agMAG
CONNECTING YOU TO NEBRASKA AGRICULTURE
Issue 3

SCIENCE, TECHNOLOGY, ENGINEERING, & MATH IN AGRICULTURE

Did you know that the population is estimated to grow to more than 9 billion people by the year 2050?

Farmers will need to grow 60% MORE food than we do today to feed the growing world population. They will even have to do it on a less amount of land.

How will we work together to preserve the earth?

It starts with **Science**, **Technology**, **Engineering,** and **Math** and how we apply these in agriculture. New developments in science help farmers grow more food on less land. Technology allows farmers to be more efficient. They use GPS to apply fertilizers and nutrients on specific areas of a field. **Engineering** systems help us find new ways to use things. Farmers can use **math** to figure out how much food each animal needs.

Farmers and ranchers are continually looking for ways to make agriculture better, but they can't do it alone. Agriculture has a variety of jobs to choose from that need new and talented employees to be ready to fill positions and be the next generation of agriculture.

Think about the people in the world. How many people live on Earth today? Put a check mark next to your answer:

- ☐ 1 BILLION
- ☐ 7.4 BILLION
- ☐ 9 BILLION

THINK & DISCUSS

What other ways do you think Science, Technology, Engineering, and Math are applied & used in agriculture?

How can **you** be involved in an agricultural career?

A LINK BETWEEN SCIENCE AND AGRICULTURE

Science is found and applied in all areas of agriculture—animals, plants and everything in between! Read the list about agriculture on the left, and draw a line to the scientific word that it matches.

A soybean plant uses sunlight to turn carbon dioxide into "food"

The study of how traits are passed from a bull and cow to the baby calf

Tracking how a pig's digestive system converts feed into muscle and meat

How the soil converts fertilizers into nutrients for plant growth

ONE OF A KIND

HAVE YOU EVER WONDERED WHY YOUR HAIR IS THAT COLOR? OR WHY YOU'RE THAT TALL? IT HAS TO DO WITH GENETICS!

Caitlyn Bruns, PhD, is an expert in applying science in agriculture. Caitlyn is a geneticist with DNA Genetics in Columbus, NE. She works with swine farms to collect accurate data, research new traits, and organize the genetics database.

Bar coded ear tag is in each pig

Caitlyn uses genetics every day. Genetics is the science of studying how living things pass on characteristics from one generation to another. Caitlyn studies genetic relationships in pigs. She takes information from individual pigs such as how much they weigh, how fast they grow, and how much they eat, and then uses statistical analysis to identify the pigs farmers need to breed in order to get the best next generation! She tracks these traits through bar coded ear tags. Genetics, biology, and statistics—science is everywhere in what Caitlyn does!

ARE YOU INTERESTED IN SCIENCE AND IN ANIMALS?

There are many opportunities for you. Nutritionists help determine the best diet. Veterinarians maintain health. And everyone in animal agriculture needs a basic understanding of the biology of animals—swine, beef, sheep, horses, goats, and more!

ROBOTS: COMING TO A DAIRY FARM NEAR YOU

Did you know that when your grandparents were young, they had to get up to change the TV channel? And, they talked on a phone with a cord attached to a wall! Technology has changed many things and made our lives easier. Technology is on farms too—tractors steer themselves and computers mix animal feed. Visit a farm and you will find technology everywhere—even robots milking dairy cows!

DEMERATH DAIRY–NEBRASKA'S FIRST ROBOTIC DAIRY

Robots are a real part of Bill Demerath's dairy farm in Plainview. When his dad started the dairy, they milked all cows by hand—two times a day! In February of 2017, the Demerath family built a brand new barn for their cows and added four robots to do all the milking—two on each side of the barn. Each robot can milk 60 cows a day, twice a day, for a total of 240 cows.

Draw a technology invention you think a farmer will use 50 years from now. Share with your classmates and explain how and why farmers would use it!

The cows wear an electronic collar that tracks their activities and records information about milking. The cows walk to the robot in the milking stall where they get a cherry flavored pellet to eat—like cow candy! The robot attaches to each of the four quarters of the cow's udder and detaches when the cow is done being milked. The cows set their own milking schedule. A cow may come in to be milked at 8 a.m. She can come back to the stall and robot anytime, but until she has more milk in her udder, she doesn't get more pellets to eat—which might be 6-7 hours later. Then she will get milked again!

WHAT MADE BILL DECIDE TO USE ROBOTS IN HIS DAIRY?

- Robots increase the number of cows milked. The cows are now milked more times per day, which means they produce more milk.
- The data that is collected on each cow (recorded from her electronic collar) is used to help with her nutrition, health, and quality of milk produced.
- The Demeraths can access information on an individual cow anytime and produce reports which help management of all areas of the dairy.

MAKING THE CONNECTION: AGRICULTURE & STEM ACROSS NEBRASKA

Gottsch Cattle Company started in 1957 and is involved in all aspects of cattle ranching—from cows having calves to selling the steers and heifers—to the feed, nutrition, health, and marketing of all the cattle. Jeremiah Rieken oversees all Nebraska locations for Gottsch. He explains that Gottsch has locations in Elkhorn, Hastings, North Platte, Juniata, Red Cloud, and Maxwell. They also have locations in Rosalia, KS, Rochester, TX, and Unionville, MO! Guess what else they have? Employees that use Science, Technology, Engineering, and Math every single day. What does that mean for you? It means that no matter where you live in Nebraska, your daily life is influenced by the use of science, technology, engineering, and math in agriculture. It also means there are lots of career opportunities waiting for you in any size of community in our state!

Directions: Read about each individual and their duties. Below each, circle **S**cience, **T**echnology, **E**ngineering, or **M**ath if the individual uses that in their everyday role. Circle all that apply!

Jeremiah Rieken
Operations Manager, Hastings

TALK LIKE A FARMER AND RANCHER

Jeremiah says there are words farmers and ranchers use when talking about cattle. Look for the following agricultural terms as you read about Gottsch Cattle Company.

RANCH - *where cows are raised to give birth to calves*

FEEDLOT - *a place where cattle are fed to grow large muscles for meat*

CALF - *a young beef animal under one year old*

HEIFER - *a female cow that has not had a calf*

COW - *a fully grown female that has had a calf*

STEER - *a neutered male beef raised for meat*

WEANED - *a baby calf that no longer nurses on its mother*

LOT - *a group of cattle*

MILL - *where corn is processed for cattle feed*

WET DISTILLERS GRAIN - *a cereal by-product from corn used for feed*

CAKE - *dried distillers grain in a large pellet* form

RATION - *the amount of feed an animal receives in one day*

EID TAG - *Electronic Identification Tag, placed in the animal's ear*

Troy Bonifas
Operations Manager, Hastings

Troy manages the eight trucks and drivers that deliver wet distillers grain to each feedlot. Each feedlot tells him how much cattle feed they need. Then, Troy creates a report to calculate how many tons each feedlot needs every day.

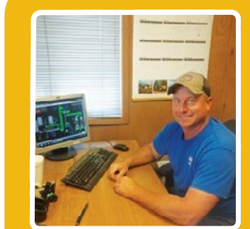
For example: The Juniata feedlot needs 972,000 pounds of feed on Monday. Let's help Troy figure out how many truck loads of feed they need!

S T E M

972,000 *Pounds needed* ÷ **2,000** *Pounds in a ton* = _____ *Tons of feed needed*

Next:

_____ *Tons of feed needed* ÷ **27** *Tons a truck carries per load* = _____ *Number of truck loads of feed to take to Juanita*



Mike Faimon
Mill Manager, Red Cloud

Mike makes daily feed calls to each cattle with his laptop. When cattle are young, they eat more hay, and as they grow, transition to more corn. Mike works on developing a ration that has the right amount of feed so there is no extra feed in the pens that will spoil.

Mike also runs the roller mill which flakes corn. He takes dry corn out of the field, adds water to it, and heats it up with steam which cooks it. It is then run through a roller mill which flattens it out. This is done to get more starch out of the corn for cattle to eat which provides better nutritional value.

S T E M

Dennis Stuckey
Feedlot Supervisor, North Platte

Dennis is responsible for the employees and 82,000 cattle in North Platte. He manages the department for shipping and receiving cattle, which includes calculating the amount of feed each animal will need.

Dennis needs to figure out how many pounds a steer must gain to be ready for market.

He estimates a steer will gain 3.8 pounds of weight per day for 170 days.

S T E M

3.8 *Amount gained per day* × **170** *Days on feed* = _____ *Pounds steer will gain*

What will be the final weight of the steer?

850 pounds *Current weight* + _____ *Pounds steer will gain* = _____ *Final market weight of steer*

Jake Warren
Cowboy, Maxwell

Jake works on the Pawnee Springs Ranch and handles all duties of the cow/calf ranch. There are 90 heifers and 300 cows. He calculates how much cake to feed them each day. When the cows are ready to give birth to a calf, Jake regularly checks them. Jake makes sure when the calf is born the momma cow licks them to clean them off and the baby calf stands up and nurses from the cow's udder.

Jake uses a computer program called CattleXpert. All cows have an EID tag in their ear. When one of the EID tags is scanned, the program identifies the cow and tracks genetics in the calves.

S T E M

Laurie Fisher
Accounting, Elkhorn

Each day Laurie takes care of deposits and pays bills for Gottsch. She tells the feedlot how many cattle are arriving and on what day.

Laurie uses computers and databases every day. She uses a machine that swipes the checks for deposit—it automatically sends so Laurie doesn't have to go to the bank!

S T E M

Mary Snell
Doctoring Crew, Red Cloud

Mary takes care of cattle that are sick and makes sure they get the medicine they need to get better. She keeps an eye on the animals until they are healthy.

Many times, sick animals have respiratory illness—just like when you get a cold! Mary uses a whisper stethoscope and puts it on the steer's side to listen to the lungs. She clicks a button on a computer that records the lungs for eight seconds. Then, Mary determines what medicine to give based on the lung reading. There are 5 different medicines to choose from, and the dosage is calculated by how much the animal weighs.

S T E M

BUILD, MODEL, INVENT - AGRICULTURAL ENGINEERING

Agricultural engineering includes many areas—the design of farm machinery, planning farm structures, soil drainage and management, water supply, and even the processing of farm products. There is and always will be a need for engineers in agriculture because farmers need ever-improving equipment and technology to feed the world! And guess what? There are many engineering opportunities right here in Nebraska!

CLAAS–MANUFACTURING AGRICULTURAL EQUIPMENT AND TECHNOLOGIES

WHAT IS CLAAS?

CLAAS is a family-owned manufacturer of agricultural equipment and technologies, including combines, forage harvesters, tractors, balers, and hay tools. The CLAAS world headquarters are located in Germany. Omaha is home to the CLAAS North American Headquarters and the hub for engineering, sales, service, product, and marketing teams. Omaha is also where the CLAAS combines are built that are sold in the United States and Canada.

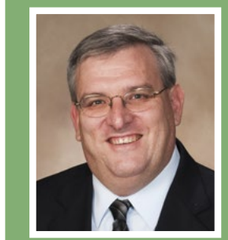
HOW IS ENGINEERING A PART OF CLAAS?

CLAAS uses many types and aspects of engineering. Design engineers, for example, develop and test the electrical and mechanical components of a machine. Manufacturing engineers develop processes for turning raw materials into a finished piece of equipment.

WHAT ENGINEERING INNOVATIONS IS CLAAS USING?

CLAAS has a long history of agricultural engineering innovations. Since founded in 1913, the company has applied for more than 5,000 patents! The latest innovations are focused on precision farming technologies that automate harvesting processes like steering, ground speed, grain threshing, and trailer-filling to help make farmers more productive and efficient.

TRACTORS - BETTER, FASTER, STRONGER!



Roger Hoy
UNL Tractor Test Lab

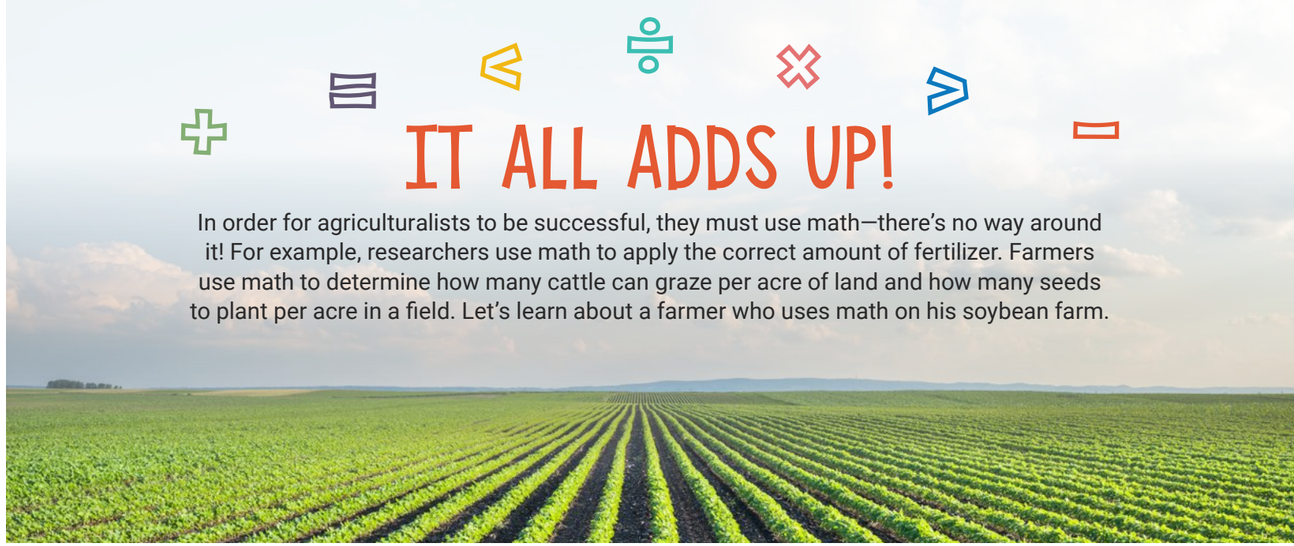
Did you know that a new tractor can't be sold in Nebraska without being tested by the University of Nebraska-Lincoln Tractor Test Lab?

According to lab director Roger Hoy, tractors are tested for power take off performance, pulling power, and hydraulic power. This proves the tractor will perform as advertised.

"UNL has one of the only programs focused in machinery systems, thanks to the Tractor Test Lab. There are fantastic opportunities for ag engineers—I haven't had any students not have one good job offer when leaving college."

THINK, RESEARCH, DISCUSS!

- What are other Nebraska agricultural companies that employ engineers?
- Where can you study agricultural engineering?
- What are two other areas of agriculture (other than farm equipment) that offer careers in ag engineering?



IT ALL ADDS UP!

In order for agriculturalists to be successful, they must use math—there's no way around it! For example, researchers use math to apply the correct amount of fertilizer. Farmers use math to determine how many cattle can graze per acre of land and how many seeds to plant per acre in a field. Let's learn about a farmer who uses math on his soybean farm.

MARK LUNDEEN–USING MATH TO RAISE SOYBEANS!

Mark Lundeen is a 6th generation farmer from Minden, Nebraska. He farms with his wife, Rebekah, his brother, and parents. They raise soybeans and corn.

Mark says, "I use math in raising soybeans every day. I need to know how much it costs me to produce a bushel of soybeans; how much seed, fertilizer, herbicide, and water to apply; and where the most profitable levels to sell the crop are at."

Mark believes it is important for farmers to have good math skills because there is little margin for error in making a profit, and there are lots of decisions that have to be made. Those can include producing the crop, selling the crop and long-term decisions like buying equipment or land.

"I think it is important for kids to know how to use math because it is something you use nearly every day. It is important to understand how numbers drive decisions in agriculture and any other industry.

SOYBEANS–MULTIPLY THE USES!

Soybeans are grown in Nebraska to provide hundreds of products for us to use each day. Use your math skills to "decode" the letters that form words to describe common soybean products!

9	11	16	18	19	20	22	27	30	33	36	42	43	44	45	54	59	66	75	80	88	90
A	M	B	C	I	O	S	E	R	P	N	G	D	H	T	Y	W	F	U	L	K	J

Use these two products to keep yourself clean:

11x2 *2x10* *3x3* *(10x3)+3* **and** *(6x5)-8* *(2x2)x11* *(3x2)+(2+1)* *15-4* *(9x4)-(3x1)* *(2x2)x5* *(5x5)-5*

A renewable fuel used in tractors:

4x4 *(9x2)+1* *5x4* *(6x6)+(3+4)* *27-(4x2)* *9x3* *63-41* *(10x2)+7* *(7x11)+3*

Livestock make a meal of this:

44-22 *100-80* *(9x2)x3* *(2x4x3)-8* *(10x2)+(4+3)`* *17-8* *(2x2)x9* *21-10* *(9x6)-27* *18-9* *160/2*

HOW CAN YOU BE A PART OF AGRICULTURE AND STEM?

YOU CAN LEARN HOW FARMERS USE SCIENCE AND TECHNOLOGY

Zach Hunnicutt
Nebraska Corn Farmer

Science and technology go together at Zach Hunnicutt's farm. He farms near Giltner and raises corn, popcorn, seed corn, and soybeans.

Zach uses an app on his phone to check soil moisture levels to determine when to start or stop irrigating. He also has a drone that flies over fields and collects images that are analyzed for data that can tell him about his crops' health and water use efficiency.

"There's no denying how cool it is that my tractor is being guided by satellites in space. There's always more to learn when it comes to science and technology."

CIRCLE THE WORDS THAT ARE INTERESTING TO YOU!

- ☐ Computers
- ☐ Robots
- ☐ Research
- ☐ Technology
- ☐ Numbers
- ☐ Improving
- ☐ Designing
- ☐ Building

Did you circle at least one word? You sound interested in STEM! Explore careers and ways **you can** be involved in agriculture and STEM.

YOU CAN LEARN WHERE YOUR FOOD COMES FROM AND HOW IT IS GROWN

Nebraska may be best known as the Cornhusker state, but our state ranks 8th in WHEAT production! There are approximately 1.5 million acres of wheat grown each year. Hard red winter wheat is the main ingredient for loaf bread and hamburger buns.

The average bushel of wheat weighs 60 pounds.

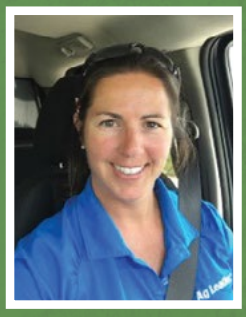
DIGGING DEEPER...

If a farmer harvests 800 acres of wheat at 55 bushels per acre, what will his total harvest weigh?

YOU CAN LOOK FOR A CAREER IN AG TECHNOLOGY

Hope Lewis works for Ag Leader, a precision farming company. They manage crops in a site-specific way, using GPS and electronic record keeping systems.

Hope recruits, trains, and helps with business planning. She uses her laptop, phone, and tablet every day.



Hope Lewis
Ag Leader

"In the future, computer systems will be more complicated and require more experience to design and fix them. It will take lots of skills from your generation to make all these things work together."

Nebraska Agriculture in the Classroom is a program of the Nebraska Farm Bureau Foundation whose mission is to engage youth, educators, and the general public to promote an understanding of the vital importance of agriculture in the lives of all Nebraskans. To learn more or access an electronic version of this publication, visit us at **www.nefbfoundation.org** or contact the Nebraska Farm Bureau Foundation.

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NEBRASKA AGRICULTURE IN THE CLASSROOM
NEBRASKA FARM BUREAU FOUNDATION

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