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TAWC

TEXAS ALLIANCE FOR WATER CONSERVATION

TEXAS TECH UNIVERSITY
Agricultural Sciences & Natural Resources
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Texas Water Development Board

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TEXAS ALLIANCE FOR WATER CONSERVATION

In this issue:

The Texas Alliance for Water Conservation strives to conserve water and soil for future generations after collaborating with producers to identify agricultural production practices and technologies that, when integrated across farms and landscapes, will reduce the depletion of ground water while maintaining or improving agricultural production and economic opportunities.

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Romine with his kids Tahlia, Lincoln, and Kelton

Serving Our Country In Numerous Ways

by Samantha Borgstedt

There are many ways people in our country serve our country. From combat overseas, to teachers educating our future leaders, to farmers and ranchers suppling food and fiber to keep us fed and clothed, everyday individuals are the ones that truly have the greatest impact on our lives.

Orin Romine of Martin County Texas has played a role in serving our country in more ways than one. Romine graduated High School in 2001 and decided to pursue a diesel mechanic degree. He knew a career in the field and using his hands was best suited for him, and with the possibility of someday returning to the family farm, he knew the education would be helpful in a variety of ways.

"I knew I wanted to eventually farm, but I also knew I needed job security and a backup plan in case my plan to farm did not work out." Romine said. "I also knew my strengths and interests, and diesel mechanic was the best fit for me."

After graduating, he worked various jobs as a journeyman mechanic and for John Deere. In 2010, a calling of another sort entered Romine's heart and he signed up for the Marines. He stationed at the Marine Corps Air Ground Combat Center Twentynine Palms, California. December of 2013 he was sent on combat mission in Afghanistan, Operation Enduring Freedom. Romine served in the 1st Tank Battalion, an armor battalion providing combat power to the 1st Marine Division.

"I felt like if I didn't join the Marines I would one day, later in life, regret it." Romine said. "My time in combat was rough. Real rough. But I'm glad I now get to say, 'I'm glad that is over' rather than 'I wish I had done that'."

In October 2014, Romine returned to Martin County with his wife and son. The same day he arrived, he climbed on a cotton stripper and helped his father harvest. In 2015, Romine began farming his own land while also helping his father and brother-in-law. All in all, the family manages 13,000 dryland acres. Of this total, 9,000 is put in cotton production, while the other rotates between wheat and grain sorghum.

In 2016, Romine began working with his local National Resources Conservation Service (NRCS) office to learn more about implementing cover crops on his farms. He learned about the seed mixes and strip-tillage and decided to try it out on a few of his acres. Through the Environmental Quality Incentives Program (EQIP), Romine purchased the equipment he needed and after the first year saw positive benefits. One-third of his operation is now in cover crops. Romine has seen better water filtration in his sandy soil, and after crunching the numbers determined he was money ahead by planting a cover crop rather than numerously running a sand fighter and trying to control weeds with tillage.

"Our soil was so depleted and lacking in organic matter, and I knew we were bound to see improvement," Romine said. "Now that we have several years to reference, we can tell what works best for our farms."

Romine said no-till has been a challenge and not yet proven to be economically feasible, yet strip-till has proven to increase cotton yields, water filtration, and soil quality when used with a grain sorghum rotation.

"Our soil is not yet healthy enough to combat compaction issues," Romine said. "The cover crop plants that do fight against compaction do not thrive well in some of our soil situations. We've tried them, but they just don't make it in our conditions."

The yearly average rainfall in Martin County is around 15 inches. This usually comes in the form of a few rainstorms accompanied by high winds, resulting in a lot of runoff. Romine has seen

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improvement in capturing rainfall in his strip-tilled fields and a reduction in this runoff, resulting in more available water for his crop.

"We get very little rainfall to begin with," Romine said. "It is important for us to capture all we can, especially being dryland. What rain we make available to the crop is all the water it is going to get."

Romine said every year brings about challenges, and in 2022 one of his greatest is fuel cost. The fewer passes he can make across his field, the fewer times he must fill his diesel tank. His goal is to manage his crop with three tillage passes, then control weeds primarily with a spray rig he runs himself, cutting down on fuel and labor costs.

Romine said if he financially makes it through this year's drought and input cost increases, he sees more crop rotation and diversification in the future of his farming operation. He would like to get to the point where no-till is a feasible option, but certainly plans to use more strip-till with a cotton, grain sorghum, and possibly wheat rotation.

Romine became a cooperating producer with the TAWC in 2020. We are honored to have him and his innovative management practices as part of our project, and we thank him for his service and leadership.

Romine with his Father, Larry Romine

Project Overview

by Philip Brown, TeCSIS-TAWC Program Manager

In September of 2004, the project 'An Integrated Approach to Water Conservation for Agriculture in the Texas Southern High Plains' was approved by the Texas Water Development Board and funding was received in February 2005 to begin the demonstration project conducted in Hale and Floyd Counties. A producer board was then elected to oversee all aspects of the project. This was the beginning of the Texas Alliance for Water Conservation.

The purpose of the project was to understand where and how water conservation could be achieved, while maintaining acceptable levels of profitability. Results of this study assist area producers in meeting the challenges of declining water supplies and reduced pumping capacities by demonstrating various production systems and water-saving technologies.

A key strategy of this project is all sites are producer-owned and producer-managed. The producers make all decisions about their agricultural practices, management strategies, and marketing decisions. Thus, practices and systems at any specific site were subject to change from year to year as producers addressed changes in market opportunities, weather, commodity prices, and other factors. Over the years, this project has measured, monitored, and documented the effects of these decisions.

The first nine years of the Texas Alliance for Water Conservation (TAWC) project are considered Phase I of our effort to demonstrate and compare irrigation systems and crop types for agronomic and economic water use efficiencies. In Phase I, 26 producer sites were identified to represent 26 different 'points on a curve' that characterize cropping and livestock grazing system monocultures with integrated cropping systems and integrated crop/livestock approaches to agriculture in this region.

In 2013, continuing under the infrastructure of Phase I, a new source of funding via the Texas Water Development Board for TAWC was approved by the Texas Legislature. This allowed TAWC to expand its impact area and establish Phase II during the 2014-2018 cropping seasons. In the first year, Phase II dropped four original sites and added 10 sites in six new counties. The

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number of sites and producers varies across years as new sites are added and some of the original sites replaced. This is to facilitate the time and effort toward the new expanded area allowing focus on a larger, more diverse group of agricultural producers in Phase II. Many of the additional farms were formerly participants in a Conservation Innovation Grant program funded by the United States Department of Agriculture Natural Resources Conservation Service, aimed at transferring technologies for conserving irrigation.

This season, we will be increasing our coverage area further to include farms located in the extreme north panhandle area of Sherman County and as far south as Martin County south of Lamesa to focus on a broader range of available water scenarios and management ecosystems. Our focus will continue to be on water conservation but include practices that can improve soil health through cover crops and enhanced system sustainability.

The TAWC project for 2022 includes 7 field sites managed by 5 producers totaling 1,100 acres. Crops grown will include cotton, grain sorghum, multi-species cover crops, and wheat. Tillage will include conventional, no-till, strip-till, and limit-till management systems.

Water saving irrigation technologies and management systems will vary and include soil moisture probes across all sites. We thank ForeFront Agronomy for assisting us installing equipment and providing soil sampling across our locations. TAWC looks forward to analyzing these results to better understand these complex relationships between available ground water, tillage, management, and rainfall capture under a broader range of conditions, rainfall, and soil types.

The TAWC is honored to have recently been awarded an Agricultural Water Conservation Grant from the Texas Water Development Board to continue this focus into 2023 and is continually exploring other opportunities to fund these efforts and provide continuing solutions to our growers.

JULY SMART IRRIGATION MONTH

Take advantage of cost-share programs The Environmental Quality Incentives Program - a USDA cost-share program - enables farmers to upgrade to more efficient irrigation solutions.

Minimize runoff and waste If too much water is applied and the storage capacity of the soil is exceeded, runoff occurs. Applying water with precision is key.

Increase productivity through efficient irrigation Efficient irrigation maximizes yield and crop quality while reducing water loss. Farmers can incorporate smart irrigation technology to be both profitable and sustainable.

Improve irrigation scheduling Improved scheduling allows farmers to more precisely irrigate, preventing stress on crops.

Practice good soil management Proper soil management can be key to conserving water by improving infiltration and reducing runoff. Know your soil and explore options to increase water-use efficiency on your farm.

LEPA irrigation nozzle applying water to alternate furrows.

Irrigating to Roots

by Bob Glodt, Agri-Search Agricultural Consulting, Inc., Plainview, Texas

"Irrigating to Roots" … that sounds easy enough and maybe just a little overly simplistic. But is it really? How much thought is actually given to where irrigation water is going in relationship to the root system? When you consider that most farmers cannot come up with more water, the efficiency of the irrigations, is critical in obtaining the best possible yields per inch of water.

To become proficient in irrigation management of cotton, you must understand how cotton root systems develop, how water moves in the soil, and the overall demand cotton places for water at any one time during the growing season. Also, a cotton farmer needs to be aware of where water is being delivered in relationship to the root system of the plant.

Roots

Cotton roots have a relatively simple structure. The root grows from the tip of the root by adding new cells. This pattern of root development allows the root to wind around clods and crevices, and previously formed root channels that are present in the soil. Behind the root tip is where root hairs or lateral roots develop; these are the primary sites for water and nutrient uptake. This area of water uptake is usually 2 to 3 inches behind the tip of the root. Cotton roots do not grow through dry soil in order to find moist soil. Moisture and oxygen must be present in the root zone growth to take place and for a healthy root system to develop.

A cotton plant can be compared to a soda straw when considering water uptake. Water is taken in by the root system and is released or evaporates through openings in the leaves called stomates. When water in the leaves evaporates, it "pulls" on the water column in the plant and causes soil moisture to be pulled into the roots. Nutrients dissolved in the soil water will also be passively carried into the plant through the root system. This is the primary way the more soluble nutrients like nitrates are taken into the plant. Conditions of severe drought or humid and overcast weather limit or reduce leaf evaporation; therefore, limiting the uptake of soil nitrates.

In general, cotton roots extend into the soil to a depth of two to three times the above ground height of the plant. So, upon emergence, cotton roots can easily protrude four to six inches into the soil. A cotton plant that is twelve inches tall can have a root system that is twenty-four inches deep or more. Remember, however, that rooting depth is dependent on the amount of oxygen and water in the soil profile and roots do not grow through dry soil to find moisture. So, in essence root health, depth, and mass is largely determined by how early season irrigation practices are managed.

One way to determine the depth and moisture content in the soil is by hand probing and feeling the soil for moisture. Oakfield apparatus (www.soilsamplers.com) sell soil probes that are useful for this purpose. These cores can be

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removed from the soil and felt to get a good idea of how much moisture is in the soil and the depth of that moisture in the soil profile. An excellent information source for determining moisture by feel can be found on the internet (www.ncrs.usda.gov). This publication is entitled Estimating Soil Moisture By Feel and Appearance. I provide soil moisture estimates by depth for my clients each week throughout the growing season.

Early in the season when cotton is very small, probing should be conducted next to the plant or in the seed drill where the majority of the root system is developing. At emergence, there should be a minimum of twelve inches of moisture available to plants. By the time plants are six to eight inches tall the moisture profile should extend be to a depth of 18 to 24 inches. And ideally, by the time cotton reaches an above ground height of twelve inches a grower should be able to probe to a depth of at least twenty-four inches. The majority of water extraction by cotton during the growing season will be in the top twenty-four inches of the soil profile. Maintaining adequate moisture in the top twenty-four inches of the soil profile during the flowering and early boll development stages is necessary for top yields in the range of three or more bales per acre.

Irrigation Systems and Water Delivery

Irrigation systems should be configured in such a way that water is delivered to the full depth in which roots are expected to have penetrated. Drip irrigation systems with drip tape directly beneath the row are the most efficient systems for irrigating early season. With a drip irrigation system, water is delivered to the root zone without exposing moisture to the soil surface, therefore, evaporation rates are minimal when compared to surface applied water. With pivot irrigation systems, there are basically three different scenarios. They are referred to as LESA, MESA, and LEPA. LESA (low elevation spray application) and MESA (mid elevation spray application) deliver water in a broadcast spray mode. With LESA, the drops are situated closer to the ground whereas with MESA drop nozzles are situated higher above the crop canopy. As would be expected, the evaporation rates of a MESA configuration are higher than with a LESA configuration. LEPA

Probing the Soil

(low elevation precision application) systems can also be adjusted to irrigate in a broadcast spray mode as well as an alternate furrow bubble mode.

Regardless of the pivot irrigation system, LESA, MESA, or LEPA there is one nozzle or drop every other row. On 30 inch rows, drops are 60 inches apart and on 40 inch rows, drops are 80 inches apart. But, with the LESA or MESA systems irrigation can only be applied in a spray configuration. In other words, the entire soil surface is wetted with LESA or MESA systems. A LEPA system offers not only a spray mode configuration, but also an alternate furrow bubble mode configuration on the same nozzle head. LEPA irrigation nozzle applying water to alternate furrows.

Up until cotton has established a good lateral root system, irrigation to cotton smaller than about 8 to 10 inches should be applied in a broadcast spray mode. It is a matter of getting water to where the roots are. Also, the broadcast spray system is ideal for incorporating pre-emergence herbicides which are normally applied when plants are small. Later in the season as the root system expands into the furrows, however, the LEPA system holds distinct advantages over a broadcast spray method for applying water and achieving less evaporative loss and deeper penetration of water into the soil per inch applied.

Irrigation efficiency should never be underestimated in the contribution it will make to the final yields. Evaporative losses are significant when irrigating in the LESA or MESA mode as compared to LEPA. LESA applied irrigations are estimated to be only 50 percent efficient, or for every inch of water that is applied, only half of an inch is available to the crop. Whereas, LEPA applied irrigations that are applied to every other furrow, are approximately 80 percent efficient. So, with LEPA applied irrigation one inch of irrigation will translate to about .8" of moisture available to the crop. This represents an increase in 0.3 inch of water available per irrigation when irrigating LEPA over LESA. Considering that a minimum of six inches of irrigation is generally applied between early bloom to cut out stage, this translates to 1.8 inches of water gained from efficiency alone. Conservatively, cotton will yield about 60 to 80 pounds of lint per acre per inch of water applied from early bloom through late bloom. Therefore, a gain of 1.8 inches in efficiency will translate to roughly 108 to 144 pounds of lint per acre.

There are two main reasons that explain this increase in efficiency when using LEPA irrigation. First, evaporation rates are much higher in the broadcast spray mode. For example, if one inch of water were applied in broadcast spray that inch would be distributed over 60 or 80 inches depending on the row spacing. In LEPA, that same inch would be concentrated in only 30 to 40 inches.

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There will be half as much moist soil surface exposed to heat and wind when LEPA is used. Second, when the same amount of water is applied to a smaller area as with a LEPA system, water is pushed deeper into the soil profile on the irrigated row. This allows water to move deeper into the soil profile to the roots and also serves to reduce evaporation.

Not all LEPA nozzles are equal, however. Some LEPA nozzles commonly referred to as "bubblers" actually concentrate water in too narrow of a band. When water is applied to soil, the water will move from the wetted gradient to the drier gradient, however, there is a limit to which this moisture can move. If a LEPA system with bubbler nozzles is only wetting 4 inches between the rows, that wetting profile is too narrow for water to be distributed to where the majority of the lateral roots are growing. Ideally, a LEPA nozzle should distribute water to within a couple inches of the drill row on each side of the nozzle. Proper LEPA nozzle configurations or above the nozzle deflectors should be used to achieve this goal. The LEPA nozzles must also be at the proper height above the furrow to ensure good distribution of water across the furrow to be irrigated.

Yield Goals and Irrigation Frequency

Cotton yields in our region are water and fertilizer dependent. As my wife always says "You can't make a silk purse out of a sow's ear". In other words, you can't make 2 or more bales per acre if the amount of available irrigation you have will only support a 1 to 1 ½ bale yield (assuming supplemental moisture from rainfall is not forthcoming). So, adjusting the amount of acreage you can irrigate properly is better than under irrigating a larger amount of acreage with inadequate irrigation levels. In 2022, if our hot and dry weather trend continues, I expect there will be some cotton acreage abandoned because of a lack of water. If you are faced with this situation, it is far better to make this decision at late squaring than after the onset of bloom and high levels of water stress are prevalent. Water demand sharply increases as cotton reaches the onset of blooming and this demand steadily increases as cotton proceeds to the early boll stage of development. At peak bloom, cotton water use can approach between 0.28" and 0.32" per day or more depending on temperature, humidity, and wind.

It has been my experience that once irrigation capacity falls below 50 percent of (PET) potential evapotranspiration, yields become very unpredictable. So, at peak demand of lets say 0.28" per day (or 1.96" per week) you would need to be able to apply about an inch a week to reach a goal of 50% of PET. If no supplemental rainfall occurred, you could expect to achieve a yield goal of around 1,000 pounds of lint per acre (give or take). This is assuming that the decision is made early enough to avoid high stress levels before abandoning a portion of a field. This time would coincide with late squaring, but before the onset of first flower. Or another way to look at this is to have moisture in the top 18-24 inches of the soil profile when this decision is made.

And last, the soil type makes a big difference in how a crop should be irrigated. In sandy soils, irrigation should be applied at a closer frequency than in the clay loam soils. A review of the USDA publication mentioned previously in this article can serve as a guide to the soil moisture holding capacity of different soils.

Drought Program

The Emergency Conservation Program (ECP), administered by the U.S. Department of Agriculture (USDA) Farm Service Agency (FSA), provides emergency funding and technical assistance to farmers and ranchers to rehabilitate farmland and conservation structures damaged by natural disasters and implement emergency water conservation measures in periods of severe drought.

ECP is administered by FSA state and county committees and county offices. Producers should contact their local FSA county office regarding ECP enrollment periods and eligibility.

FSA county committees determine land eligibility based on on-site inspections of damaged land and the type and extent of damage.

Eligible land includes land used for:

- Commercial farming, ranching and orchard operations;
- Growing nursery stock and Christmas tree plantations;
- Grazing for commercial livestock production; and
- Conservation structures such as, waterways, terraces, diversions and windbreaks.
- Conservation problems existing before the applicable disaster event are ineligible for ECP assistance.

Cost-share payments are:

- Up to 75 percent of the cost to implement approved restoration practices;
- Up to 90 percent of the cost to implement approved restoration practices for producers who certify as limited resource, sociallydisadvantaged or beginning farmers/ranchers;
- Limited to $500,000 per person or legal entity per disaster; and
- Available as an advance payment of up to 25 percent of expected cost-share, for only the replacement or restoration of fencing.

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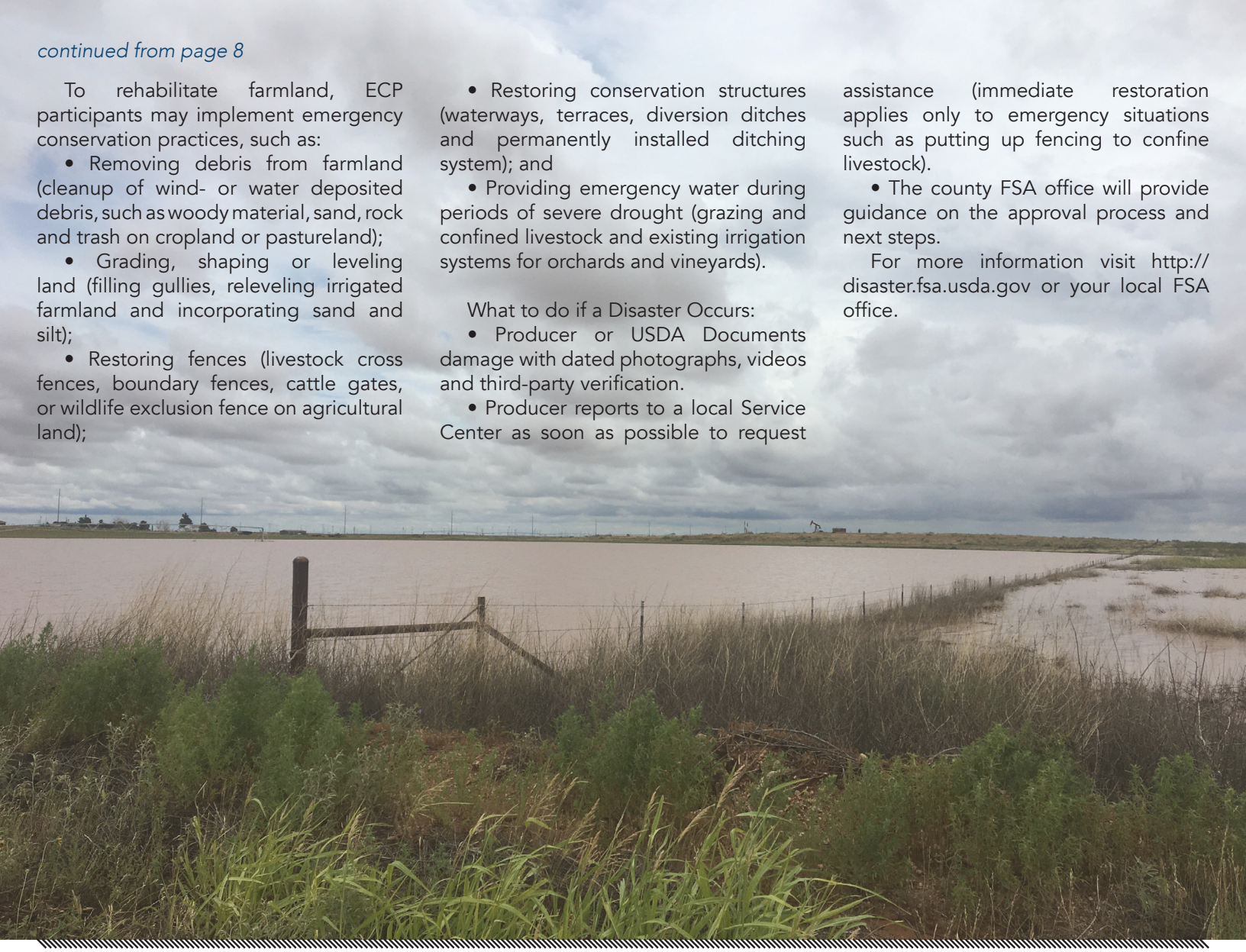
To rehabilitate farmland, ECP participants may implement emergency conservation practices, such as:

- Removing debris from farmland (cleanup of wind- or water deposited debris, such as woody material, sand, rock and trash on cropland or pastureland);
- Grading, shaping or leveling land (filling gullies, releveling irrigated farmland and incorporating sand and silt);
- Restoring fences (livestock cross fences, boundary fences, cattle gates, or wildlife exclusion fence on agricultural land);
- Restoring conservation structures (waterways, terraces, diversion ditches and permanently installed ditching system); and
- Providing emergency water during periods of severe drought (grazing and confined livestock and existing irrigation systems for orchards and vineyards).

What to do if a Disaster Occurs:

- Producer or USDA Documents damage with dated photographs, videos and third-party verification.
- Producer reports to a local Service Center as soon as possible to request assistance (immediate restoration applies only to emergency situations such as putting up fencing to confine livestock).
- The county FSA office will provide guidance on the approval process and next steps.

For more information visit http://disaster.fsa.usda.gov or your local FSA office.



Texas Alliance for Water Conservation Field Walk at Ralls farm

by Norman Martin

The tough job of irrigating in a drought was in the spotlight of a Texas Alliance for Water Conservation Field Walk from 9:00 a.m. to 11:30 a.m. on Thursday (Jul. 14) at the farm of Lloyd Arthur in Ralls, Texas (1102 CR 135).

"We analyzed crops, technology and soil moisture data," said TAWC Project Director Rick Kellison. "We heard Lloyd and Jeff Miller discuss the data used to verify making hard decisions during a costly drought year." Fieldnet, Forefront Agronomy, and Autonomous Pivot also discussed their technologies installed at the farm, he said.

Funded by a grant from the Texas Water Development Board, TAWC operates as a partnership of producers, technology firms, universities and government agencies working to extend the life of the largest subterranean aquifer in the United States. Stretching from the Texas panhandle in the south to the northern boundary of Nebraska, the Ogallala Aquifer lies beneath one of the most important agricultural regions in the United States.

The project uses on-farm demonstrations of cropping and livestock systems to compare the production practices, technologies, and systems that can maintain individual farm profitability while improving water use efficiency with a goal of extending the life of the Ogallala Aquifer while maintaining the viability of local farms and communities. All production-related decisions are made by the more than 20 producers involved in the project.

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Editor's Note: For more information on this year's Texas Alliance for Water Conservation Field Walk, contact Samantha Borgstedt at (806) 789-4177 or samantha.borgstedt@ttu.edu

Beyond The Row Crops: Flying Y Farms

by Samantha Borgstedt

The more technologically advanced and modernized our society becomes, the more disconnected it becomes to its food sources. There is now a grocery store every few blocks in every town, and sadly to most people this is what they consider their local food source. Milk comes from the refrigerated section, green beans from a can, and bread from the shelf on aisle 4.

Young adults today are generations removed from any agricultural roots instilling the knowledge of how, where, and when food is grown. In turn, this knowledge is not being relayed to their children, so once again we are leading ourselves into another generation with no knowledge of local food sheds.

The Coronavirus pandemic shined some light on the importance of local food sources. As supply chains were halted and shelves left empty, the public realized the need to better understand how to grow food and source it locally. The demand for fresh produce, eggs, milk, and meat within driving distance enhanced overnight, as did the desire to learn how to grow a garden and be at least somewhat self-sustaining.

De Ann Yates is owner and operator of Flying Y Farms, a market farm in Tarzan, Texas, located about 35 miles northeast of Midland. Yates and her husband primarily farm about three thousand acres of row crops and run a cow-calf operation. Her love for gardening has always been something she practiced as a hobby, but one Saturday in 2010 she decided to participate in the Midland Downtown Farmers Market and soon realized there was a thriving customer base yearning for fresh, seasonal vegetables.

Yates has continued to vend at the Midland Downtown Farmers Market, as well as provide produce to local restaurants and Midland Meat Company. Flying Y Farms focuses mainly on growing greens with primary crops being spring

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mix, kale, chard, and spinach. Seasonal vegetables are grown throughout the year as weather and crops change. Conservative and organic practices are heavily focused on with above ground drip irrigation and soil amendments.

"I have always had a love for gardening and the challenges and rewards it brings to each day," Yates said. "Each year is different, but lessons learned from each year's challenges can always be applied to the next. I love it when people tell me I cannot grow something in West Texas. I accept it as a challenge."

Yates knew when she decided to make greens her primary crop that the West Texas winds would be her greatest enemy. She applied for a grant with her local USDA office for a high tunnel, which she received. She now has three high tunnels on her market farm, all primarily growing her specialty greens. The tunnels are also spaced out so she can grow crops between them, using their structures as a wind block.

"The high tunnels were a huge turning point in our gardening operation," Yates said. "Farming greens has similar challenges to growing cotton, the wind and blowing sand create the greatest challenge. The tunnels have allowed me to control wind damage and greatly hold moisture and humidity."

Through her local USDA office, Yates has hosted several garden tours for fellow producers and researchers. She is part of a network organized by Ogallala Commons consisting of local food producers and food advocates in Colorado, Kansas, Texas, and New Mexico. The group meets monthly to discuss issues, problems, and solutions to growing, marketing, and advocating for local farmers and all of those that use the products local farms produce.

"I am grateful to be a part of this eclectic group," Yates said. "I have benefited from every session and always take away something that is useful to my own operation. The resources are invaluable to small producers and the group networking, even on Zoom, is motivating."

In addition to working with adults, Yates hosts several school fieldtrips each year. She, along with her daughter Samantha Borgstedt, have taught children from Pre-K to high school about where their food comes from and how it is grown. The students have the opportunity to dig in the dirt finding worms and organic matter to better understand soil health; plant their own seed to take home; and walk-through paths in the garden visualizing all stages of plant growth. Demonstrations are also used to show students about proper watering techniques emphasizing the importance to water enough without over watering plants.

"There is no industry more important than agriculture." Yates said. "I take pride in what I do and sharing it with others, especially others with no prior experience or knowledge of agriculture. If they can better understand what we do and how their food and fiber is grown, hopefully they will have a deeper appreciation."

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