael was proud of his farm. Dr. Gabi explained how they could now use the animal waste to help plants grow and then use the plants to feed people and animals.

"Everything works together in a circle," she said. "Scientists call this a **circular economy**."



“You know what’s really special about this?” Dr. Gabi asked Michael. “We took something that seemed like a big problem (all that poop) and turned it into something wonderful that helps our Earth!”

Michael nodded eagerly. “Just think of all the other ways we could help the planet by turning problems into solutions!”



As the sun began to set, Michael, Dr. Gabi, and Max walked proudly through the cornfield, dreaming up new ways to help the Earth. They knew this was just the beginning of their adventures in turning waste into wonderful things.

“What should we try next?” Michael asked Dr. Gabi with a smile.



GLOSSARY

AGRICULTURE
Agriculture is the science of growing crops in soil and raising animals on farms. It helps feed people all over the world.

CASFER
CASFER stands for the Center for Sustainable and Distributed Fertilizer Production, a National Science Foundation Engineering Research Center

CIRCULAR ECONOMY
A circular economy is the process of using things wisely, so they don't go to waste. Instead of throwing stuff away, we reuse, fix, or recycle it to make something new.

ELECTROLYSIS
Electrolysis is a special process where scientists use electricity to change something from one thing into another.

ENGINEER
An engineer is a person who uses science to solve problems. They use their creativity to build things like machines, bridges, or computers, and make the world a better place.

FERTILIZER
Fertilizer is something farmers add to soil to help plants grow better and faster. It gives plants the nutrients they need, like vitamins for people.

MANURE
Manure is animal poop that farmers use to help plants grow. It's full of natural nutrients that plants love.

SCIENTIST
A scientist is a person who asks questions about how things work and tries to find answers by doing experiments and making observations. They explore the world around us and use what they learn to help people and solve problems.

WASTE
Waste is stuff we get rid of because we don't need it anymore, which can include things like poop. But sometimes, waste can be turned into something useful again!

FEEDING THE WORLD FOR GENERATIONS TO COME

ABOUT CASFER:

Founded in 2022, the Center for Advancing Sustainable and Distributed Fertilizer Production (CASFER) addresses critical food security challenges as global population approaches 10 billion by 2050. CASFER aims to transform the 80% of fertilizers that become waste into sustainable solutions, modernizing production processes unchanged for nearly a century.

Through interdisciplinary research, industry partnerships, and workforce development, CASFER is building a more sustainable future in agriculture for generations to come.

Learn more at casfer.us.

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ABOUT THE AUTHORS:



NIKKI RIOJAS

is a marketing and communications leader with a BA and MFA in Graphic Design. She excels at making complex scientific research accessible to broader audiences, bridging cutting-edge agricultural science with practical applications. Having lived in Nebraska and now Texas, Nikki understands the importance of agricultural advancement in farming-intensive states. Her creative expertise enables her to transform CASFER's innovative research into engaging stories for readers of all ages.



NATHAN CABALLERO

is a storyteller, digital media expert, and proud advocate for imagination in all its forms. He currently serves as the Media Relations Coordinator for CASFER at Texas Tech University, where he brings stories to life through graphics, videos, and social media. Nathan earned both his Bachelor's degree in Writing and Strategic Communication and his Master's degree in English Literature from Texas Christian University. When he's not creating engaging digital content or writing, Nathan enjoys exploring new ways to connect with readers through fun, thoughtful, and inspiring tales.




MICHAEL AND THE MAGNIFICENT MANURE MACHINE
In this heartwarming story, farmer Michael and his dog, Max, discover a remarkable solution to their smelly farm problem. When scientist Dr. Gabi introduces them to the Magnificent Manure Machine, they learn how science can turn yucky waste into valuable plant food. Join their adventure as they help their crops grow, save money, and protect our planet, proving that sometimes the biggest problems lead to the most wonderful solutions!
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