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*No data included, for either the Shelly Hoobler or American Warrior Farms due to flooding in 2019. The farms were enrolled in the program but unfortunately were unable to utilize and implement any technologies.
2019 Program Summary

The 2019 technology farm season was the fourth year of the program since its fruition. The Water Technology Farm concept is a Phase II action item from the Ogallala-High Plains Aquifer section of the Long-Term Vision for the Future of Water Supply in Kansas. It grew from producers began asking the State of Kansas for ideas on how to share their experiences with newer irrigation technologies to other producers in their local areas. This program began with three (3) farms involved in 2016 but since then it has grown to 15 farms enrolled in 2019. All producers have shown a passion to demonstrate new or unknown technologies that haven’t received a lot of attention in the past. They enroll in the program to help showcase these irrigation technologies and services in the hopes that others across the state would adapt them to their farming operations.

2019 has brought its own challenges across the state from major flooding in central and east Kansas to dry summer (growing) months in west Kansas. While some farms in the program were needing to use a bit more water this season, other farms had too much precipitation that it required them to replant their crops multiple times. In some cases they had to terminate some crops for the season without needing to pump any groundwater all season due to the overwhelming amount of precipitation.

For the 2019 Fiscal Year, $75k was allocated from the State Water Plan Budget to be distributed to the technology farm program. Even with these allocated funds there were other major contributions provided to the program; so much that there were more contributed from outside sources than was allocated from the state budget to the tech farm program. The funding has sufficed to provide for technologies such as soil moisture probes, more efficient nozzle packages, remote pivot controls, crop monitoring imagery, and much more. These types of technologies have had testimony to change the mindset of water usage to be more efficient and have helped ease the risk of spending funding on such equipment for the farms.

In conclusion, as the 2020 growing season is about to kick off our agency has had much outside interest in our program. We hope to keep the partners involved in the future and incorporate more technology farms in other areas of the state where water is of concern. We welcome any producer to come speak to our office if he or she wishes to demonstrate other technologies and wants to take that next step in preserving one of our greatest resources in our great state of Kansas. Lastly, we want to thank all the sponsors and our partners who have helped us greatly to expand the program over the years and ultimately make a positive impact on the Ogallala.
Field Operator(s): Steve Compton & John Payne

Established: 2017
Enrolled in a Water Conservation Area (through Kansas Department of Agriculture-Division Water Resources)
Water saved across farm: 493 Acre-Feet (38.5% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KD&A-DWR WRIS Database

2019 Sponsors:
Agrela Ecosystems
American Irrigation
Dragon-Line
Great Plains Precision Ag, Inc.
Groundwater Management District No. 1
Kansas Corn Commission
Kansas Department of Agriculture
Kansas Farm Bureau
Kansas Water Office
K-State Research and Extension
Teeter Irrigation, Inc
TerrAvion
Western Sprinklers, Inc.

Average Annual Precipitation- 22 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The farm has had soil field mapping completed to identify management zones and locate where soil moisture probes should be installed to give the best representation of the fields. The larger (sectional) pivot is utilizing water application comparisons with different nozzle packages and variable rate irrigation. Aerial imagery is being collected to monitor the moisture and yield results and then compared to different water management strategies in different areas throughout the season. Overall there are several technologies being utilized including electrical conductivity soil mapping of all fields, soil moisture probes, variable rate irrigation, iWob and Bubbler nozzles.

Producer Testimonial:
“By applying less water, we are saving on our input cost and we are banking that for the future. It’s tough to put a value on the savings of water that we are leaving in the ground.”

Producer Report on 2019 applicable field(s):
Technologies utilized- Soil moisture probes, various nozzle applications to include Dragon-Line mobile drip irrigation, soil mapping, crop aerial imagery, and K-State Research & Extension evaluation services

Pivot 1:
Crop- Corn (livestock feed)
Nozzle Type- various depending on span
Yield- 28.49 tons of silage
Water Use- 12.8 acre inches

Other Farming Practices on Pivot 1 include soil sampling and Cover Crops planted in fall 2019

Pivot 2:
Crop- Corn (livestock feed)
Nozzle Type- various depending on span
Yield- 126 bu/ac (High wind damage prior to harvest caused 70-80 bu yield loss)
Water Use- 11.28 acre inches

Other Farming Practices on Pivot 2 include soil sampling
Field Operator(s): Nick Hatcher

Established: 2017
Enrolled in a Water Conservation Area (through Kansas Department of Agriculture-Division Water Resources)
Water saved across farm: 154 Acre-Feet (30.6% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDA-DWR WRIS Database

2019 Sponsors:
American Irrigation
Kansas Corn Commission
Kansas Farm Bureau
Kansas Water Office
K-State Research and Extension
Lindsay Corporation
Seaman Crop Consulting
Servi Tech
TerrAvion

Average Annual Precipitation- 20 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The Hatcher Land & Cattle Water Technology Farm is owned and operated by Nick Hatcher. The farm is located 6 miles north of Liberal, Kansas in Seward county. This tech farm started in conjunction with a Water Conservation Area (WCA) with the goal of maintaining crop production while increasing water use efficiency and reducing wheel track issues.

There are two irrigation pivots on the tech farm. They have had field mapping completed to identify management zones and locations for the probes to best represent the area. Aerial imagery is also being collected to monitor the results and then evaluate the impacts of different water management strategies.

For the 2019 growing season, Hatcher made the decision to plant the same corn variety as he did two years prior when he first enrolled in the Water Technology Farm program. He wanted to compare the two growing seasons to determine if it's possible to take further steps in reducing water use but still maintain the same crop yields.

The irrigation pivots utilized several technologies, including EC soils mapping of all fields, soil moisture probes, variable rate irrigation, iWob and Bubbler nozzles, and aerial imagery.

Producer Testimonial:
“We have learned we do not need to start irrigation up as quickly in the beginning because we had adequate sub-soil moisture as well as when significant rain fall events have occurred, we have learned we did not need to watering again as early as we had in the past thus contributing to a savings.”

“It does not matter what water saving management practice to use, JUST USE ONE!!!”
Producer Report on 2019 applicable field(s):
Technologies utilized- FieldNet Advisor, Crop Metrics Soil Moisture Probes, Various efficient nozzle package

Tedford East:
Crop- Corn (Variety- Pioneer 0801 AM)
Population- 32,000
Nozzle Type- I-WOB, LDN Sprays, Bubblers @ 600 gpm
2019 Yield- 225.60 bu/ac
2017 Yield- 244.60 bu/ac

Tedford West:
Crop- Corn (Variety- Pioneer 0801 AM)
Population- 32,000
Nozzle Type- Standard Sprinkler @ 600 gpm
2019 Yield- 203.53 bu/ac
2017 Yield- 239.80 bu/ac

Total Annual Groundwater Use:
2019- 16.6 acre-inches (Total Precipitation 21.8” in Seward Co.)
2017- 16.2 acre-inches (Total Precipitation 22.5” in Seward Co.)
*Precipitation data based on Kansas State University Monthly Precipitation Maps
Harshberger Farm
Field Operator(s): Gary Harshberger
Established: 2018
Water saved across farm: 318 Acre-Feet (55.4% Savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDWP WRIS Database

2019 Sponsors:
AquaSpy
Encira
Kansas Corn Commission
Kansas Department of Agriculture
Kansas Farm Bureau
Kansas Water Office
Pioneer Hybrid Seed

Average Annual Precipitation: 22 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The Harshberger Technology Farm has utilized the mobile drip irrigation (MDI), as well as other water efficient sprinkler nozzles such as low drop nozzles (LDN's). This farm is also monitored throughout the season with soil moisture probes and satellite imagery. This year he chose to expand his tech farm from one irrigation pivot to two pivots. His plans are to grow corn and soybeans side by side and rotate them yearly for comparison to his nearby pivots.

Producer Testimonial:
“We’re utilizing every bit of benefit that we can with every drop we are putting on.”

“The whole idea is to show we can do more with less and I think we demonstrated it. Technology is technology. There’s growing pains sometimes but we’ll learn more and figure out what the best tools are for our farm.”
Field Operator(s): Ray Smith & Steve Schemm
Enrolled in a Water Conservation Area (through Kansas Department of Agriculture-Division Water Resources)
Established: 2019
Water saved across farm: 1,327.789 Acre-Feet (79.6% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDA-DWR WRIS Database

2019 Sponsors:
American Implement
AquaSpy
Channel Seed
Climate / FieldView
Ceres Imaging
Crop Quest
Farm Reign
Groundwater Management District No. 1
Kansas Corn Commission
Kansas Department of Agriculture
Kansas Farm Bureau
Kansas Water Office
K-State Research and Extension
Phytech
Precision Planting
Premier Ag

Average Annual Precipitation: 18 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
Homeland Water Technology Farm is owned and operated by the Smith family. The farm is located in Greeley County, approximately 15 miles north of Tribune and is split into two locations. The Smith family has strived to conserve water in recent years. They already have enrolled most of their farm ground into the Water Conservation Area (WCA) program with KDA-DWR. They want to take the next step in conservation by implementing new, more efficient water irrigation technology on their farm. They hope to save even more water and demonstrate that farming can still be profitable with less water in today's economy.

For 2019, the Homeland Technology Farm utilized technology on four irrigation pivots. The farm incorporated various technologies, more efficient sprinkler nozzles, multiple soil moisture probe products, variable rate pivot irrigation systems, cover crops, aerial mapping and imagery, an on-site weather station and monitored irrigation wells.

Producer Testimonial:
"This was our first year in the Water Technology Farm program and because of that we had a lot of work to do to get everything setup and enrolled in the program. We have 4 different fields with differing soils in the program and believe that each will help other farmers to look at our testing and see a field that might be similar to one they have. The fields involve a section sprinkler and three quarter-section sprinklers with a variety of soils including Richfield Silt Loam, Goshen, Ulysses, and Colby Silt Loam. We have seen a large variance between each in soil and sprinkler type and additionally two of the pivots are wiper style while the other two are irrigated traditionally."

KWO Note: For harvest data and more information provided by Homeland Farms, please see the additional document labeled “Homeland Water Tech Farm.”
Field Operator(s): Ryan Speer
Established: 2018
Water saved across farm: 107 Acre-Feet (54.9% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDWP WRIS Database

2019 Sponsors:
96 Agri Sales Inc
Aqua Spy
Bactifeed
Ceres
Farmers Edge
Fieldnet by Lindsay
Groundwater Management District No. 2
Growsmart by Lindsay
Heartland Soil Services
Kansas Corn Commission
Kansas Department of Agriculture
Kansas Farm Bureau
Kansas Its (KITS)
Kansas Water Office
Komet
Phytech
Senniger
Servi-Tech
TerrAvion
Zimmatic by Lindsay

Average Annual Precipitation: 33 inches
The Water Technology Farm focuses on both water conservation and water quality. The objectives of the farm include applying less water during growing season and decreasing the application of saline-rich water to help improve crop yields. Speer also incorporates the farming method of no-tilling the field to help maintain the healthy soil nutrients.

One goal of the farm is to mitigate water quality issues and planting corn, soybean and wheat on the field will help accomplish this. By applying less water, the amount of bad components would be reduced from any poor quality water in the local aquifer. Utilizing more efficient sprinkler nozzles, a pivot controller to adjust rate of application, soil moisture probes, and direct plant sensing technology will help reduce water use on the field. Each of these technologies aid him in making better management decisions each season. Also, by taking regular soil and water quality tests, he hopes to determine if less water application reduces the rate of deterioration of the soil.

**Producer Testimonial:**

“We had severe flooding and replanted some areas three times well into June. Unfortunately the south half and west side never recovered fully from multiple rounds of excessive water.”
Producer Report on 2019 applicable field(s):
Technologies/services utilized:
Phytec Direct Plant moisture sensors
Fieldnet

Crop- Corn Channel 218-44 (livestock feed & ethanol production)
Population- 28,000
Nozzle Type- i-WOB
Yield- 166 bu/ac
Water Use- 7.25 ac-in

Other Farming Practices- No-Till, cover crops
Field Operator(s): Thad Geiger
Established: 2019
Water Savings: Dryland farm no irrigate water use

2019 Sponsors:
Doniphan County Conservation District
Highland Community College
Kansas Farm Bureau
Kansas Water Office
Kansas Department of Health & Environment
Kansas Corn Commission
Kansas Department of Agriculture- Div. of Conservation
K-State Research and Extension Office

Average Annual Precipitation: 37 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The Loess Hills Water (Quality) Technology Farm is owned and operated by Thad Geiger, a local farmer in Doniphan County. Following discussions with the Doniphan County Conservation District, Geiger had a desire to see how new farming technology methods on dryland farm ground to help monitor water quality and soil moisture. The goal of the farm is to adapt certain irrigation technology and research to a dryland operation to help make better management decisions throughout the season and for future crops. Geiger is also working to get assistance from many other local businesses to help demonstrate the utilizing the technologies increases efficiencies on the farm.

For 2019, the farm implemented no-till operations, crop rotation, cover crops, cattle grazing, and precision agriculture machinery. He also worked with the Doniphan County Conservation District, Highland Community College, and other agencies with the goal being to implement resources available locally to demonstrate better research for dryland farming.

Producer Testimonial:
“We were able to save on hay costs and accelerate soil health at the same time by grazing the cover crops planted on the row crop fields. The cows’ digestion of biomass, returning it to the soil in the form of manure, improves soil quality and lessens our input costs for both the cattle herd and next cash crop.”

2019 Season Summary:
The Loess Hills have fertile soil found nowhere else in Kansas however that good soil creates some production issues with steep slopes and highly erosive soils. The 2019 growing season was challenging like most years on a 640-acre family farm that is trying to survive in a big farm environment. Points worth noting for 2019:

• The 37” annual rainfall for the area was exceeded by more than 33” however every little erosion was visible where annual rye had been used as a cover crop
• Corn yields ranged from 165 to 210 bushels per acre, with some loss of fertilizer on thinner soils
• Soybean yields averaged 60 bushels per acre farm wide
• Cattle herd had a tough year with the cold, wet spring resulting in record death losses of baby calves
• With all the moisture, forage had less digestible matter, reducing calf weight gain
• Even with these conditions the cows bred back well with a 96% conception rate
Other items that took place on the farm to aid in improving farming operation or the water quality leaving the farm:

- Soil sampling collected by Highland Community College students
- Establishment of alfalfa border strips to help limit erosion and provide extra forage
- Flew on 60 acres of rye and turnips into corn stalks
- Completed terracing on northeast field
- Removed small trees from drainage washout and installed pipe drain and basin dam
- Applied NPK according to soil test recommendations
- No tilled orchard grass into alfalfa around pond and drainage area
- Surveyed pasture erosion for area that need basin dams and drainage tile

Thad Geiger will be using wheat in the standard crop rotation of corn and soybeans which will allow for a longer growing season for cover crops and ability to use a more diverse mixture. This diversity has the potential to decrease common pests and improve soil organics. The use of rye has also eliminated the need for additional herbicides, lessening the cost of production.
Field Operator(s): Matt Long
Established: 2018
Enrolled in a Water Conservation Area (through Kansas Department of Agriculture-Division Water Resources)
Water saved across farm: 70.485 Acre-Feet (44.1% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDAG-DWR-WRIS Database

2019 Sponsors:
AgSense
Crop Metrics
Dragon-Line
Golden Harvest Seeds
Groundwater Management District No. 1
Kansas Corn Commission
Kansas Department of Agriculture
Kansas Farm Bureau
Kansas Water Office
K-State Research and Extension
Red Barn Enterprises, Inc.
Seaman Crop Consulting
Teeter Irrigation, Inc
Todd and Diana Long

Average Annual Precipitation: 19 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The Long Technology Farm has utilized various water efficient technologies, such as irrigation nozzles on the pivot spans, soil moisture probes, mobile drip irrigation, a weather station and irrigation management. This year the farm also began to make use of electronic conductivity mapping services and try other soil moisture probes for comparison. K-State Research and Extension worked with Matt to study the crop development compared between the different span nozzles as well.

Producer Testimonial:
“The basis of our tech farm is to identify how to improve irrigation efficiency through nozzle type and planting population to grow more bushels with every inch of water we apply. Our farm set up is fairly simple as we utilize variable rate irrigation to irrigate one section approximately half as much as the other section and are working to dial in our planting populations in order to understand where the optimum population/water application thresholds are.

In the first year we utilized full irrigation populations of 30,000 plants per acre with approximately 7” of water and 26,000 population with 4” of water. We had some start up issues with our pivot system that restricted us from irrigating in 2018 and caused some yield losses. In 2019 we were able to efficiently irrigate when we needed to and utilized full irrigation populations of 30,000 plants per acre with approximately 8” of water and limited irrigation populations of 20,000 with 5” of water. I believe we will find a population between 20,000 and 26,000 that brings us to a greater efficiency than we have previously seen.

I believe that both years we were yield limited by population. In 2018 our population on the limited irrigation was too high, and in 2019 it appeared to be too low to achieve maximum yield. For the future we plan to continue to dial in our population on these plots along with starting to explore variable rate fertility and additional technologies to monitor soil moisture and plant stress.”

Producer Report on 2019 applicable field(s):
Technologies utilized
a. AgSense
   i. Weather Station
   ii. Field Commander Pro – Pivot Monitor and Control
   iii. Field Commander – Well Monitor and Control
b. Premier Crop Systems
   i. Data Analysis and Calibration
c. Seaman Crop Consulting
   i. EC Mapping
   ii. Crop Metrics Soil Probes
   iii. Crop Consulting
Crop- Corn, G10S30-5222 (livestock feed)
Population- 20k-30k
Nozzle Type- LDN, LEPA Bubblers, Dragon-Line mobile drip irrigation

Yield-
Average Yield 221bu/ac
Limited Irrigation Area 198bu/ac
Full Irrigation Area 228bu/ac

Water Use-
Water use/applied for particular Crop
a. Limited Irrigation Area – approx. 5”
b. Full Irrigation Area – approx. 8”

Water use/applied for entire calendar year
c. 29,164,800 gallons
d. 89.503 AF
e. Average 8.66”/Acre Average

Other Farming Practices- No-Till irrigated corn
Field Operator(s): Weston McCary & Brad Bergsma
Established: 2017
Enrolled in a Local Enhanced Management Area (through Kansas Department of Agriculture-Division Water Resources)
Water saved across farm: 729 Acre-Feet (94.8% Savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDA-DWR WRIS Database

2019 Sponsors:
AgLeader-SMS
AgSense
AgVenture - Dorn Seeds
American Implement - John Deere
Amvac - Simpas
AquaSpy
Bayer Ag
Central Plains Equipment - Case IH
Ceres Imaging
Channel
The Climate Corporation
Climate / FieldView
CropMetrics
Dane G. Hansen Foundation
Davis
Dekalb
DigiFarm
Farmers Edge
Fontanelle
Franklin Farms
Frontier Ag
Golden Plains Equipment
Groundwater Management District No. 4
Hemisphere GNSS (Outback Guidance)
Kansas Corn Commission
Kansas Corn Growers Association
Kansas Department of Agriculture
Kansas Department of Commerce
Kansas Farm Bureau
Kansas Water Office
Lindsay Corporation
ModernAG
Nex-Tech
Northwest Kansas Groundwater Conservation Foundation
OnTarget Ag Solutions
Phytech
Precision Planting
Red Barn Enterprises, Inc.
Rivulis
SatShots
Schaal Well Service
Servitech
Simplot
STEPS
TerrAvion
Trellis
Trimble
Tri-State Irrigation
Western Irrigation
Woofter Irrigation
Yost Farm Supply - New Holland

Average Annual Precipitation: 20 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The Northwest Kansas Technical College Water Technology Farm is located south of Goodland, Kansas in Sherman County. This project is a public-private cooperation with the college, students and local farmers. The precision agriculture program allows students to implement new irrigation technologies on campus and work with area land owners. This gives the students the opportunity to utilize, monitor, and test modern irrigation technology that isn't commonly available. The ultimate goal is to not only educate the students, but also local farmers on how new irrigation technology can be utilized for more efficient irrigation water use to extend the life on the local aquifer.

The Precision Agriculture Technology Department Vision:
To sustain agricultural economic viability in western Kansas through workforce development, and focus on increased adoption of innovative technologies and sustainable practices.

Producer Report on 2019 applicable field(s):
Technologies utilized- Soil moisture probes, irrigation controllers, variable seed prescription speed tables, electro-conductive soil mapping, soil sampling, sub-surface irrigation, weather station data, aerial imagery

Total Groundwater Water Use on Campus Farm- 40.00 acre-feet

Additional data of local farms off campus:
Owner/Operator: Kent Banister
Field: SW 23-4-36
Crop: Corn
Previous Crop: Milo 2018
Yield: 174 bu/ac
Water use: 7.1in/ac
Equipment Used: 36inch CropMetrics Drill-N-Drop probe; Valley Pivot w/ Low Senninger nozzles
Note: Renewed with Tri-State Irrigation

Owner: Rick Billinger
Field: NE 12-8-42
Crop: Corn
Previous Crop: Corn 2018 (100% hailed in 2018)
Yield: 102 bu/ac (hail damage)
Water use: Not Reported
Equipment Used: 48inch AquaSpy probe
Note: Renewed with AquaSpy
Field: SW 6-8-41
Crop: Pinto Beans
Previous Crop: Corn 2018 (100% hailed in 2018)
Yield: 16 Bags (hail damage)
Water use: Not Reported
Equipment Used: 48inch AquaSpy probe
Note: Renewed with AquaSpy

Owner/Operator: Franklin Family Farms (Tim and Gerry Franklin)
Field: NW 11-9-39
Crop: Corn
Previous Crop: East side corn on corn since before 2012 (west side wheat in 2016 & 2017), hail damage corn in 2018
Yield: 244.63 bu/ac
Water use: 52.115 acre ft (5.2115 in/ac)
Equipment/Practices: 36inch CropMetrics Drill-N-Drop probe
Note: Renewed with On Target Ag Solutions
Field: NW 34-8-39
Crop: Corn
Previous Crop: Corn on corn since before 2012, hailed corn in 2018, 29 ac above 8.2 pH
Yield: 213.05 bu/ac
Water use: 82.86 acre ft (8.286 in/ac)
Equipment/Practices: The circle was planted using prescription maps generated from Veris EC soil data for seed & fertility zones. A 36inch CropMetrics Drill-N-Drop probe was installed in a total of three different zones (average soil, heavy soil, light soil), and irrigated using Valley/AgSense VRI scripts accordingly.
Note: Renewed with On Target Ag Solutions

Owner/Operator: Sederstrom Family Farms (Greg and Blaine Sederstrom)
Field: NE 16-9-40
Crop: Soybeans
Previous Crop: Milo
Yield: 74 bu/ac
Water use: 7.75 inches/acre
Equipment/Practices: 36inch CropMetrics Drill-N-Drop probe
Note: Renewed with On Target Ag Solutions
Field: SW 27-9-40
Crop: Corn
Yield: 191 bu/acre
Water use: 8.75 inches/acre
Equipment/Practices: 36inch CropMetrics Drill-N-Drop probe
Note: Renewed with On Target Ag Solutions
Field Operator(s): Ryan Goering & Eugene Goering
Established: 2019
Water saved across farm: 97 Acre-Feet (43.5% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDA-DWR WRIS Database

2019 Sponsors:
American Robotics
Autonomous Pivot
Bactifeed
Ceres Imaging
Heartland Soil Services
Inman Irrigation
Kansas Corn Commission
Kansas Farm Bureau
Kansas Water Office
Komet
Lee Wheeler Consulting
MKC
Netafim
San-d-Akr Farms
Senninger
Servitech
TerrAvion

Average Annual Precipitation: 30 Inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The Goering Farm is owned and operated by Ryan and Eugene Goering and is located in McPherson County approximately three miles west of Moundridge, KS. Both Ryan and his father, Eugene, want to demonstrate ways to use water more efficiently.

The Goering Farm is on a corn and soybean rotation for the next few years. The pivot spans implemented include Komet Twisters, Senninger Bubblers, Xi-Wob, and precision mobile drip irrigation (PMDI). The pivot system utilized a new Autonomous system that is new to the program. Servitech soil moisture probes, a Farmers Edge weather station and aerial imagery services were also used this past season. Were never able to apply Bactifeed due to weather conditions.

Producer Report on 2019 applicable field(s):
Field:
NE Qtr. of 30-21-2

NOTE:
West half of circle is a research area since the east half of circle has significant terracing, slope and varying soil types and bottom ground that floods.

Crop: Yellow Field Corn – Pioneer 1366AM
Previous Crop 2018: Soybeans

Farming Practice: Minimum Till
- Chisel applied NH3 and 10-34-0 in March 2019
  - 12 gal/acre of 10-34-0
  - 175lb/acre of Nitrogen (NH3)
- Single Pass with Field Cultivator in April 2019
- Planted April 18, 2019
- Fertigated 30lb/acre of Nitrogen June 29th (28-0-0)

Purpose: Animal Feed, Ethanol production, etc.

Tech Services Utilized:
Irrigation Management:
- AgSense – Used for monitoring and controlling center pivot
- Servi-Tech – Soil Moisture Probes
- Autonomous Pivot – Soil moisture monitoring (product in development)

Arial Imagery:
- TerrAvion – Fixed Wing Imaging
- Ceres – Fixed Wing Imaging
American Robotics – Daily Drone Imagery

Weather Data:

Farmers Edge – Weather Station

Pivot Nozzle Packages Used:

Control Spans 1-4:

Senninger – Xi-Wobs with 15lb regulators – 750 gpm nuzzling w/ End Gun

Test Spans 5-7:

Komet – Twisters with 6lb regulators – 87%

Netafim – Precision Mobile Drip Irrigation – 86%

Senninger - LDN Bubblers with shrouds and 6lb regulators – 80%

Rainfall and Irrigation Data in file:  Goering Water Tech Rain and Irrig 2019.xlsx

Ceres Arial Imaging in file:  R&E Tech Farm Ceres Imaging 2019

TerrAvion Arial Imaging in file:  R&E Tech Farm TerrAvion Imaging 2019

Yield Map – R&E Water Tech 2019 Yield Map

Weather Data – 2019 Farmers Edge Weather Data
Field Operator(s): Zion & Dwane Roth

Established: 2016

Enrolled in a Water Conservation Area (through Kansas Department of Agriculture-Division Water Resources)

Water saved across farm: 1,581 Acre-Feet (93% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDA-DWR WRIS Database

2019 Sponsors:
Agrela Ecosystems
American Irrigation
BASF Corp
Crop Metrics
Farmers Edge
Kansas Corn Commission
Kansas Farm Bureau
Kansas Water Office
Kansas Mesonet
K-State Research and Extension
NetaFim
The Garden City Company
Western Water Conservation Project

Average Annual Precipitation- 20 inches
Other Farming Practices- Strip-Till and Split Fertilizer applications

KWO Tech Farm Aerial Map:
2019 Farm Summary:
In 2019, the GCC and Dwane Roth decided to expand their Water Technology Farm from one irrigation pivot to four pivots; and include a 10-acre experimental tract of subsurface drip irrigation (SDI) to study alternative ways to mitigate water quality from the Arkansas River. The farm is unique in that the water source is both ground and surface water. Surface water from the irrigation canal comes from the Arkansas River and is known for its poor water quality particularly for salinity issues.
For the 2019 growing season, the farm evaluated corn, sorghum, wheat and sunflower. The entire farm is designed to compare the effectiveness of different sprinkler packages on separate irrigation pivots based on the crop. Other technologies such as soil moisture probes and a new all-comprehensive soil probe (from Teralytic) were tested and compared to aerial imagery and agronomist services.

Producer Testimonial:
“The 2019 growing season was extremely challenging. It was too wet the first half of the growing season and too dry in the second half. We planted these circles in a window between all the rains mid-May. It was cool, cloudy, and the corn did not emerge in a timely fashion. It seemed like it would never quit raining until it did! Starting June 1, we did not have another significant rain until August 13 when we received 0.85”. We were able to use plentiful surface water to stay caught up, even though rainfall was nonexistent during peak water usage. In total on these two circles of corn we only used about 50 acre/ft of groundwater. It is great having Lindsey flowmeters at the pivot so we can keep track of our total water use. Since we have surface and groundwater. Also, the FieldNet pivot controls/telemetry have been invaluable. We know the pivots are running and that we have the right amount of water flowing. We immediately know the pivots are broken down via text message. So, we avoid pivots getting stuck and wasteful irrigating. We tried the FieldNet advisor irrigation scheduling tool this year and found human error threw off the scheduling. We forgot to set the pivots to wet on our phones and made a few passes with the sprinkler. This caused the Advisor program to think we were much drier than we were. We had the FieldNet Advisor on other fields where we had no human error and it matched up reasonably well compared to moisture probes. Advisor shows promise and will be tested again next season. We know moisture probes work, but we need another year with scheduling programs like Advisor to make sure they can be counted on. Once again on the tech farm we used very little groundwater with the help of these different tools and look forward to trying new tech that can make us even more efficient moving forward.”
Producer Report on 2019 applicable fields:
Technologies utilized- FieldNet Advisor Irrigation Scheduling Tool, Lindsey Flow meters at pivot, Fieldnet Telemetry/pivot controls, & K-State Mesonet Weather Station Data.

NE 22-23-34:
Crop- Corn (livestock feed)
Population-26,000
Nozzle Type- i-WOB
Yield-207.3 bu/ac
Water Use: 8.755-acre inches/73.3-acre ft (100% surface water)

SE 22-23-34:
Crop- Corn (livestock feed)
Population- 30,000
Nozzle Type- Bubblers and i-WOB
Yield-197.5 bu/ac
Water Use- 8.83-acre inches/ 89.3-acre ft (50% ground water/50% surface water)
Field Operator(s): Tom & Josh Willis

Established: 2016
Enrolled in a Water Conservation Area (through Kansas Department of Agriculture-Division Water Resources)
Water saved across farm: 1,343 Acre-Feet (59.2% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KDA-DWR WRIS Database

2019 Sponsors:
AquaSpy
Conestoga
Crop Metrics
Dragon-Line
Kansas Corn Commission
Kansas Department of Agriculture
Kansas Farm Bureau
Kansas Geological Survey
Kansas Grain Sorghum Commission
Kansas Water Office
K-State Research & Extension
K-State University - Kansas Mesonet
NETAFIM
Ogallala Aquifer Program
Outlaw Irrigation, LLC
Presley Solutions
Seaman Crop Consulting
Servi-Tech
Syngenta
T&O Farms
Teeter Irrigation, Inc
United Sorghum Checkoff
Valley
Valmont Industries
Western Water Conservation Project

Average Annual Precipitation- 20 inches
Other Farming Practices- Cattle Grazing
2019 Farm Summary:
For the 2019 growing season there was a total of 12 pivots utilized in the program. The emphasis for this year was studying corn, soybeans and crab grass (primarily for grazing) amongst different pivots; as well as studying the same crop side-by-side with slightly different farming practices to determine the most efficient methods.

There is an abandoned irrigation well on the farm which is part of the index well program monitored by the Kansas Geological Survey. More information about the well can be found at [http://www.kgs.ku.edu/HighPlains/OHP/index_program/index.shtml](http://www.kgs.ku.edu/HighPlains/OHP/index_program/index.shtml). This observation well measures changes in the static groundwater level on a real time basis to compare to nearby irrigation wells. The farm also hosts a weather station through the K-State Kansas Mesonet program which measures temperature, precipitation, humidity and wind velocity. For more information visit [https://mesonet.k-state.edu/](https://mesonet.k-state.edu/).

Crop and water consultations were provided by Mr. Loren Seaman, with Seaman Crop Consulting, LLC. Dr. Jonathan Aguilar from the K-State Research and Extension office in Garden City assisted with the crop evaluation.
Producer Testimonial:
“My goal is to see what the least amount of water we can use with the maximum economic output. Soil moisture probes have been a huge asset to our farm. The root development we have seen shows us we can trust what the probes are telling us. Ultimately we have learned we don’t need all the water we used to apply to get the yields we need.”

Producer Report on 2019 applicable field(s):
Technologies utilized- i-WOB 600/400/300, MDI, DL 400/300, Weather Station, Soil Moisture Probe, KGS Water Level Monitoring

NW 27-26S-33W
Crop- Corn (E109Y2)
Population- 31,016 seeds/ac
Nozzle Type- Various
Yield- 219 bu/ac
Area- 130 Acres
Water Use- 137.124 Ac-Ft (or average 12.66”)
WaterPACK & ILS Farm

Field Operator(s): Pat Janssen, Bronson Smith, & Mike Barton
Established: 2019 (2nd Tech Farm)
Water saved across farm: 107 Acre-Feet (27.9% savings)
*Based on total water use of total annual authorized quantity allowed. Information obtained from KD 6-DWR WRIS Database

2019 Sponsors:
AquaSpy
Autonomous Pivot
Ceres Imaging
Innovative Livestock Services
Kansas Corn Commission
Kansas Farm Bureau
Kansas Water Office
K-State Research and Extension Office
Lee Wheeler Consulting
Nature Conservancy of Kansas
Phytech
TerrAvion
Trellis
WaterPACK

Average Annual Precipitation: 28 inches

KWO Tech Farm Aerial Map:
2019 Farm Summary:
The goal of this second project is to develop a farm that is more financially feasible to establish for the common farmer. The primary focus will be setting up a sprinkler package with various nozzles, basic soil moisture technology and requesting advice from an agronomist throughout the season.

This new technology farm compared two irrigation pivots side-by-side; and each pivot utilized its own irrigation well for water use. One pivot is was equipped with the standard sprinkler nozzles and irrigated as it has in the past. The second pivot was equipped with various more efficient sprinkler nozzles such as i-Wob, bubbles, or LDN’s. It will also had soil moisture probes installed in multiple locations on the field to monitor the moisture content. Ultimately, the goal was to determine that by using even a few new irrigation technologies, some that could be added to already existing equipment and seeking advice from specialized individuals, these extra farming steps can help save water for the future.

Producer Testimonial:
“Our vision was to help other farmers see what tools are best to adopt in this area as well as which could be applied to most all of their existing equipment. Technology is good but my best advice is to use the expertise that comes with the tools. They know their products and what they are capable of. We have found since implementing these tools it’s not only decreased water use while maintaining the same yields but also decreasing overall input costs, including nitrogen rates.”

“The mindset has to change – we need to work to farm for the economic yield, not production yield.”

Producer Report on 2019 applicable field(s):
Technology utilized-
Ag Sense command and operation monitoring, especially pressure
AquaSpy soil moisture sensors
Autonomous Pivot system approach to IWM
Ceres Satellite Imagery
CropMetrics with AgSense system on #308 Control field only
Phytech plant sensors
Terravion aerial photography
Trellis soil moisture sensors
Field 308 (East, standard field):
Crop- Corn
Nozzle Type- Standard Spray Nozzles
Flow Rate- 875gpm
Yield- 255 bu/ac
Water Use- 18.24 ac-in
15 bu/ac per ac-in

Field 309 (West, tech field):
Crop- Corn
Nozzle Type- i-Wob, bubbles, or LDN’s
Flow Rate- 550 gpm
Yield- 248 bu/ac
Water Use- 13.56 ac-in
20 bu/ac per ac-in
Field Operator(s): Eddie Weber

Established: 2018

Water saved across farm: 130 Acre-Feet (66.7% savings)

*Based on total water use of total annual authorized quantity allowed. Information obtained from KDWR WRIS Database

2019 Sponsors:
96 Agri Sales Inc
Aqua Spy
Ceres
Crop Metrics
Fieldnet by Lindsay
Groundwater Management District No. 2
Growsmart by Lindsay
Heartland Soil Services
Kansas Corn Commission
Kansas Department of Agriculture
Kansas Farm Bureau
Kansas Its (KITS)
Kansas Water Office
Komet
Phytech
Senniger
ServiTech
Zimmatic by Lindsay

Average Annual Precipitation- 32 inches
The Water Technology Farm focuses on both water conservation and water quality. The objectives of the farm include applying less water during growing season and decreasing the application of saline-rich water to help improve crop yields to identify a balance when tackling both issues.

One goal of the farm is to mitigate water quality issues. Applying less water will also help reduce the amount of bad components associated with the poor quality of water. Utilizing more efficient sprinkler nozzles, a pivot controller to adjust the rate of application, soil moisture probes, and plant-based moisture sensing technology helped reduce water use on the field. Each of these technologies help make better management decisions each season. Also, by regularly taking soil and water quality tests, Weber hoped to determine if less water application reduces the rate of deterioration of the soil.

Producer Testimonial:
“The Weber farm encountered a lot of rain in the early season that flooded out the farm multiple times. Unfortunately we ended up replanting twice over the season.”

Producer Report on 2019 applicable field(s):
Technologies/Services utilized- ServiTech, Crop Quest, Phytech, 96 AgSales

Crop- Corn Pioneer 1197 (livestock feed)
Population- 32,000 seeds/acre
Nozzle Type- i-WOB, LDN, Rotators, Dribbler
Yield- 114 bu/ac
Water Use- 4-5” irrigated
Other Farming Practices- No-Till

Additional materials provided by producer:
Field Info-
Seed: pioneer 1197@ 30k/ac
Fertilizer:
  In-furrow 5 gal 8-16-11-2S
    1 pt zinc
    1 pt sugar
  Banded behind planter
    27 gal of 30-0-0-2s
    1 pt boron
    1 qt gaurdian nitrogen stabilizer

Pre-plant compost spread
  1 ton compost w analysis of 24.3-41-30.8-15

Helpful descriptions of some data provided:
Field Harvest Maps- Help producer visually see the crop yield across the entire field in regions versus the average yield of the total field.

Soil Moisture Probe Water Profiles- Soil moisture profiles help provide the producer information on whether or not the crop root zone is water stressed. It gives the producer a better idea on whether to irrigate or to stop irrigating if oversaturated.

Lab Soil Results- This information provides data to producer on where more attention may be needed on field if an area lacks certain nutrients for the crop each season.

Chlorophyll Index Aerial Imagery- Provides information on the plant nitrogen content

Color Infrared (or RGB) Aerial Imagery- Shows vegetation growth or emergence, canopy density, and water content

Normalized Difference Vegetation Index Aerial Imagery- NDVI is a measure of the state of plant health based on how the plant reflects light at certain frequencies (some waves are absorbed and others are reflected).

Thermal Aerial Imagery- Can detect temperature difference on crops to possibly indicate water stress or crop overheating
Water Stress Aerial Imagery- Helps to detect if crops do not have enough moisture content by measuring the temperature differences.

KWO Note: This pivot was outfitted with various irrigation sprinkler to compare the difference in yield based on different watering patterns. The +/- x BPA is the difference between the average BPA across the field compared to each nozzle. The aerial imagery shows the entire field yield results with dark green showing greater yield results.

T&O Farm- Yield results for entire field
T&O Farm- Soil Moisture Probe Profiles on each span

KWO Note: The profiles below show the amount of moisture throughout the season. Each span was outfitted with a different nozzle so one can infer how each nozzle irrigated the soil when the pivot was running.
Circle C Farms- Weather Data

<table>
<thead>
<tr>
<th>Historical Weather For Plant 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Temperature</td>
</tr>
<tr>
<td>Maximum Temperature</td>
</tr>
<tr>
<td>Total Growing Degree Units</td>
</tr>
<tr>
<td>Total Liquid Precipitation</td>
</tr>
<tr>
<td>Total Solid Precipitation</td>
</tr>
<tr>
<td>Last Foot</td>
</tr>
<tr>
<td>First Foot</td>
</tr>
</tbody>
</table>

Circle C Farms- Soil Sample Lab Analysis
Circle C Farms - Cover Crop Seed Distribution
KWO Note: The total is the amount of pounds of seed distributed in each row of cover crop
Circle C Farms - Weather Data

**Historical Weather For Pivot 2**

- **Maximum Temperature**: 104°F
- **Minimum Temperature**: 34°F
- **Total Growing Degree Units**: 3K
- **Total Liquid Precipitation**: 19.5" (inches)
- **Total Solid Precipitation**: 0"
- **Last Frost**: n/a
- **First Frost**: n/a

**Temperature**

A graph showing temperature trends from 2019-05-01 to 2019-09-22. The graph compares maximum and minimum temperatures.

**Precipitation**

A graph showing precipitation trends from 2016-05-01 to 2019-09-22. The graph shows the amount of precipitation and the dates of significant events.

**Growing Degree Units (Base 50°F)**

A graph showing the cumulative growing degree units from 2019-05-01 to 2019-09-22. The units are counted based on a base temperature of 50°F.
Circle C Farms - Corn Harvest Yield Data

**2019 Corn: Harvest**

**Layer: Dry Yield**

**Pivot 2**

Circle C Farms | Irrigated

Operation Dates: 10/03/2019 - 10/26/2019

**2019 Corn: Harvest**

**Layer: Dry Yield**

**Pivot 2**

Circle C Farms | Irrigated

Operation Dates: 10/03/2019 - 10/26/2019

**Agronomic Data**

**Total Dry Yield**

63,316.09 bu

7,058.32 lb/ac

**Avg. Dry Yield**

125.83 bu/acre

**Avg. MSTR**

13.37 %

**Avg. Speed**

3.96 m/h

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KWO Note: Notice the pivot was running as the blue areas indicated more moisture while ahead of the line the crop is more stressed.
Hatcher L&C - Precipitation Data
Grain Harvest 2019 - North Half Pivot (SOYBEANS)

Grower: NWKTC
Farm: Tech Farm
Field: North Half Pivot
Year: 2019
Operation: Grain Harvest
Crop/Product: SOYBEANS
Op. Instance: Harvest - 1
Area: 57.53 ac
Avg. Yield: 68.98 bu/ac
Avg. Moisture: 10.23 %

Yield (Dry) (bu/ac)
- 83.59 - 386.77 (5.232 ac)
- 77.61 - 83.59 (8.516 ac)
- 75.81 - 77.61 (9.540 ac)
- 69.85 - 75.81 (9.756 ac)
- 64.67 - 69.85 (9.575 ac)
- 59.89 - 64.67 (8.028 ac)
- 5.08 - 53.69 (6.645 ac)

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Page 1 of 1
NW KS Tech College- Yield Data and Soil Moisture Profile
NW KS Tech College- Yield Data on-campus field

Grain Harvest 2019 - South Half Pivot (CORN)

Grower: NWKTC
Farm: Tech Farm
Field: South Half Pivot
Year: 2019
Operation: Grain Harvest
Crop/Product: CORN
Op. Instance: Harvest - 1
Area: 56.26 ac
Avg. Yield: 141.32 bu/ac
Avg. Moisture: 18.17%

Yield (Dry)
(bu/acre)

177.88 - 399.56 (7.90 ac)
155.99 - 177.88 (18.73 ac)
130.66 - 155.99 (12.76 ac)
108.83 - 130.66 (4.69 ac)
85.76 - 106.83 (3.37 ac)
65.97 - 85.76 (3.84 ac)
5.07 - 55.97 (3.97 ac)

Ag Leader Technology SMS Advanced
NW KS Tech College- Yield Data and Soil Moisture Profile

NWKTC / PIVOT / CORN

MONTHLY PLANT STATUS

MONTHLY STRESS DAYS
LOCATION VS. REGIONAL

MONTHLY IRRIGATION
DAYS OF OPERATION

PRE-VT DATE: 07/10/2019
MAP DATE: 09/03/2019, YIELD POTENTIAL: 198 bu/ac

Customer: NWKTC
Plot name: NWKTC - corn - pivot

2019 SUMMARY
NWKTC / DRIP / CORN

PRE-VT DATE: 07/08/2019
MAP DATE: 09/03/2019, YIELD POTENTIAL: 228 bu/ac

Customer: NWKTC
Plot name: NWKTC - Corn - drip

MONTHLY PLANT STATUS

NWKTC - Corn - drip (R)

MONTHLY STRESS DAYS
LOCATION VS. REGIONAL

2019 SUMMARY
### Soil Moisture Graph

**KWO Water Technology Farm Report - 2019 Growing Season**

<table>
<thead>
<tr>
<th>Sensor Depth</th>
<th>Water Exposed</th>
<th>Plant Available Water (%)</th>
<th>Readily Available Water (%)</th>
<th>Soil %</th>
<th>Sensor Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>0&quot;</td>
<td>0.04 in</td>
<td>25.0%</td>
<td>2.0%</td>
<td>56%</td>
<td>0.25 in</td>
</tr>
<tr>
<td>6&quot;</td>
<td>0.07 in</td>
<td>79.00%</td>
<td>6.00 in</td>
<td>56%</td>
<td>0.25 in</td>
</tr>
<tr>
<td>12&quot;</td>
<td>0.17 in</td>
<td>71.42%</td>
<td>8.43 in</td>
<td>56%</td>
<td>0.25 in</td>
</tr>
<tr>
<td>18&quot;</td>
<td>0.30 in</td>
<td>74.41%</td>
<td>9.10 in</td>
<td>56%</td>
<td>0.25 in</td>
</tr>
<tr>
<td>24&quot;</td>
<td>0.51 in</td>
<td>71.14%</td>
<td>6.00 in</td>
<td>56%</td>
<td>0.25 in</td>
</tr>
<tr>
<td>30&quot;</td>
<td>0.84 in</td>
<td>80.18%</td>
<td>4.50 in</td>
<td>56%</td>
<td>0.25 in</td>
</tr>
<tr>
<td>36&quot;</td>
<td>1.37 in</td>
<td>79.18%</td>
<td>1.00 in</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Root Zone</td>
<td>1.57 in</td>
<td>77.18%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Each sensor Plant Available Water (%)

Use crop root zone instead of total profile.
NW KS Tech College- Yield Data on-campus field

Grain Harvest 2019 - Drip Tape (CORN)

Grower: NWKTC
Farm: Tech Farm
Field: Drip Tape
Year: 2019
Operation: Grain Harvest
Crop/Product: CORN
Op. Instance: Harvest - 1
Area: 31.57 ac
Avg. Yield: 182.41 bu/ac
Avg. Moisture: 15.67 %

Yield (Dry)
(bu/ac)

<table>
<thead>
<tr>
<th>Yield Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>252.24 - 309.28</td>
<td>(3.808 ac)</td>
</tr>
<tr>
<td>225.80 - 252.24</td>
<td>(4.366 ac)</td>
</tr>
<tr>
<td>202.13 - 225.80</td>
<td>(4.443 ac)</td>
</tr>
<tr>
<td>179.80 - 202.13</td>
<td>(4.423 ac)</td>
</tr>
<tr>
<td>156.76 - 179.80</td>
<td>(4.590 ac)</td>
</tr>
<tr>
<td>114.32 - 156.76</td>
<td>(5.187 ac)</td>
</tr>
<tr>
<td>5.96 - 114.32</td>
<td>(4.779 ac)</td>
</tr>
</tbody>
</table>

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Page 1 of 1
NW KS Tech College- Water Stress Aerial Imagery

*KWO Note: The blue areas indicated more soil moisture while green to red indicated some crop moisture stress.*
NW KS Tech College- additional harvest data and soil moisture profiles of local farms off-campus:

Owner: Rick Billinger
Field: NE 12-8-42
Crop: Corn
Soil moisture profile-

Owner: Rick Billinger
Field: SW 6-8-41
Crop: Pinto Beans
Soil moisture profile-
Owner/Operator: Franklin Family Farms (Tim and Gerry Franklin)
Field: NW 11-9-39
Crop: Corn
Yield scans completed by aerial imagery

Soil Moisture Profiles:
Owner/Operator: Franklin Family Farms (Tim and Gerry Franklin)
Field: NW 34-8-39
Crop: Corn
Yield scans completed by aerial imagery

Soil Moisture Profiles-

<table>
<thead>
<tr>
<th>Telemetry</th>
<th>Depth (in)</th>
<th>Water (in)</th>
<th>Water (%)</th>
<th>Capacity (in)</th>
<th>Deficit (in)</th>
<th>Average Daily Use (in)</th>
<th># Days to Refill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>16.71</td>
<td>87</td>
<td>19.10</td>
<td>2.39</td>
<td>0.08*</td>
<td></td>
<td>&gt; 7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profile</th>
<th>Depth (in)</th>
<th>Water (in)</th>
<th>Water (%)</th>
<th>Capacity (in)</th>
<th>Deficit (in)</th>
<th>Average Daily Use (in)</th>
<th># Days to Refill</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Root Zone</th>
<th>Depth (in)</th>
<th>Water (in)</th>
<th>Water (%)</th>
<th>Capacity (in)</th>
<th>Deficit (in)</th>
<th>Average Daily Use (in)</th>
<th># Days to Refill</th>
</tr>
</thead>
</table>

Profile Sum

Percentage

Inches
Light soil probe-

Heavy soil probe-
Owner/Operator: Sederstrom Family Farms (Greg and Blaine Sederstrom)
Field: NE 16-9-40
Crop: Soybeans
Yield scans completed by aerial imagery

Soil moisture profiles-
Owner/Operator: Sederstrom Family Farms (Greg and Blaine Sederstrom)
Field: SW 27-9-40
Crop: Corn
Yield scans completed by aerial imagery
Soil moisture profiles-
# Long Farm Report Data

## SE 17-17-35

### FIELD DETAILS

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop Variety</td>
<td>G10S30-5222</td>
</tr>
<tr>
<td>Relative Maturity</td>
<td>110</td>
</tr>
<tr>
<td>Planting Date</td>
<td>May 16, 2019</td>
</tr>
<tr>
<td>Planting Population (seeds/ac)</td>
<td>31000</td>
</tr>
<tr>
<td>Technology Type</td>
<td>Capacitance Probe Scheduling</td>
</tr>
<tr>
<td>Soil Type (at probe location)</td>
<td>Silt Loam</td>
</tr>
<tr>
<td>Available Water Capacity in Root Zone (inches)</td>
<td>3.6</td>
</tr>
<tr>
<td>Irrigation Type</td>
<td>Center Pivot</td>
</tr>
<tr>
<td>Well/Water Source Output (GPM)</td>
<td>500</td>
</tr>
<tr>
<td>FSA Track Number</td>
<td>3159</td>
</tr>
<tr>
<td>Field</td>
<td>1</td>
</tr>
</tbody>
</table>
KWO Note: This data helps to see what amount of water each sector of the field was provided during the season.
Field Maps

Yield

<table>
<thead>
<tr>
<th>Yield</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.9-182.8</td>
<td>12.3</td>
</tr>
<tr>
<td>182.8-208.1</td>
<td>24.6</td>
</tr>
<tr>
<td>208.1-219.2</td>
<td>24.6</td>
</tr>
<tr>
<td>219.2-227.6</td>
<td>24.6</td>
</tr>
<tr>
<td>227.6-237.8</td>
<td>24.6</td>
</tr>
<tr>
<td>237.8-296.6</td>
<td>12.3</td>
</tr>
<tr>
<td>None</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Harvest Date

10/20/2019, 10/21/2019, 10/22/2019, 10/23/2019, 10/18/2019
KWO Note: Thermal imaging monitors the visible and near infrared radiation that plants reflect, capturing the data needed in order to take action on time. This data can identify many problems which are caused by extreme climate changes, weeds, pests and diseases, over-planting, improper irrigation, inconsistent application of fertilizers, poor drainage and more.
Hi,
FluroSense report — New remote sensing data — 17 September 2019

Farm **Eddie Weber**:

- Total rain: 40.21 in.
- 1 fields received new imagery.

Evolution of average NDVI or NDVI value:

- Fallowed field(s): from 0.72 (3 Sep) to 0.73 (16 Sep)
Weber Farm - Field Yield Data

2019 Corn: Harvest
Layer: Dry Yield

Operations Center

Schmitt Weber Farms Gen Part | Inter-Company

Map data ©2019 Imagery ©2009, Maxar Technologies, USDA Farm Service Agency

AGRONOMIC DATA

<table>
<thead>
<tr>
<th>TOTAL DRY YIELD</th>
<th>AVG. WET WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,765.66 bu</td>
<td>6,506.87 lb/ac</td>
</tr>
</tbody>
</table>

LEGEND

| 144 | 9% |
| 132 | 21% |
| 120 | 25% |
| 106 | 17% |
| 89  | 10% |
| 67  | 7%  |

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Jacob Farm- Yield Data Report

Additional materials provided by producer:

Hi,
FluroSense report — New remote sensing data — 17 September 2019

Farm Beal South:

- Total rain: 32.62 in.
- 1 out of 2 fields received new imagery.

Evolution of average NDVI or NDVI value:

- Fallow field(s): from 0.73 (3 Sep) to 0.64 (16 Sep)
### Jacob Farm - Aerial Imagery

**CLIMATE FIELDVIEW**

**Harvest Summary**

**beal south**
Ryan | Jacob farms

**Corn - Harvested 9/26/19 - 10/11/19**

#### Hybrid

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Avg Yield (Bu/Ac)</th>
<th>Moisture</th>
<th>Harvested Acres</th>
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</thead>
<tbody>
<tr>
<td>CHANNEL 218-44</td>
<td>166</td>
<td>15.9%</td>
<td>133.3</td>
</tr>
<tr>
<td>Missing Hybrid / Variety</td>
<td>133</td>
<td>19.0%</td>
<td>0.1</td>
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<tr>
<td><strong>Total/Avg</strong></td>
<td><strong>166</strong></td>
<td><strong>15.9%</strong></td>
<td><strong>133.4</strong></td>
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</table>

#### Combine

<table>
<thead>
<tr>
<th>Combine</th>
<th>Operator</th>
<th>Wetweight (Lbs)</th>
<th>Moisture</th>
<th>Acres</th>
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<tbody>
<tr>
<td>723D</td>
<td>-</td>
<td>1,243,760</td>
<td>15.9%</td>
<td>133.4</td>
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<tr>
<td><strong>Total/Avg</strong></td>
<td></td>
<td><strong>1,243,760</strong></td>
<td><strong>15.9%</strong></td>
<td><strong>133.4</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Harvested Acres</th>
<th>Avg Yield (Bu/Ac)</th>
<th>Moisture</th>
<th>Dry Bushels</th>
<th>Wet Weight (Lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>133.4</strong></td>
<td><strong>166</strong></td>
<td><strong>15.9%</strong></td>
<td><strong>22,113</strong></td>
<td><strong>1,243,760</strong></td>
</tr>
</tbody>
</table>
WaterPACK & ILS- Chlorophyll Index Aerial Imagery

Ceres mid August - Chlorophyll

WaterPACK & ILS- Water Stress Aerial Imagery

WaterPACK & ILS- NDVI Aerial Imagery
WaterPACK & ILS- Soil Moisture Profiles
WaterPACK & ILS- The Autonomous Pivot Camera can provide similar information as aerial imagery can but can do so by mounting a camera atop a pivot. Autonomous Pivot’s platform utilizes on-pivot (1) moisture, (2) nitrogen and (3) crop-disease sensors.
Irrigation recommendation

17% Speed 1.02” Today

17% Speed 1.02” 22 Aug

17% Speed 1.02” 23 Aug

17% Speed 1.02” 24 Aug
2019 Corn: Harvest

Layer: Dry Yield

Operation Center

ILS Farm Partnership | Rafter Lazy D

Operation Dates: 09/13/2019 - 09/14/2019

WaterPACK & ILS - Field Yield Results

### AGRONOMIC DATA

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tr>
<td>TOTAL DRY YIELD</td>
<td>27,495.67 bu</td>
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<tr>
<td>AVG. DRY YIELD</td>
<td>232.66 bu/ac</td>
</tr>
<tr>
<td>AVG. MSTR</td>
<td>29.67 %</td>
</tr>
<tr>
<td>AVG. SPEED</td>
<td>2.97 m/h</td>
</tr>
<tr>
<td>AREA WORKED</td>
<td>118.18 ac</td>
</tr>
<tr>
<td>WET WEIGHT</td>
<td>1,860,964.46 lb</td>
</tr>
</tbody>
</table>

**WATER PACK Field**

**HME: 224 bu/ae**

**113. ac/ft**

**LEGEND**

- 269: 8%
- 253: 15%
- 239: 24%
- 226: 23%
- 211: 16%
- 189: 8%
- 0: 6%

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2019 Corn: Harvest
Layer: Dry Yield

Operation Dates: 10/16/2019 - 10/17/2019

<table>
<thead>
<tr>
<th>AGRONOMIC DATA</th>
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</thead>
<tbody>
<tr>
<td>TOTAL DRY YIELD</td>
<td>27,356.35 bu</td>
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<tr>
<td>AVG. DRY YIELD</td>
<td>227.4 bu/ac</td>
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<tr>
<td>AVG. MSTR</td>
<td>16.04 %</td>
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<tr>
<td>AVG. SPEED</td>
<td>4.16 mi/h</td>
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<tr>
<td>AREA WORKED</td>
<td>120.3 ac</td>
</tr>
<tr>
<td>WET WEIGHT</td>
<td>1,554,411.31 lb</td>
</tr>
</tbody>
</table>

| AVG. WET WEIGHT         | 12,921.12 lb/ac |

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LEGEND
- 280
- 252
- 25
- 244
- 24
- 185
- 137
- 0

152 ac left - had probe
R & E Goering Farm - Field Yield Results
2019 CORN HARVEST: DRY YIELD

**Field Analyzer**

<table>
<thead>
<tr>
<th>Time</th>
<th>Selected</th>
<th>Full Operation</th>
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<tbody>
<tr>
<td>Start</td>
<td>Sep 17, 2019 5:20 PM</td>
<td>Sep 17, 2019 4:20 PM</td>
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<tr>
<td>End</td>
<td>Sep 24, 2019 12:38 PM</td>
<td>Oct 15, 2019 6:12 PM</td>
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**Operators**

Operator Name: EUGENE GOERING

**AGRONOMIC DATA**

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<thead>
<tr>
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<tbody>
<tr>
<td>Total Dry Yield (bu)</td>
<td>11,025.81</td>
<td>22,912.87</td>
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<td>Avg. Dry Yield (bu/ac)</td>
<td>232.86</td>
<td>155.21</td>
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<tr>
<td>Wet Weight (lb)</td>
<td>565,283.34</td>
<td>1,286,197.85</td>
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<tr>
<td>Avg. Wet Weight (lb/ac)</td>
<td>12,724.84</td>
<td>10,060.68</td>
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<tr>
<td>Avg. Msh (%)</td>
<td>14.7</td>
<td>14.55</td>
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<tr>
<td>Area Worked (ac)</td>
<td>42.72</td>
<td>121.22</td>
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### 2019 CORN HARVEST: DRY YIELD

**Field Analyzer**

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<th>Full Operation</th>
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<tr>
<td>Operators</td>
<td>Operator Name</td>
<td>EUGENE GOERING</td>
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### AGRONOMIC DATA

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<th></th>
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<th>Full Operation</th>
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<tr>
<td>Total Dry Yield (bu)</td>
<td>5,922.55</td>
<td>22,912.87</td>
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<tr>
<td>Avg. Dry Yield (bu/ac)</td>
<td>237.42</td>
<td>195.21</td>
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<tr>
<td>Wet Weight (lb)</td>
<td>277,725.57</td>
<td>1,286,197.85</td>
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<tr>
<td>Avg. Wet Weight (lb/ac)</td>
<td>12,986.7</td>
<td>10,666.68</td>
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<tr>
<td>Avg. Mtr (%)</td>
<td>34.68</td>
<td>14.95</td>
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<tr>
<td>Area Worked (ac)</td>
<td>25.21</td>
<td>121.22</td>
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</table>
### 2019 CORN HARVEST: DRY YIELD

**Field Analyzer**

- **Time**
  - Selected: Sep 23, 2019 3:33 PM - Sep 17, 2019 4:20 PM

- **Operators**
  - Operator Name: EUGENE GOERING

### AGRONOMIC DATA

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<thead>
<tr>
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<th>Selected</th>
<th>Full Operation</th>
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<tbody>
<tr>
<td>Total Dry Yield (bu)</td>
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<td>22,912.87</td>
</tr>
<tr>
<td>Avg. Dry Yield (bu/ac)</td>
<td>230.57</td>
<td>195.21</td>
</tr>
<tr>
<td>Wet Weight (lb)</td>
<td>25,225.16</td>
<td>1,286,197.85</td>
</tr>
<tr>
<td>Avg. Wet Weight (lb/ac)</td>
<td>12,585.04</td>
<td>10,666.68</td>
</tr>
<tr>
<td>Avg. Mitr (%</td>
<td>14.57</td>
<td>14.95</td>
</tr>
<tr>
<td>Area Worked (ac)</td>
<td>2.86</td>
<td>121.22</td>
</tr>
</tbody>
</table>

Span 7
Senninger LDN Bubblers - 80% of Control
6 psi regulators - 30" spacing, 30" height
231 bu/acre
Span 5
Komet Twist - 87% of Control
6 psi regulators - 54” spacing, 48” height
Span 4
Senninger XI-Wobs - Control @ 750 gpm
15 psi regulators - 108" spacing, 84" height
241 bu/acre
Goerning Farms

Chlorophyll Index

CIR

Core Thermal

RGB
## 2019 Corn Harvest: Dry Yield

<table>
<thead>
<tr>
<th>Field Analyser</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Time</strong></td>
<td><strong>Selected</strong></td>
<td><strong>Full Operation</strong></td>
</tr>
<tr>
<td>Start</td>
<td>Sep 23, 2019 3:23 PM</td>
<td>Sep 17, 2019 4:20 PM</td>
</tr>
<tr>
<td>End</td>
<td>Sep 24, 2019 12:18 PM</td>
<td>Oct 15, 2019 6:12 PM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operators</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator Name</td>
<td>EUGENE GOERING</td>
<td></td>
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### AGRONOMIC DATA

<table>
<thead>
<tr>
<th></th>
<th>Selected</th>
<th>Full Operation</th>
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<tbody>
<tr>
<td>Total Dry Yield (bu)</td>
<td>638.67</td>
<td>22,912.87</td>
</tr>
<tr>
<td>Avg. Dry Yield (bu/ac)</td>
<td>238.21</td>
<td>195.21</td>
</tr>
<tr>
<td>Wet Weight (lb)</td>
<td>27.202.2</td>
<td>1,286.197.85</td>
</tr>
<tr>
<td>Avg. Wet Weight (lb/ac)</td>
<td>13,001.87</td>
<td>10,666.68</td>
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<tr>
<td>Avg. Mthr (%)</td>
<td>14.5</td>
<td>14.95</td>
</tr>
<tr>
<td>Area Worked (ac)</td>
<td>2.85</td>
<td>121.22</td>
</tr>
</tbody>
</table>

**Span 6**
Netafin PMDI - 86% of Control
20" spacing
238 bu/acre
**Report Summary**  
2020-01-14

**CUSTOMER**  
Ryan Goering

**FARM**  
Goering Farms

**FLIGHT**  
2019 - #6

<table>
<thead>
<tr>
<th>FIELD NAME</th>
<th>FLIGHT DATE</th>
<th>IMAGES</th>
<th>FIELD NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goering Farms</td>
<td>2019-09-02</td>
<td>6</td>
<td>0</td>
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</tbody>
</table>

**Terravion**

Farmer: Ryan Goering  
Farm Name: Goering Farms  
Field Name: NE 30-21-2  
Imagery Date: 2019-09-13

---

**Color**  
![Color Image]

**Color Infrared**  
![Color Infrared Image]

**Vigor**  
![Vigor Image]

**Thermal**  
![Thermal Image]
Goering Farms

Water Stress

![Image of water stress map]

![Image of irrigation and rainfall chart]

Customer: Ryan Goering
Crop: Corn
Flight: 2019 - #6
Flight Date: 9/2/2019
## Goering Water Tech Farm- Water Application

<table>
<thead>
<tr>
<th></th>
<th>118 acres</th>
<th>Area acres</th>
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</thead>
<tbody>
<tr>
<td>S2-S4 Xi-Wob</td>
<td>750 gpm</td>
<td>60.8</td>
</tr>
<tr>
<td>S5 Twister</td>
<td>652 gpm</td>
<td>18.3</td>
</tr>
<tr>
<td>S6 MDI -20°</td>
<td>645 gpm</td>
<td>21.9</td>
</tr>
<tr>
<td>S7 Bubbler</td>
<td>600 gpm</td>
<td>25.6</td>
</tr>
</tbody>
</table>

### Using flow meters Actual % (Bubbler 80, MDI 86, Twister 87)

<table>
<thead>
<tr>
<th>Date</th>
<th>Rain</th>
<th>Xi Wob - Control</th>
<th>PMDI &amp; Twister</th>
<th>Bubbler</th>
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<td>5-Apr</td>
<td>1.02</td>
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<td>30-Apr</td>
<td>1.14</td>
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<tr>
<td>1-May</td>
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<td>5-May</td>
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<tr>
<td>7-May</td>
<td>2.81</td>
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<tr>
<td>8-May</td>
<td>1.43</td>
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<tr>
<td>18-May</td>
<td>0.94</td>
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<tr>
<td>20-May</td>
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<td>21-May</td>
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<td>11-Jun</td>
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<tr>
<td>15-Jun</td>
<td>0.30</td>
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<tr>
<td>20-Jun</td>
<td>0.50</td>
<td>0.43</td>
<td>0.40</td>
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<tr>
<td>22-Jun</td>
<td>0.77</td>
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<tr>
<td>23-Jun</td>
<td>2.58</td>
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<tr>
<td>26-Jun</td>
<td>0.25</td>
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<tr>
<td>29-Jun</td>
<td>0.89</td>
<td>0.76</td>
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<td>4-Jul</td>
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<td>9-Jul</td>
<td>0.25</td>
<td>0.79</td>
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<tr>
<td>13-Jul</td>
<td>0.76</td>
<td>0.65</td>
<td>0.61</td>
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<td>17-Jul</td>
<td>0.17</td>
<td>0.76</td>
<td>0.65</td>
<td>0.61</td>
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<td>21-Jul</td>
<td>0.75</td>
<td>0.64</td>
<td>0.60</td>
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<td>25-Jul</td>
<td>0.80</td>
<td>0.69</td>
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<td>28-Jul</td>
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<td>30-Jul</td>
<td>0.75</td>
<td>0.64</td>
<td>0.60</td>
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<td>3-Aug</td>
<td>0.30</td>
<td>0.77</td>
<td>0.66</td>
<td>0.62</td>
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<tr>
<td>6-Aug</td>
<td>0.43</td>
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<td>7-Aug</td>
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<td>8-Aug</td>
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<tr>
<td>17-Aug</td>
<td>0.37</td>
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<tr>
<td>18-Aug</td>
<td>2.35</td>
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<tr>
<td>21-Aug</td>
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<tr>
<td>8-Sep</td>
<td>0.16</td>
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<tr>
<td>12-Sep</td>
<td>0.31</td>
<td></td>
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<td></td>
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<tr>
<td>Total</td>
<td>29.62</td>
<td>6.77</td>
<td>5.80</td>
<td>5.42</td>
</tr>
</tbody>
</table>

Actual % 86% 80%
Precipitation in the Loess Hills region for the growing season of 2019 was 27.03 inches, 91% of the 30-year average. There were 11 storm events during the growing season with an average of 2.47 inches per storm event. The individual storm events were of diverse magnitude and duration, with precipitation ranging from 0.04 to 5.75 inches per storm event. The 7- to 28-day cumulative precipitation was between 0.00 and 6.34 inches, with an average of 2.80 inches. Gage 5 recorded the greatest amount of rainfall, 35.98 inches, and Gage 1 recorded the least, 14.75 inches. These differences were due to the local effects of contouring, tree cover, and the permeability of the soil. The soil in the area is primarily Loess, which is well-drained and supports good agricultural productivity.

Loess Hills Water Quality Farm - Soil Sample Lab Results

<table>
<thead>
<tr>
<th>SAMPLE IDENTIFICATION</th>
<th>LABORATORY NUMBER</th>
<th>HSA EXTRACTION</th>
<th>ORTHOPHOSPHATE-P</th>
<th>PHOSPHORUS</th>
<th>POTASSIUM</th>
<th>MAGNESIUM</th>
<th>CALCIUM</th>
<th>SODIUM</th>
<th>IRON</th>
<th>ALUMINUM</th>
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<td>36822752</td>
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<td>6</td>
<td>41</td>
<td>45</td>
<td>251</td>
<td>58</td>
<td>162</td>
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</tbody>
</table>

**ANALYTICAL LABORATORY FINDINGS**

**SOIL HEALTH ASSESSMENT**

0.85 - 1.00

*The HSA Soil Extractant was developed by Haney*. This extract is designed to mimic organic acids produced by living plant root systems. These organic acids increase nutrient availability in the root zone.

*The Water Soluble Extract provides an snapshot of nutrients that are immediately available to the plants.*

*The CO2 Burst test is a good indicator of soil health. This test measures the amount of CO2 naturally released from the soil due to the activity of the soil microbes through microbial respiration. The test is very dependent on the amount of carbon that is available to the soil microbes and the form that the carbon is in. As the available carbon increases in your soil the Microbial respiration will increase.*

*Organic Carbon is the available total water extractable organic carbon from your soil. This pool of carbon is roughly 80 times smaller than the Soil Organic Matter. The organic carbon pool reflects the energy/food source that is driving the soil microbes.*

*The Organic Nitrogen pool is replenished by fresh plant residues, manure, composts, and dying soil microbes.*

*The Organic C/N ratio is a ratio component of the nutrient cycle. A soil C/N ratio above 25 generally indicates that Nitrogen will be tied up and not available to plants. The ideal range for the Organic soil will be from 8:1 to 15:1.*

*The Soil Health Calculation uses the CO2 Burst, Organic Carbon, Organic Nitrogen, and the C/N ratio to generate the soil health number. The calculation looks at the balance of soil carbon and nitrogen and their relationship to microbial activity. This number represents the overall health of your soil. Soil values will range from 0 to 25. A value below 7 would be considered low. You want to see this number increase as you make changes and adjustments. Keeping track of this number will allow you to gauge the effects of your management practices over time.*

*Modifying to the New Soil Extractor HSA-5: A Multifunction Extractor* R.L. Haney (a); E.S. Haney (b); L.R. Reamer (c); J.G. Arnold (d)

**ADDITIONAL NITROGEN CREDIT IDENTIFIED VIA HANEY TEST:**

| NITROGEN RECOMMENDATIONS MAY INCLUDE ADDITIONAL NITROGEN CREDITS BASED ON PREVIOUS CROPS AND NITROGEN MINERALIZATION RATES. | 16 |

The above restrictions apply only to the specifically collected samples from the area of concern a maximum of 24 hours.
### Soil Health Assessment

<table>
<thead>
<tr>
<th>Sample Distribution</th>
<th>Laboratory Number</th>
<th>Results</th>
<th>Low</th>
<th>Medium</th>
<th>Optimum</th>
<th>Very High</th>
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<tbody>
<tr>
<td>H2O Extraction</td>
<td></td>
<td></td>
<td>10</td>
<td>6</td>
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</tr>
<tr>
<td>Orthophosphate-P</td>
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<td>14</td>
<td>8</td>
<td>4</td>
<td>1</td>
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<tr>
<td>Potassium</td>
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<td>44</td>
<td>28</td>
<td>14</td>
<td>8</td>
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<td>Magnesium</td>
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<td>27</td>
<td>14</td>
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<tr>
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<td>0</td>
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<tr>
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<td>157</td>
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### Water Soluble Nitrate-N

<table>
<thead>
<tr>
<th>Water Soluble Nitrate-N</th>
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<tbody>
<tr>
<td>Ammoniacal Nitrogen</td>
<td>1.8</td>
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<tr>
<td>Orthophosphate-P</td>
<td>0.68</td>
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<tr>
<td>Carbon</td>
<td>10.10</td>
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<tr>
<td>Total Nitrogen</td>
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### 1-DAY CO2 BUST

<table>
<thead>
<tr>
<th>1-DAY CO2 BUST</th>
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<tbody>
<tr>
<td>Organic Carbon</td>
<td>101.6</td>
</tr>
<tr>
<td>Organic Nitrogen</td>
<td>3.3</td>
</tr>
<tr>
<td>Organic Nitrogen</td>
<td>3.3</td>
</tr>
</tbody>
</table>

### Additional Nitrogen Credit Identified via Haney Test: 10

### Nitrogen Recommendations

Nitrogen recommendations may include additional nitrogen credits based on previous yield and nitrogen utilization rates. The data provided may apply to the crop being harvested. Treatment can require a re-evaluation of 10 lbs.

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The NHI Soil Extractant was developed by Harry. The extractant is a solution of nitric acid that is used to extract organic matter from soil samples. The results are expressed as mg/kg of dry soil. The extractant is then analyzed for the following components:

- **Organic Carbon**: The extractant is autoclaved at 121°C for 30 minutes to inactivate microorganisms. The extract is then analyzed for organic carbon by the acid dichromate procedure using the Walkley-Black method.

- **Total Nitrogen**: The extract is analyzed for total nitrogen using the Kjeldahl method.

- **Ammoniacal Nitrogen**: The extract is analyzed for ammoniacal nitrogen using the indophenol blue method.

- **Orthophosphate-P**: The extract is analyzed for orthophosphate-P using the ascorbic acid method.

- **Potassium**: The extract is analyzed for potassium using the flame photometry method.

- **Magnesium**: The extract is analyzed for magnesium using the flame photometry method.

- **Calcium**: The extract is analyzed for calcium using the flame photometry method.

- **Iron**: The extract is analyzed for iron using the colorimetric method.

- **Alkalinity**: The extract is analyzed for alkalinity using the titration method.

These results provide a comprehensive assessment of the soil's nutrient status and can be used to inform fertilizer recommendations for the next growing season.