ILLINOIS AG MAG

An Agricultural Magazine for Kids

SUSTAINABILITY

Sustainability and the Environment

Everything that surrounds you is a part of the environment! This includes living things like plants and animals, and non-living things like weather and climate, rocks, soil, water, nutrients, and even the atmosphere. All the living and non-living things interact with one another in some way. They also depend on one another, which is what keeps balance in the environment. This balance is very important for all living things, including humans, to survive. If something changes in the environment, it will affect all living and non-living things in some way, big or small, quickly or over time.

Humans play a large role in how the environment is impacted. This is because we develop the environment in ways that are not natural. As the human population continues to increase, we impact more and more of the environment. We need food, so we use land to grow food and to build stores. We need things like vehicles to get around, cell phones to connect with each other, and plastic for basically everything! All these things are important to us but they come with a cost. Producing all of these things uses a lot of earth's natural resources and creates pollution, habitat loss, waste, and more.

So how do we continue to grow enough food for everyone, keep building houses and apartments, and have all the items we use every day? By focusing on **SUSTAINABILITY**. Sustainability is the idea that we can use these natural resources for the things we need and want in a responsible way so that they will also be available for future generations to use. The way we do this is by making responsible decisions every day that keep our environment healthy. Farmers work hard each year to become more sustainable in how they grow our food. But we can all play a role in becoming more sustainable!

Progress starts with change, and change starts with awareness.

The environment is made up of many different ECOSYSTEMS.

THE 3-LEGGED STOOL

AGRICULTURE is a huge part of our everyday lives. All of your food, clothes, fuel, school supplies, soap, and much more are available to us because of agriculture. Through the supply chain, we can usually get what we need from stores and not have to make all these items ourselves. But this also impacts our environment in many ways. So how do we continue to produce high quality food for the world, create income for communities and farmers, and protect the environment all at the same time? We can do this by practicing Sustainable Agriculture and focusing on an equal balance of three things: social responsibility, environmental responsibility, and economic responsibility.

A traditional three-legged milking stool is incredibly stable. As long as each leg is the same length, it is nearly impossible to tip over. If we give equal attention to each of these three aspects of Sustainable Agriculture, we can continue to produce nutritious food, ensure farmers and communities are profiting, and maintain a healthy environment. Remember, balance is important!

VOCABULARY

Agriculture: The act of preparing and using soil, growing crops, and raising livestock to provide many products for humans

Cover Crop: A crop grown to help protect and enhance the soil rather than to harvest

Deoxyribonucleic Acid (DNA): The blueprints in every living organism, like the coding of a video game

Ecosystem: The interactions between all of the living and non-livings things in their environment

Environmental Stewardship: Caring for the earth's environment by becoming informed, accepting responsibility, and taking action

Ethanol: A high-performance fuel made from corn

Erosion: When pieces of the Earth's surface are moved from one place to another, usually by water and/or wind

Fossil Fuels: Natural substances used for energy that formed from ancient plant organisms decaying under heat and pressure for millions of years

Genetically Modified Organism: An organism whose genetic material has been changed to produce a more valuable trait

Greenhouse Gas: Gases, like carbon dioxide (CO_2), in the earth's atmosphere that trap and hold heat

Native Species: Plants and animals that occur naturally in an area without human intervention

Nonrenewable Resource: A natural resource that has a limited supply and cannot be replaced as quickly as it is consumed

Renewable Resource: A natural resource that is unlimited, or can be replaced quickly as it is consumed

Sustainability: Meeting our current needs without sacrificing the ability of future generations to also meet their needs

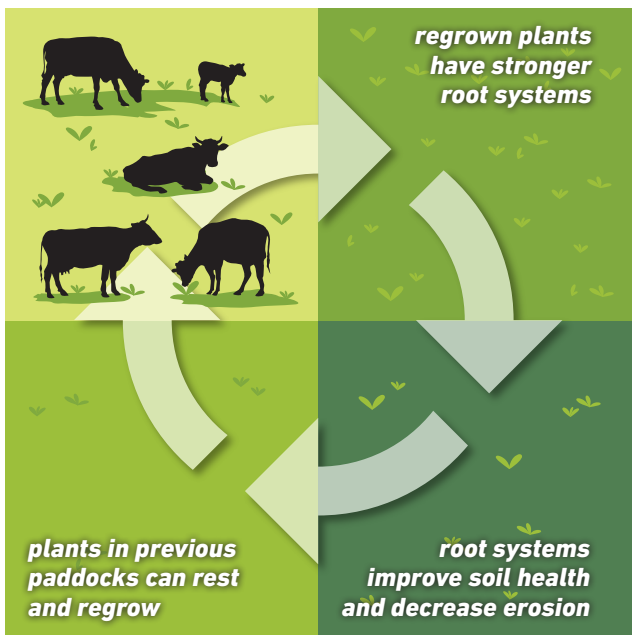
Pesticides: Mixtures of different chemical substances that are meant to prevent, destroy, or control pest populations (like weeds, fungi, insects) that may cause damage or spread disease

FACING *the* CHALLENGE

A farmer's job is to provide high quality food, fiber, or fuel for millions of people. But our population keeps growing. As our population grows, we need more land for housing, stores, and roads. This means that farmers must keep growing more food on less land, all while making sure they are protecting the soil, water, and air. This is a very big challenge! Luckily, we have many people around the world who put their time and effort into researching ways we can become more agriculturally sustainable. Keep reading to learn how farmers are practicing ENVIRONMENTAL STEWARDSHIP!

Keep in mind that every farm is different. They are all a part of different ecosystems with different weather patterns, different NATIVE PLANT AND ANIMAL SPECIES, different land formations, and different access to resources. What might work for one farmer may not work for the next.

Rotational Grazing

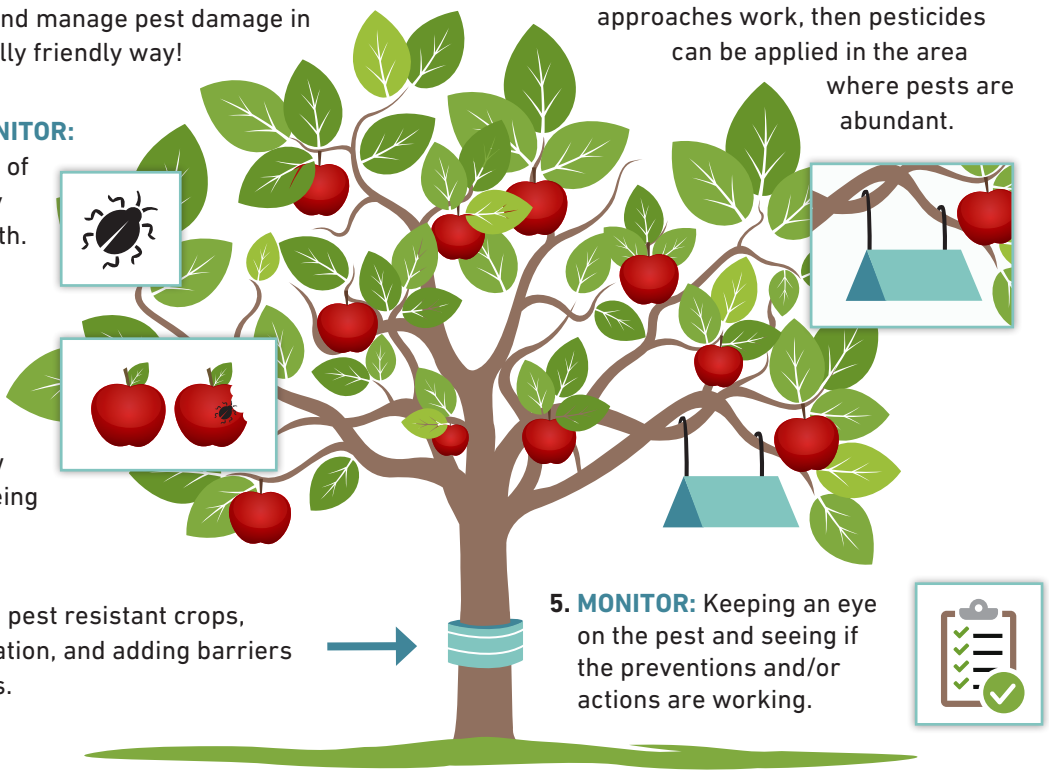


Livestock, like cattle and sheep, can cause a lot of damage to plants and soil as they are grazing. Farmers can minimize the damage by creating smaller sections in a pasture, called paddocks, and rotating their livestock through each paddock over time. Each paddock must have plants, water, and shade to keep the livestock healthy!

Integrated Pest Management

Pests are living organisms *(like weeds, fungus, or insects)* that cause a lot of damage to plants in crop fields, orchards, and garden beds. Instead of just spraying the entire field with **PESTICIDES**, farmers are trying to reduce and manage pest damage in a more environmentally friendly way!

1. **IDENTIFY AND MONITOR:** Identifying the kind of pest and how many they are dealing with.
2. **EVALUATE:** Determining if the pest population is increasing and how much damage is being caused.
3. **PREVENT:** Growing pest resistant crops, practicing crop rotation, and adding barriers are some examples.
4. **ACTION:** Introducing the pest's natural enemy, changing various processes/ practices, or creating mechanical or physical controls. If none of those approaches work, then pesticides can be applied in the area where pests are abundant.
5. **MONITOR:** Keeping an eye on the pest and seeing if the preventions and/or actions are working.



Cover Crops


fall cover crop in harvested corn field


fall cover crop of turnips


spring planting into cover crop

Soil health is extremely important to plant growth and so farmers want to make sure they have healthy soil. Crops use a lot of nutrients in the soil. When farmers harvest their crops in the fall, the soil has fewer nutrients than it did in the spring. Farmers can plant **COVER CROPS** between growing seasons. These cover crops will hold the soil in place, add nutrients back to the soil, control pests, and even enhance water availability. Many plants can be used as a cover crop, depending on the area where the field is located.

Till vs. No Till

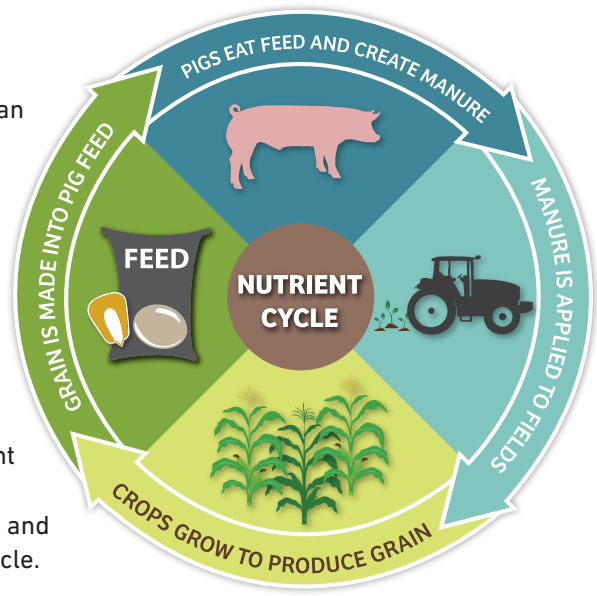
Tilling is a way to loosen the soil in order to plant seeds in the spring or to clean up fields after harvest in the fall. But tilling can sometimes create **EROSION** and even hurt the good microbes that live there. Some farmers are practicing a no-till method. This means they leave the remains of harvested plants *(called residue)* in the soil over the winter to decompose. Then in the spring they will plant new seeds right through the residue. This practice helps keep soil healthy and reduces the amount of fertilizer needed. It also reduces CO_2 emissions from driving the tractors. No two farms are exactly alike, so farmers must make choices based on what is best for their unique farms.


Spring corn growing in tilled field.


Spring corn growing in no-till field.

Manure Management

Livestock manure may be considered waste *(and is sometimes stinky!)* but it can actually be recycled for a purpose. The gases released from manure can be collected in a machine and used to create heat and electricity. Manure can also be used as natural fertilizer in crop fields. This decreases the amount of chemical fertilizers needed for plants to grow and is a part of the nutrient cycle.



Bioplastic




So many things around you are made from plastic, just take a look! From cell phones and containers to lifesaving machinery in hospitals, plastics are critical in our modern life. Unfortunately, plastics do not decompose in the environment and mostly end up in landfills or as litter in both land and water ecosystems. Plastic is made from petroleum, or crude oil. This is a **NONRENEWABLE RESOURCE** that is also used for many other things, like gasoline and electricity. Bioplastic is a type of plastic made from plant crops, like corn, which is a **RENEWABLE RESOURCE**. Using plastic made from corn instead of fossil fuels also emits 68% fewer **GREENHOUSE GASES**! Lastly, bioplastics can be recycled in an industrial composting plant and under controlled conditions, will decompose completely!

***The prefix bio- means* LIFE.**
***Any word starting with* bio-**
has something to do with life or living organisms.

Biofuel

Most types of transportation require fuel to provide power. Diesel fuel and gasoline come from the fossil fuel petroleum, or crude oil, which is a **NONRENEWABLE RESOURCE**. **ETHANOL** is a biofuel made from corn, a **RENEWABLE RESOURCE**. Instead of taking millions of years to decompose like **FOSSIL FUELS**, we can use the process of fermentation to make ethanol in just a few days! Most gasoline today already has a small percent of ethanol mixed in it. Using ethanol as fuel for vehicles will allow us to use fossil fuels for other things, like heating our homes and schools.

Biodiesel is another type of biofuel that is made from soybeans. It can also be made from new and used vegetable oils, animal fat, and recycled cooking grease. In this case, we are conserving fossil fuels and recycling materials that would normally end up in the landfill. That's a win-win!

26% **of the corn produced in Illinois by IL farm families is used for ethanol, reducing fossil fuel usage for the entire world!**

Technology

Farming is a science that is constantly evolving! Farmers, scientists, and engineers are working together to create a variety of technologies to grow more food, decrease crop loss, and decrease practices that are harmful to the environment. Here are a few examples of new technologies and how they are beneficial:

DRONES:
Aerial imagery of crop fields can help farmers monitor plant health and growth so they don't have to walk through their entire fields to collect data by hand.

AUTONOMOUS TRACTORS:
These are tractors that can drive by themselves! With the amount of work a farmer must do in one day, autonomous tractors could be extremely helpful.

INFIELD SENSORS:
Small sensor machines can be placed in fields which will collect data like chlorophyll absorption, leaf wetness, heat stress, soil temperature, precipitation, and more.

BIOTECHNOLOGY:
One type of biotechnology is **GENETICALLY MODIFIED ORGANISMS**, or GMOs. Many areas around the world, and right here in the U.S., are experiencing major changes in weather patterns. These changes are causing heavy flooding, drought, and increases in pest populations which all can be very damaging to crop fields. Scientists can make small changes in the **DNA** of the plants to help survive these types of events.

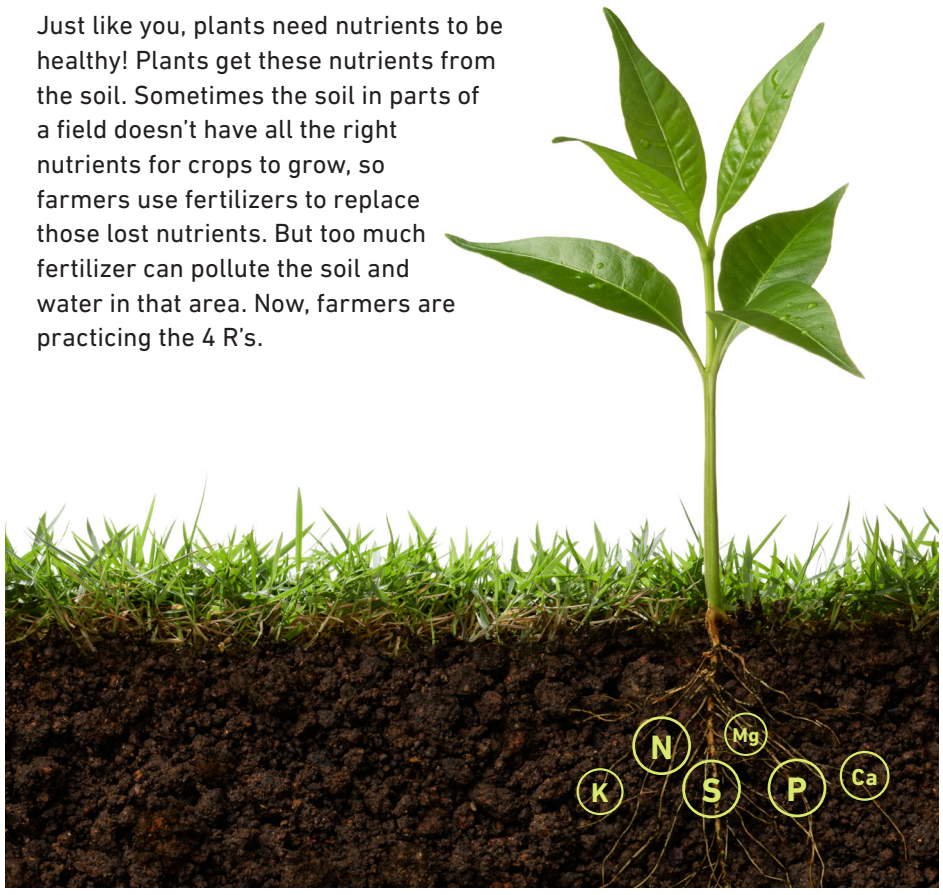
SMART PHONES:
The data collected from drones and infield sensors can be analyzed through apps on smart phones.

These are just a few examples of what farmers are doing to practice **SUSTAINABILITY**. Some other examples include:

- Riparian Buffers
- Biodiversity
- Bioreactors
- and more!
- Renewable Energies
- Agroforestry
- Autonomous robots

4 R's of Nutrient Stewardship

Just like you, plants need nutrients to be healthy! Plants get these nutrients from the soil. Sometimes the soil in parts of a field doesn't have all the right nutrients for crops to grow, so farmers use fertilizers to replace those lost nutrients. But too much fertilizer can pollute the soil and water in that area. Now, farmers are practicing the 4 R's.



4R NUTRIENT STEWARDSHIP

RIGHT SOURCE
Many types of nutrients are available. It is important to select the right nutrients for the plant's needs.

RIGHT RATE
It is important to match the right amount of nutrients to a plant's needs. Too little limits the plants growth and too much is wasteful.

RIGHT TIME
It is important to apply nutrients at the right time for healthy plant growth. A plant needs access to different nutrients in the soil at different times as it grows.

RIGHT PLACE
Plants need nutrients located in the right place within reach of the plant's roots. Tractors help farmers place nutrients in the right place.

CAREERcorner

Lowell Gentry

Principal Research Specialist in Agriculture *(Retired)*

Department of Natural Resources
and Environmental Sciences
University of Illinois
Champaign-Urbana, IL

Tell us a little bit about your job and how you became interested in this field of work.
I am an agricultural scientist, but more specifically I am an agronomist, who is a person that studies soil management and crop production. I was raised on a farm in northern Illinois where my mother, Shirley, showed me at a very young age how to plant and manage a vegetable garden. I really got interested in understanding how plants grow and what made them thrive and looking back it's not surprising that I ended up getting my M.S. degree in Agronomy while working in a crop physiology laboratory at the University of Illinois.

How is a career like this important to both the agriculture industry and to the environment?
For over 30 years I have been trying to understand how to best grow corn and soybeans in central Illinois without losing valuable nutrients from the soil, which can be transported to streams and rivers by artificial drainage (plastic perforated pipes called drainage tiles). It costs farmers money to replace nutrients that get washed out of the soil (especially nitrate), so it is in their best interest to be as efficient with their nutrient management as possible. This will save farmers money and help protect water quality throughout Illinois and the Corn Belt. Although Illinois and Iowa are the number one and two states for corn and soybean production, they are also the number one and two states for contributing nitrogen and phosphorus pollution to the Gulf of Mexico.

What is one of the most exciting or interesting things you've researched?
Corn loves nitrogen and I have spent much of my career investigating nitrogen uptake of corn and understanding how much nitrogen fertilizer is needed to maximize grain yield. It amazes me to witness corn yields greater than 230 bushels per acre that only needed 150 lbs of nitrogen fertilizer per acre to maximize yield. Clearly new corn hybrids (and soybean varieties too) have greater yield potential today than when I was a kid.

Are you currently researching anything that you can share with us?
Yes, we have found that planting a grass called cereal rye after corn harvest and letting it grow until soybeans are planted the next spring can greatly reduce the amount of nitrate lost from fields in central Illinois. We have found that agricultural systems that use cereal rye can reduce nitrate loss to drainage tiles by more than 50%.

Ellen Rahn

Seed Salesperson

R&H Seed Solutions
Mt. Carroll, IL

Tell us about your job and how you became interested in the agriculture industry.
My husband Justin, and I own R&H Seed Solutions where we specialize in all things seed. I sell Channel corn and soybeans. We both sell an extensive list of cover crop seeds, as well as the production of rye and oats. I first became interested in agriculture after high school. I had wanted to go into the Ag Education sector, but one class of crop science completely changed my mind. I then went on to pursue a degree in Agronomy with an emphasis on seed science technology from Iowa State University. After college I had a career in seed corn production that was followed up by green bean and carrot production which brought me back home to the farm.

Why cover crops? What is the importance of cover crops?
We farm in an area with highly erodible land that's susceptible to erosion. Minimal/no till and cover crops work for us. We're able to protect our soil profile by being good stewards all while regenerating our soil health. We sell an extensive list of cover crops, all depending on what is called for in the specific situation. We sell and offer seeding for rye, wheat, and oats but we also do custom mixes. Some of our more popular mixes are oats and forage peas, or turnips, rape, millet, clover and rye. Every acre is unique and we're here to help fit all those needs.

How do you and your family practice sustainability in farming?
What we take from the land, we give back. For example, we have a field of rye that is being grown for seed. Once we harvest that field, we will come in and bale the stubble to be used for bedding in our cattle operation. We will then come back with manure from our cattle operation and prepare the field for corn planting the next season. We will use fewer commercial fertilizers and maintain a no till system.

What is your favorite part of your job?
The best part of my job is the people and learning from them. Every farmer has the same end goal of being sustainable and reducing their input costs while maintaining a positive return on their investment. That being said, every farmer has their own way of doing this. By taking the time and talking to them and learning what works for them, I can take and apply to our own farm or another customer. We're in this together and the best way we can achieve our goals is being open to new ideas and working together.

CIRCLE OF EARTH *Bracelet*

Create a bracelet and learn about the 'circles' of earth! The non-living parts, like nutrients, molecules, and energy, constantly flow through their cycle and then start over again, like a circle.

Materials Needed: pipe cleaners and colored pony beads *(see list below for colors)*

Directions: String the colored beads on the pipe cleaner, one at a time, to represent the resources of Earth. String the clear bead on last, keeping it closer to the end of the pipe cleaner. String the opposite end of the pipe cleaner through the clear bead so that you have an adjustable bracelet. This shows that everything 'hinges' on the people since we are the stewards of the planet.

Blue: Water rains down on land. Water collects in oceans, rivers, lakes, and streams. It evaporates back up into the sky and collects in clouds. The clouds become heavy, and rain falls down to land again.

Green & Brown: Plants *(green)* grow from soil *(brown)*. Plants provide food for animals. Animals provide food for animals. Animals die and decompose. New soil is made. New plants grow.

Black & Orange: Earth is spinning through space, rotating on its axis, revolving around the sun. The Earth and sun give us the circle of the seasons and the circle of night *(black)* and day *(orange)*.

White: Animals breathe in oxygen and exhale carbon dioxide. Plants take in carbon dioxide, use it to make food, and give off oxygen. Animals breathe it in again.

Yellow: The sun provides warmth and light for all of the Earth's circles. Without the sun, plants and animals would not survive. The sun binds us together.

Clear: The earth provides us with everything we need to survive. The survival of our planet hinges on how well we, the people, are stewards of Earth's resources.

EARTH DAY Every Day

In 1970, a Senator from Wisconsin, Gaylord Nelson, organized a national demonstration to help raise awareness about environmental issues. He called it "Earth Day". On the first Earth Day, more than 20 million people across the U.S. protested and said they wanted cleaner water and air. By 1990, Earth Day celebrations spread to over 141 nations across the world! Today, we celebrate Earth Day to recognize the achievements made and to continue to raise awareness to protect Earth's natural resources for our future generations.

Although we celebrate Earth Day one day each year on April 22nd, we practice stewardship every day. There are so many things **YOU** can do that help make our world a happier and healthier place to live! Here are some examples of how you can be a steward of our planet:

- Turn off the lights when you're not in the room
- Turn off the water when you're brushing your teeth
- Take shorter showers
- Recycle
- Plant native trees, shrubs, and flowers to increase food and habitat for our native animals and insects
- Grab some gloves and a garbage bag and clean up litter
- Reduce your food waste by taking only the amount of food you will eat, using leftover ingredients in other meals, starting a compost bin, or even regrowing vegetables from cooking scraps

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This Ag Mag complements and can be connected to the following educational standards:
Common Core State Standards: ELA-Literacy – RI.4.2; RI.4.4; RI.4.7; RI.4.10; W.4.8-9; L.4.1; L.4.4
Next Generation Science Standards: 2-ESS2-1; 3-LS4-2-4; 3-ESS3-1; 4-ESS3-1-2; 5-LS1-1; 5-ESS3-1; 3-5-ETS1-1-2
IL Social Science Standards: SS.EC.1.3; SS.EC.2.4; SS.G.2.4; SS.G.2.5