

Memorandum

To: Greg Peterson
From: Brenna Mefford and Erin Wilson
Date: 2/12/2026
Re: 2025 Ag Drought Resilience Project Results



Over the past ten years, drought and limited water supplies have impacted agricultural operations throughout Colorado more frequently than seen historically. In response to increased drought conditions, in 2023 the Colorado Ag Water Alliance (CAWA) and project partners launched the Ag Drought Resiliency Program to provide funding to support the design and implementation of drought resilient and innovative water conservation projects with agricultural water users and water managers. The program serves to address several gaps in funding to support incubator projects on farms and ranches that can improve agriculture's drought resiliency. The program funded 31 projects in 2023, 25 projects in 2024, and 19 new projects in 2025. The program also provided funding for three of the 2023 and 2024 projects to continue their investigation in 2025. The program has funded the following project types:

- Alternative Cropping
- Irrigation Efficiency Improvements
- Hay and Forage Management
- Livestock Management
- Soil Health Improvements

This memo provides a summary of the projects and general lessons learned. One-page summaries of each project completed in 2025 are included in Appendix A, including a few projects that were originally funded in previous years and completed in 2025. Appendix B includes project updates participants in 2023 and 2024.

Projects Selected and Project Status

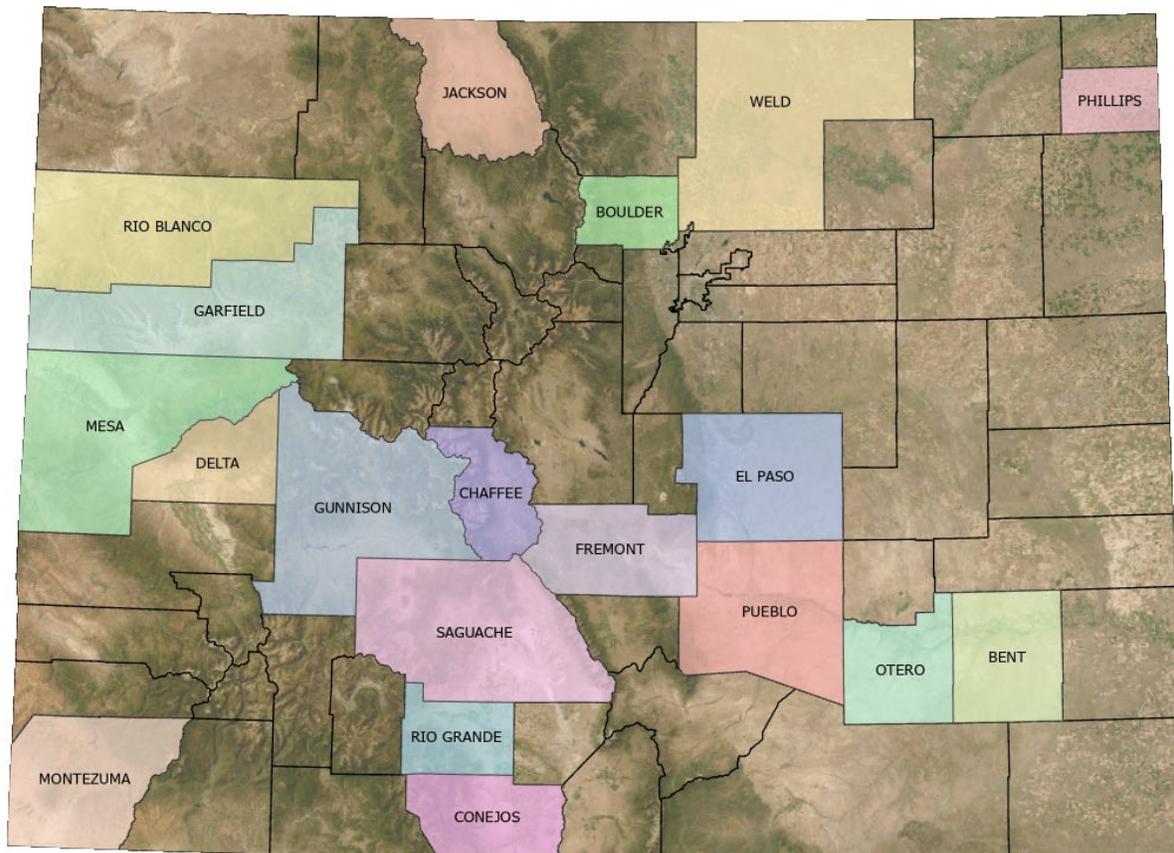
Two of the 19 funded projects for 2025 were not implemented and two funded projects did not begin until the fall of 2025 and will be completed in 2026. The three projects that were continued from 2023 and 2024 were all completed in 2025. The following table summarizes the projects funded and/or completed in 2025.

| Project Name | Year Funded | Project Organization | Grant Amount | Project Type | Status |
|---|--------------------|------------------------------|---------------------|-----------------------|--|
| Economics of Grazing Irrigated Cropland | 2025 | Hemphill | \$21,180 | Livestock Project | Completed in 2025 |
| Innovative Turnout Structure on a Ditch Project | 2025 | Espinoza | \$26,248 | Irrigation Efficiency | Completed in 2025 |
| Automated Flood Irrigation Project | 2025 | Trout Unlimited | \$22,040 | Irrigation Efficiency | Completed in 2025 |
| Biochar Injection Project | 2023, 2024, & 2025 | Lobato | \$2,556 | Soil Health Project | Completed in 2025 |
| Drought Hardy Seeds and Legumes Project | 2023, 2024, & 2025 | Pueblo Seed & Food Company | \$15,000 | Alternative Crops | Completed in 2025* |
| Processing Wool Pellets for Field Application Project | 2025 | Center Conservation District | \$20,000 | Soil Health Project | Completed in 2025 |
| Sod-Bound Meadows | 2025 | Routt County CSU Extension | \$950 | Soil Health Project | Project was not implemented |
| Efficiency - Soil Moisture Probes Project | 2025 | Arnusch | \$13,458 | Alternative Crops | Completed in 2025 |
| Drip Tape - Gated Pipe Connector Project | 2025 | Delta Conservation District | \$1,760 | Irrigation Efficiency | Completed in 2025 |
| Soil Moisture Monitoring Project | 2023, 2024, & 2025 | LoPresti | \$1,950 | Irrigation Efficiency | Completed in 2025 |
| Growing Sesame as a Dryland Crop | 2025 | PFZ Farms | \$1,313 | Alternative Crops | Completed in 2025 |
| Revegetating Degraded Lands Project | 2025 | Cactus Hill | \$12,675 | Soil Health Project | Completed in 2025 |
| Sainfoin Project | 2025 | Jill Lucero | \$14,950 | Alternative Crops | Planted in Fall 2025, Results expected in 2026 |
| Corn/Sorghum Crop Mixes Project | 2025 | Lubbers | \$4,113 | Alternative Crops | Completed in 2025 |
| Improve Soil Moisture for Germination Project | 2025 | Bender | \$2,080 | Soil Health Project | Completed in 2025 |
| Increasing Processing Capacity for Rye Project | 2025 | CO Malting Company | \$20,170 | Alternative Crops | Project was not implemented |
| Contours and Ditches Project | 2025 | Two Roots Farm | \$18,860 | Soil Health Project | Project was not implemented |

| Project Name | Year Funded | Project Organization | Grant Amount | Project Type | Status |
|--|-------------|--------------------------------------|--------------|------------------------|--|
| North Platte Irrigation Season Project | 2025 | North Platte Project | \$6,300 | Irrigation Efficiency | Will be Completed in Spring 2026 |
| Surge Irrigation with Automated Gated Pipe | 2025 | North 40 Technology | \$10,984 | Hay and Forage Project | Completed in 2025 |
| Teff Grass Project | 2025 | Lisco | \$9,731 | Alternative Crops | Completed in 2025* |
| Forage Conversion | 2025 | 2C | \$10,439 | Hay and Forage Project | Completed in 2025 |
| Pasture Improvement | 2025 | Arrowpoint | \$7,000 | Soil Health Project | Completed in 2025 |
| Cover Crop Water Usage | 2025 | Highwater | \$14,592 | Alternative Crops | Completed in 2025 |
| Orchard and Forage Establishment | 2025 | Clayton | \$3,985 | Alternative Crops | Completed in 2025 |
| Virtual Fencing Project | 2024 | Burk | \$29,600 | Livestock Project | Completed in 2025 |
| Increasing Water Holding Capacity in Dryland Project | 2024 | Boulder Valley Conservation District | \$8,750 | Soil Health Project | Started in 2024, Completed in 2025 |
| Kernza and Bale Grazing Project | 2024 | Bent Conservation District | \$11,125 | Alternative Crops | Planted in Fall 2024, No Crop Established , Geese ate all the Seed. Bale Grazing Project was Completed in 2024 |
| Mapping Ditch Assets | 2023 & 2024 | Mapping Ditch Assets | \$20,000 | Irrigation Efficiency | App completed in 2025, Testing Continues in 2026, Project will be Completed in 2026 |
| Kernza and Sainfoin Trials Project | 2024 | Ute Mountain Ute Mancos Ranch | \$22,500 | Alternative Crops | Planted in 2025, Not Enough Water and Issues with Weeds. Producer will try again in 2026. |

*Note that the project was completed, but a one pager is not yet available for these projects. This report will be updated with the remaining one pagers when they are available.

The following map highlights the counties where projects occurred in 2025.



General Lessons Learned

Specific lessons learned by project are documented in the one-page summaries included in Appendix A. The following are general lessons learned across all projects:

- **Sensors:** In the third year of the program, it has been found that participants that utilize sensors, like soil moisture sensors, have the most success when they have technical support from the company and/or a local representative that can help them understand the data and the platform. The largest noted issue with the sensors is trusting the information. Technical assistance that can explain the data and help calibrate the probes is an important component of trusting the data.
- **First Time User Error:** The Ag Drought Resilience Projects were funded to allow producers to try a new method or new technology. The producers often had a steep learning curve as they implemented their ideas. This often resulted in first-time user errors. The producers with the fewest issues often had an experienced outside consultant (agronomist, etc.) helping with the project.
- **Soil Health Projects:** Projects that target soil health often require multiple years to see results. A few of the projects, like biochar, saw changes within the project year, but others, like range land bale grazing, will likely require multiple years to see results.

- **Alternative Cropping:** Several projects that attempted alternative crops are either dryland or water short producers. These projects are greatly influenced by the precipitation received each year. Projects that received enough precipitation to establish crops had the best success, while projects that did not receive enough precipitation to establish crops struggled with germination and weeds. Alternative drought tolerant crops still need water to germinate before they can establish.

Potential for Scalability

In general, most of the projects could be easily scaled and the methods could be used elsewhere in the state. For alternative crop projects, the producers should determine if the new crop has been tested in their specific area before trying out a crop based on results from different climates. A few of the projects noted that while the results could be scaled up, many of the neighbors or other producers in their area would not be interested as the practice was outside of the norm for the area. For most projects, the hardest part would be the initial cost to scale up; either the producer needs a new type of equipment or needs new and/or improved infrastructure to implement. In addition, it is important to make sure there is a market for the new crop. Some participants found that alternative crop markets in their area were small and needed to be developed to scale up the project.

Summary

2025 was an abnormally warm year across the state. Statewide snowpack was below average; western Colorado got little growing season precipitation while eastern Colorado growing season precipitation was average to wet¹. Unlike previous project years, weather did not play as large of a factor in 2025 and most projects were able to be implemented and provide results. The projects that had clear results generally had well defined goals and had both trial and control areas for comparison. These projects were also identified as the easiest to replicate.

¹ Colorado Climate Center – A look back on Water Year 2025 Blog Post.
<https://climate.colostate.edu/blog/index.php/2025/11/09/a-look-back-on-water-year-2025/>

Appendix A

One Page Project Summaries for Projects Completed in 2025

Appendix B

Update on Previously Completed Projects

DROUGHT RESILIENCY PROJECTS

Forage Conversion

Project Type: Hay and Forage Project
Project Location: Rio Blanco County
Grant Amount: \$10,439
Producer Type: Rancher
Irrigation Method: Center pivot
Identified Water-related Challenge: Due to sod binding in Smooth Brome-dominated meadow, forage yields have declined despite ample irrigation water and fertilizer application.



Solution: The producer will establish and measure the characteristics of establishing more drought tolerant, non-sod binding forage. The meadow was ripped, tilled and planted with interim crop(s) for one or two years, then planted to a final mixture of meadow grasses and legumes.

Results: This is the third year of the project. In 2025, the 13-acre treatment portion of a pivot irrigated field was not tilled or seeded. Forage growth consisted of volunteer barley, sainfoin and clover from the 2024 season, along with surviving smooth brome. The treatment field yielded 1.0 T/acre, while the control field produced 2.0 T/ac. An estimated 0.5 T/ac was removed via grazing after harvest. Soil test results are shown below. No fertilizer has been applied on the treatment field since 2022. Fertilization of the control field has been based on soil tests since 2023. The producer started aerating the control field in 2022 and has continued each year since. In 2023, he overseeded the control field with timothy and orchard grass. In 2024 and 2025 the timothy and orchard grass were observed to be fairly abundant among the smooth brome.

| | Soil Test Result | Soil Test Result | Soil Test Result | | Soil Test Result | Soil Test Result | Soil Test Result |
|-------------------------|------------------|------------------|------------------|-----------------------|------------------|------------------|------------------|
| Treatment Field: | NO3-N (lbs/ac) | Phos (ppm) | OM (%) | Control Field: | NO3-N (lbs/ac) | Phos (ppm) | OM (%) |
| Spring, 2023 | 25 | 14 | 5.3 | Spring, 2023 | 34 | 7 | 5.5 |
| Fall, 2023 | 13 | 4 | 4.4 | Fall, 2023 | 7 | 8 | 6.7 |
| Spring, 2024 | 96 | 17 | 3.5 | Spring, 2024 | 37 | 6 | 4.3 |
| Fall, 2024 | 74 | 12 | 6.3 | Fall, 2024 | 31 | 8 | 7.6 |
| Spring, 2025 | 56 | 24 | 4.8 | Spring, 2025 | 13 | 10 | 5.4 |
| Fall, 2025 | 35 | 21 | 4.7 | Fall, 2025 | 4 | 6 | 3.9 |

Scalability: Scalable. Sod binding in Smooth Brome-dominated meadow is a common problem throughout the mountain areas of the west slope. Rock picking from the field may be needed to implement. Costs could include tillage and planting, seed, equipment repair and herbicides, if used. Alternatively, an aerator may be used.

Lessons Learned: Fewer tillage passes were needed in 2024 to prepare a seedbed vs. 2023. The peas in 2023 and clover and sainfoin in 2023 fixed significant soil N despite being visually sparse. Rocks being turned up during tillage were still a problem in 2024. Weeds were a greater problem in 2025 than in 2023 or 2024. The producer will use herbicides to kill the remaining smooth brome and weeds in 2026. The producer now estimates only 30% of the smooth brome and other turf grasses have been eliminated. Based on the control field observation thus far, overseeding and annual aeration may be a simpler and much less costly way of reducing smooth brome dominance.

DROUGHT RESILIENCY PROJECTS

Pasture Improvement – Chaffee County Project

Project Type: Bale grazing to improve pasture

Project Location: Chaffee County

Grant Amount: \$7,000

Producer Type: Rancher

Irrigation Method: portable pipe with sprinklers.

Identified Water-related Challenge:
Improve a weedy, degraded pasture pock-marked by prairie dog holes.



Solution: This project used a combination of re-seeding, limited irrigation, and rotational bale grazing with horses in small paddocks. The 8-acre trial was comprised of 4 irrigated tracts and 4 non-irrigated tracts, which served as the control tracts. Each tract was 1 acre in size. Six horses were used. The objective was to use the bales as a carbon, nutrient and seed source. The horses consumed the bales as feed and trampled some into the ground, increasing surface residue, soil water retention and organic matter. The small acreage parcel on which this trial was conducted is typical of highly sub-divided rural areas near towns where ‘ranchettes’ are common, and horses are often the only grazers. Thus, horses were used to see if they could be utilized with bale grazing to improve pastureland.

Results: Broadcast seeding was done prior to the onset of the bale grazing trial. The 4 irrigated tracts received 4 rounds of irrigation water using portable 3” diameter aluminum pipes with attached sprinkler heads. The round bales were rolled out to increase the area of coverage. The downside of this was that high winds blew some of the hay away. Some of the planted seed (Sand drop, Indian rice grass, thick spike wheatgrass and clover) germinated in the areas where bales and manure created protective moist environments. Total forage cover was higher in the bale grazed tracts, but this was expected as the control tracts were not irrigated.

Scalability: Very scalable as small acreage tracts with limited irrigation water and a few head of horses are common. Round bales are also readily available in rural areas.

Lessons Learned: A harrow was pulled through 2 of the irrigated tracts to help break up the clumps of bale-grazed hay and provide more uniform residue coverage. It was hoped the harrowing would increase desirable forage production. Instead, weeds came up strongly in the area where the harrow had been pulled through. In contrast, the non-harrowed tracts had significantly fewer weeds, indicating the intact hay and manure residue suppressed weeds.

DROUGHT RESILIENCY PROJECTS

Efficiency- Soil Moisture Probes Project

Project Type: Alternative Crops
Project Location: Weld County
Grant Amount: \$13,458
Producer Type: Commodity
Irrigation Method: Center pivot
Identified Water-related Challenge: Increasing scarcity of surface water for historically grown crops.



Solution: Install soil moisture probes in two fields to measure water usage for two different crops – alfalfa and black eyed peas. Confirm the hypothesis that black eyed peas will require less water than alfalfa and help maintain profitability when surface water is limited.

Results: The producer installed Hortau soil moisture probes at three different levels (8, 16, and 24 inches) in two fields. One field was planted in alfalfa and the other in black eyed peas. The soil moisture probes were used to help determine irrigation events, by irrigating to attempt to keep crop stress at a minimum on a water short system. Black eyed peas, as expected, did take less water and allowing the producer to minimize crop stress and keep the soil moisture levels generally in the suggested range of the probes. The probes also helped the producers understand water consumption of alfalfa and how quickly the soil profile was depleted. Crop yield is reduced when allowing crop stress; by using the probes to anticipate irrigations the producer was able to minimize stress and yield drag.

Along with lower water usage, black eyed peas could be a good “tool in the toolbox” to help with weeds such a rye or hard to kill grasses. The producer also believes it could help reduce sawfly by not providing habitat for the wasp to lay their eggs. Black eyed peas do not take much specialized equipment, are drought hardy, and are a great option to break up the grass-on-grass rotation. The main downside is the uncertainty with the marketplace. Currently for a farmer to grow black eyed peas, they require a contract upfront - and the future forecast for the demand for black eyed peas is uncertain.

Scalability: Scalability is primarily dependent upon contracts. If contracts were not limiting, the producer believes there is real scalability for black eyed pea production.

Lessons Learned:

The lessons learned was the importance of keeping the profile wet and not having drastic drying periods. The drying periods require significant water to replenish the profile and by matching the crop to the water available, there is less stress, less water demand, and a better crop. This lesson was pivotal for the producer when determining which crop to use during the legume rotation.

DROUGHT RESILIENCY PROJECTS

Automated Flood Irrigation Project

Project Type: Efficiency

Project Location: Gunnison and Saguache County

Grant Amount: \$22,040

Producer Type: Commodity

Irrigation Method: Flood

Identified Water-related Challenge:

Need a more effective way to flood irrigate fields that optimizes efficiency when water supply is short.



Solution: Install automated water control structures (“auto-tarps”) on four properties in the Gunnison basin. An auto-tarp consists of: 1) A standard structure for water 2) A trap door-type drop gate and 3) A latch control mechanism - all of which allow for automated checking and diversion onto segments of a field based on predetermined conditions.

Results:

Trout Unlimited (TU) installed 30 autotarp latch mechanisms on three properties in the Upper Gunnison River Basin. The latch mechanism can be programmed and communicates with a radio. The radio can then communicate with a smart phone via text messages. A producer can text the door to open or close or schedule a future open/close event. The producers on the three different properties utilized the autotarps for the entire irrigation season in 2025 and provided feedback. There is not currently quantifiable water savings from the 2025 trials; however, producers felt that it saved water due to the decrease in labor needed to move water between fields, as the labor efficiency component of the latch mechanism is what tends to result in water savings. Producers no longer had to spend a day moving tarps and were able to change their watering remotely. Estimated labor savings in 2025 per property was \$2,000.

Scalability: The autotarp could be used in any predominately flood irrigated areas, like the Upper Gunnison. TU is currently working to expand sites to include the Upper Arkansas and the Upper Green.

Lessons Learned:

- Minor tweaks were made to the programming to make it more user friendly.
- Stakeholders that visited the sites suggested an open option rather than autoclose would be beneficial.
- Livestock enclosures are required if grazing takes place in field with equipment.
- Options to fund purchase of equipment for locals is a limiting factor as scaling occurs.
- Lumping of unit purchases (more than 30) brings the cost per unit down.

DROUGHT RESILIENCY PROJECTS

Economics of Grazing Irrigated Cropland

Project Type: Livestock

Project Location: Bent County

Grant Amount: \$21,180

Producer Type: Commodity

Irrigation Method: Center pivot and flood

Identified Water-related Challenge:

Irrigated cropland in the Lower Arkansas Valley of Colorado often lacks enough water to profitably grow crops that are easily marketed in the area.



Solution: Achieve drought resiliency using low-water requirement, low-input crops and adaptive grazing. The idea of planting low input, low water-use crops (sorghums, millet, cereals, etc) for grazing is attractive because of increased drought resiliency and the elimination of mechanized harvest costs.

Results: The producer planted four different crops (milo, sudan grass, warm season cover crop, cool season cover crop) during the summer of 2025 to be used to for grazing in the fall and winter of 2025/2026. The water year was above average for both precipitation and irrigation. In late October the producer began strip grazing the crops using polywire/step-in posts and moved paddocks between four days to a week depending on the crop being grazed and the number of cows. Based on the producers' observations, the average grazing rate is approximately 225 Standard Animal Unit days per year. Below is the producer's economic analysis of grazing compared to crop production.

- Custom Grazing – Avg Profit = \$67/acre (assuming SAU grazing rate of \$1.67/SAU/day)
- Owned Fall Breds to Pairs – Avg Profit = \$371/acre assumes (assumes current valuation of running age cows and calves to wean in April)
- Owned 650# heifers to 850# heifers – Avg Profit = \$250/acre (assumes current valuation of weaned heifers and feeder heifers)
- Harvest and Sell Crops – Avg Profit = \$88/acre (assumes similar crop rotation and revenue/expenses as adjacent farm)

The economics of grazing irrigated cropland are influenced by the class of livestock grazed and market conditions at the time of purchase and sale. In general, owning the cattle grazed appears to be more profitable than custom grazing someone else's cattle and, due to current commodity prices and cattle prices, grazing offered higher profit margins than harvesting the crops.

Scalability: Changes in commodity or cattle prizes will determine if this practice is scalable in future years. Scalability depends on investment in fencing and cattle water and labor availability.

Lessons Learned: Cattle must be exposed to hot wire fence within the confines of a corral for several day before release into the field. Fencing Sudangrass is much easier if crop is swathed or lanes are mowed. Crop insurance is fairly limited on irrigated crops planted specifically for grazing. The type of forage grown highly influences which livestock can be successfully grazed.

DROUGHT RESILIENCY PROJECTS

Innovative Turnout Structure on a Ditch Project

Project Type: Efficiency

Project Location: Conejos County

Grant Amount: \$26,248

Producer Type: Commodity

Irrigation Method: Center pivot

Identified Water-related Challenge:

Water diverted from a ditch to a center pivot, using a lateral and reservoir, experiences high losses.



Solution: Install a pump to divert water directly from the bottom of the ditch. Connect a stainless-steel box to the existing headgate to collect the water. Connect the box to the existing pump for the center pivot.

Results:

On the Manassa Ditch, there has been an increase in center pivots, which has led to changes in how water is rotated to different users. Sprinkler users need less cfs rate over a longer period of time. On each lateral there is a mix of flood and sprinkler users, leading to individual users needing water for different lengths of time. The mix in how much water users need is causing increased tailwater running out ends of laterals and increasing the difficulty to deliver water needed to individual laterals. To help negate this issue, the producer, working with the conservancy district installed a check structure to help slow water so it can be delivered to a pipe that feeds a center pivot. The check structure is a stainless steel box that is attached to an existing headgate. On the bottom of the box is a screen that feeds water directly into pipe that goes to the sprinkler. The benefits of the check structure include:

- Do not need to raise water levels to deliver to end user.
- Water user no longer needs a stabilization pond for their sprinkler, which reduces water loss from evaporation and seepage.
- Structure has shown to reduce tailwater and helps better manage deliveries
- Is a way to improve efficiency on a large open-ditch system without piping and pressurizing the system.

Scalability: The Manassa Ditch plans to install more of these structures on each lateral. This is the third structure, and the largest they have installed to date.

Lessons Learned:

Users that have this structure on their headgate are less likely to take more water than they need. The vibrating trash rack helps keep necessary filter cleanings to minimum, keeping up keep of the structure low.

DROUGHT RESILIENCY PROJECTS

Virtual Fencing Project

Project Type: Livestock

Project Location: El Paso

Grant Amount: \$29,600

Producer Type: Livestock

Irrigation Method: N/A

Identified Water-related Challenge:

More frequent droughts, along with compaction due to cattle has led to lower water infiltration in rangeland soils.



Solution: Utilize virtual fencing on cattle along with soil data and ecology informed grazing management to improve soil health and water infiltration.

Results:

In November of 2025 Vence range collars were placed on 200 red angus cows. The collars were set to on, but no fenceline boundaries were set to allow for the collection of seasonal information on where the cattle naturally spent most of their time during different parts of the year. The collar gps will inform where cattle naturally congregate and the producer plans to perform site and seasonally specific soil and forage tests to determine how the natural cattle behavior impacts the landscape and grasses. After using the 2025 to 2026 winter to observe the cattle movements, the producer plans to adjust the grazing rotation using the fenceline boundaries feature of the collars. The goal of implementing the virtual fenceline will be to optimize the regrowth of grass and for targeted grazing for the rumen bypass.

So far the collars are working as they should, after the initial collaring the producers rode through the cattle the next day to check on how the cows were adjusting and brought in 30 cows to readjust the collar fit to ensure they were not too tight. So far only two collars have fallen off the cows. All of the cows adapted quickly to the collars and returned to normal range behavior.

Scalability: Depending on how the 2025 to 2026 winter grazing season goes, there are other producers in the area that are potentially interested.

Lessons Learned: Getting the collars on is somewhat stressful for the cows. When possible, the producer is trying to time putting on the collars and any major battery replacements for the collars with times the cows would be coming into the pens anyways to prevent unnecessary stress on the cows. The producer is interested to see how the battery capabilities of the collars are impacted by severe cold, and what the lifespan of the batteries currently in the collars will be.

DROUGHT RESILIENCY PROJECTS

Increasing Water Holding Capacity in Dryland Project

Project Type: Soil Health

Project Location: Weld County

Grant Amount: \$8,570

Producer Type: NA

Irrigation Method: Flood

Identified Water-related Challenge:

Different soil testing labs have different theories behind their soil fertility recommendations and, therefore, different ideas of “correct” soil fertility management. How do producers decide which soil labs to trust and utilize?



Solution: Compare two different soil testing labs’ recommendations on yield, nutrient density (which we hope producers increasingly place value in), and soil moisture (some theories of soil fertility management claim to shift soil structure and aid in infiltration/water holding capacity).

Results: A five-acre parcel featured three treatments: (1) soil amendments applied based on the recommendation of a lab that follows a conventional approach to nutrient recommendations, (2) soil amendments applied based on the recommendations of a lab that uses a mineral and cation-balancing approach, and (3) no soil amendments to serve as a control. Amendments were applied in the middle of June and pinto beans were planted at the end of June and irrigated using flood irrigation. One Sentek soil moisture meter was put in each treatment in early July. Pinto beans were harvested from each field in mid-November and samples from each treatment were sent to a nutrient-testing lab. A total of 3,000 lbs of pinto beans were harvested overall with the standard soil test treatment yielding 522 lbs/acre, the mineral-balancing soil test treatment yielding 189 lbs/acre and the control yielding 282 lbs per acre. This indicates that the conventional soil testing recommendations yielded two to three times as much as the other two treatments. All treatments yielded significantly lower than expected yields of irrigated pinto beans most likely due to significant weed pressure and potentially due to late irrigation applications. Soil moisture meters did not reveal any major differences between treatments, but the conventional soil test treatment did appear to fluctuate in soil moisture more greatly than the others (highest values after irrigation and lowest values before irrigation).

Scalability: The producer wants to continue this project into another year to determine if the results are duplicatable, before determining if the results should be scaled up.

Lessons Learned: Herbicide needs to be applied prior to planting to avoid weed pressure. Weed pressure could have been worse in the second soil amendment approach making the results not as reliable. Changes in the soil and associated benefits often take longer than one year to show up, so more research and tracking of soil moisture are needed on this parcel.

DROUGHT RESILIENCY PROJECTS

Growing Sesame as a Dryland Crop Project

Project Type: Alternative Crops
Project Location: Phillips County
Grant Amount: \$1,313
Producer Type: Commodity
Irrigation Method: Dryland
Identified Water-related Challenge: Need to establish a crop that will proliferate in the hot arid conditions of Northeastern Colorado.



Solution: Use a five-acre parcel to test sesame as a crop that can be produce on a dryland operation. The project will assess germination rates; growth, row spacing to decrease pan evaporation (it is a tall thin stalk); pest management; time to harvest; harvesting technique to reduce shatter; and average yield.

Results:

Sesame prefers a very hot, dry climate and has a long growing season (120 days). While some years Colorado's climate may be able to support those requirements, 2025 was not that year. Sesame prefers warm soil temps for germination (around 70 degrees). The spring soil temperatures were variable and it was hard to get the temperature needed by the time the sesame needed to be planted. After planting, a hard rainfall compacted the soils and reduced germination. The producer then re-drilled two weeks later but did not receive enough moisture after replanting to help germination. Some emergence occurred, but the producer struggled with weeds due to being behind the residual spray window. The weather was variable, hot in July and cool in August, which stressed the sesame. Two separate big hail storms also hit the field in late August and early September. Some of the sesame did flower and go to seed, but it wasn't enough to harvest.

Scalability: The producer would be willing to try growing sesame when the area is in a drier and hotter cycle.

Lessons Learned:

- Soil temperature is extremely important for germination
- Sesame is very sensitive to hail.
- Potential producers should check for seed treatments. Untreated seed is best, treated seed makes plant dangerous to bees.

DROUGHT RESILIENCY PROJECTS

Sorghum Planting Rates Project

Project Type: Alternative Crops

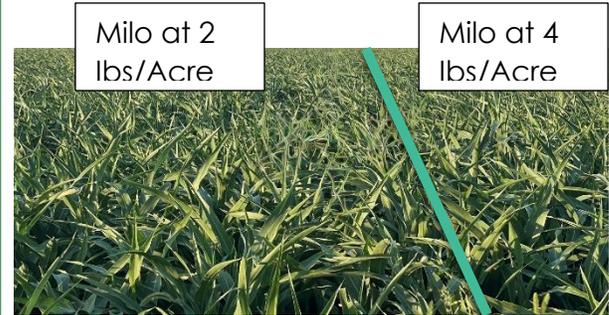
Project Location: Otero County

Grant Amount: \$4,113

Producer Type: Commodity

Irrigation Method: Pivot

Identified Water-related Challenge: Water scarcity and the need for a drought resistant crop.



Solution: Compare water needs and soil moisture differences, as well as economic returns, between fields planted with different lbs/acre of sorghum.

Results:

30 acres on a center pivot were divided into trial plots. Approx 12.5 acres were planted at a higher rate of 4 lbs seed/acre and the remaining 17.5 acres were planted at the low rate of 2 lbs seed/acre. In the area, the typical normal practice is to plant at around 6 to 8 lbs of seed/acre. The field was irrigated with approximately 9 inches of water. The field was purposely under irrigated to see how the different planting rates handled stress. Unfortunately, the field ended up receiving 13.6 inches of rainfall during the growing system so the Sorghum was not very stressed.

The 4 lb/ac milo yielded approximately 124 bushels/acre and the 2 lb/ac milo yielded 107 bushels/ac. These yields were both good for the area and impressive for the planting rate. Weed control was good and the field was very clean, which may have contributed to the higher yields. The producer is now also curious what the upper end of yields could be for the lower planting rates. There was very little visual difference between the two crops throughout the year due to the high precipitation received.

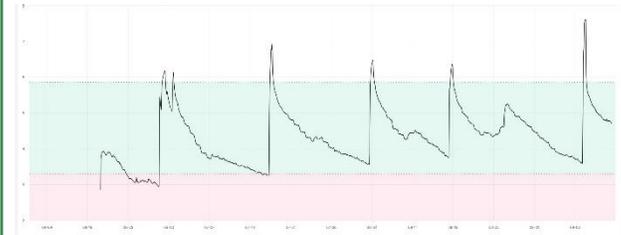
Scalability: The potential scalability has yet to be proven due to not being able to stress out the Sorghum in 2025.

Lessons Learned: The producer could not properly test if the lower planting rates helped with drought resilience due to the large amount of precipitation but did learn that good yields could still be obtained at the lower planting rates. This shows promise for utilizing lower planting rates.

DROUGHT RESILIENCY PROJECTS

Soil Moisture Monitoring Project

Project Type: Efficiency
Project Location: Pueblo County
Grant Amount: \$1,950
Producer Type: Commodity
Irrigation Method: Flood
Identified Water-related Challenge: Water scarcity and the need for increased irrigation efficiency



Solution: Evaluate the efficacy of soil moisture-based irrigation by comparing the results of irrigating two fields; one with irrigation based on past furrow irrigation timing and one with irrigation based on input from two CropX soil moisture probes.

Results: The producer did a split field trial comparing irrigation based on CropX probes to standard practice of irrigation whenever ditch water is available. Two probes were used for the soil moisture trial; one installed at the top of the field and the other at the bottom end of the. The producer irrigated the soil moisture side when the graphs (see figure above) reached the refill point (red line).

Irrigation Results: The growing season had both precipitation and ditch water allocation close to average. The soil moisture side was irrigated 6 times using 16-hour sets for a total of 3.2 ac-ft. The standard irrigated side was irrigated 7 times using 24-hour sets for a total of 5.0 ac-ft. Switching to using 16-hour sets was a significant change and was only made after three years of learning to trust the sensor data. Utilizing the technical support from CropX and a local representative, along with better measurement of irrigation flows, also played a big role in feeling confident to cut back to 16-hour sets.

Yield Results: The soil moisture irrigated field yielded 316.6 bu/ac. The standard irrigated side yielded 320.5 bu/ac. When considering costs of water, pumping electricity, labor, and the soil moisture probes; the net profit difference was \$47.37 per ac higher on the sensor side with 36% less water used.

Scalability: The producer plans to continue using the sensors in future years, in different fields with different soil types. More soil probes may be purchased; the initial investment in the probes is high but when used over multiple years and acres they are about \$10/ac. Even without additional probes, the producer will be able to use what he has learned on other fields, including using shorter runs, especially when water is short.

Lessons Learned: CropX probes are easy to install and remove, and the platform can provide clear graphs and irrigation timing recommendations. It took **3 years** of using soil moisture probes for the producer to fully trust and implement the irrigation recommendations. Technical support is vital. The producer needed assistance from both CropX and a local rep to adjust settings in CropX, interpret the data, and gain confidence in the data. Measuring applied water is an important step in improving efficiency, along with measuring on site precipitation.

DROUGHT RESILIENCY PROJECTS

Drip Tape – Gated Pipe Connector Project

Project Type: Efficiency
Project Location: Delta County
Grant Amount: \$1,760
Producer Type: Commodity
Irrigation Method: Gated Pipe/Drip Tape
Identified Water-related Challenge: Water scarcity and the need for increased irrigation efficiency



Solution: Historically, drip tape has been used with pumps and filters for irrigation. This project tested advanced drip tape that can operate with low pressure and sediment in the source water, which allows operation without requiring pumps and filter. The test involved placing a special gate on the pipe that is used to attach the drip tape

Results:

Since 2023 the Delta Conservation District has worked to develop a prototype to connect drip tape to gated pipe with minimal to no leakage. In 2023 they started with a rigid plastic prototype that leaked a decent amount. In 2024 the District developed a prototype with urethane plastic. Urethane is more flexible and has led to a substantial increase in the quality and user friendliness of the adapter. The District now has a design for two sizes of drip tape. In 2025 the District focused on conducting a small proof of concept field trial. The results were surprisingly successful even though the tape was not used at less than recommended specifications for water filtration and pressure. Both 3/4 and 7/8" diameter drip tape was tested; each tape was 1000 feet long. Over 500 plus hours of irrigation through both tapes was completed with very few issues.

Scalability: The new adapter could be easily used by any gated pipe water user.

Plans to scale up include:

- Turn the prototype into a durable field design able to be used in both major brands of pipe.
- Make versions of the adapter for a variety of tape sizes.
- Develop a small water cleaning unit.
- Develop a business plan.

Lessons Learned:

The specifications for water cleanliness and pressure developed by drip tape manufactures may be rather conservative. Using the tape with dirtier, lower pressure water has risks but can still lead to a successful crop.

DROUGHT RESILIENCY PROJECTS

Orchard and Forage Establishment

Project Type: Irrigation Efficiency
Project Location: Fremont County
Grant Amount: \$3,985.00
Producer Type: Commodity
Irrigation Method: Drip
Identified Water-related Challenge: Maximizing agricultural productivity on saline soil with limited irrigation water.



Solution: Establish semi-dwarfing apple rootstock and grow forage for hay in the alleys between the tree rows. The alley cropping will not only diversify production but should also provide shade needed to cool the soil and reduce evapotranspiration from the semi-irrigated forage area.

Results:

In 2025 the producer expanded the orchard planting an additional 70 fruit trees adjacent to the drought resilient orchard. Different varieties of apple trees, along with peaches and plums, were planted to create diversity in future harvests. Note that the funding was not for the purchase of the trees but contributed to the overall project. In winter of 2025, the producer developed biochar from material on the property. The new trees were planted in a mixture of 50/50 biochar and aged horse manure. The tree roots were also dipped in mycorrhizal fungi and a tablespoon of sulphur was also added to the soil to help reduce the pH.

The trees planted in 2025 grew fast and were larger than the trees planted in 2024 by the end of the 2025 growing season. The producer believes this was the result of the added biochar, which likely helped the soil retain more water. Supplemental irrigation water was added to make sure the trees received water weekly and to ensure the trees were established. In addition, heritage breed turkeys were used to assist with grasshopper control. Overall, the results were better than what the producer was expecting.

Scalability: If more acreage is available, the producer would like to add more trees with forage crop between rows and utilize the biochar. Others could also employ the methods to use biochar when starting young trees.

Lessons Learned:

- The added biochar worked well in helping the soil around the trees retain more water and grow more quickly.
- The additional cover crop added this year most likely aided in keeping the soil wetter.
- Utilizing the turkeys to help protect the trees from grass hoppers allowed for the producer to remove netting from the trees and begin shaping the trees.

DROUGHT RESILIENCY PROJECTS

Processing Wool Pellets for Field Application Project

Project Type: Soil

Project Location: Rio Grande County

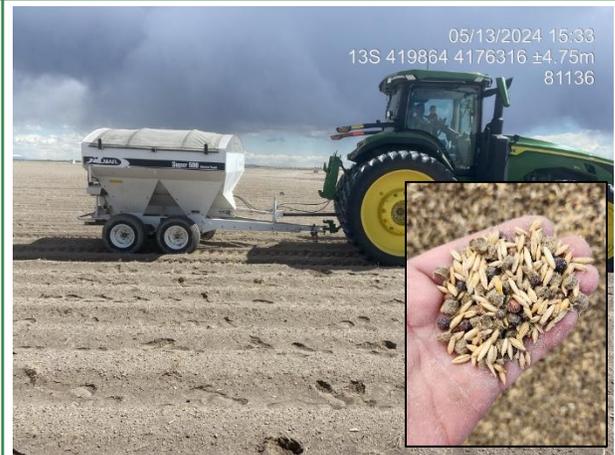
Grant Amount: \$20,000

Producer Type: Commodity

Irrigation Method: Unknown

Identified Water-related Challenge:

Improve water holding capacity in an effort to reduce groundwater pumping.



Solution: The Center Conservation District as part of the Southern Colorado Wool Pellet Project purchased prototype wool production equipment to create wool pellets that could be used to develop quality wool pellets and help determine if wool pellets planted with seed could be used in fields to determine their impact on water holding capacity and crop production.

Results: The participant used multiple grant sources to buy the wool pellet maker they wanted, causing delays in receiving the pellet maker after the irrigation season had begun. In order to do a trial in 2025 season, wool pellets were purchased from a supplier in Colorado. Three testing sites are being used, two in the Rio Grande Valley and one at the Arkansas Valley Research Station. The three testing sites had different soils, different crop types and different water application rates to provide results from a wide range of conditions. The soil moisture at all sites was compared to a control, an area of the field that did not have wool pellets. Soil moisture was monitored on every field to determine how the wool pellets affected water holding capacity. The wool pellets were combined with the seed and drilled directly into rows. In 2025 the areas of the field that contained the wool pellets tended to have higher levels of soil volumetric water content between irrigation events. During irrigation events both the control and wool pellet sections had similar volumetric water content. The wool pellets can hold up to 25 percent of their weight in water and provide an NPK of 9-0-2, improve soil porosity and release up to 50% of their weight in Carbon that stays in the soil. Improving soil health and water retention with wool pellets can drastically reduce input costs for the crop producer while also providing an outlet for excess wool

Scalability: Due to the success of the project, the Conservation District plans to scale up to three to four test sites next year. The plan is to gradually increase field sites depending on the number of pellets they can produce. The District also plans to start producing their own pellets in 2026 using prototype mill equipment.

Lessons Learned: The main lesson learned was that during pellet development low humidity needs to be kept. The 2025 sourced pellets were introduced to high humidity during production which caused felting in the fertilizer spreader. Pellets need to have integrity to withstand spreading. Another lesson is to ensure field is appropriate for testing the wool pellets.

DROUGHT RESILIENCY PROJECTS

Revegetating Degraded Lands Project

Project Type: Soil

Project Location: Conejos County

Grant Amount: \$12,675

Producer Type: Commodity

Irrigation Method: Surface water

Identified Water-related Challenge: A field cannot be irrigated from the acequia and suffers degraded conditions, particularly wind and water erosion.



Solution: Establish a perennial crop on a challenging field by applying manure and compost and then using low and no-till methods to plant into an existing crop or into bare soil.

Results:

After preparing the field, the producer planted a mix of native grass seed, clover and rashes into a field in an effort to transition the field into a perennial pasture. The producer has transitioned most of their fields into perennial pastures, however due to slope and overgrazing, had yet to transition this field. A decent amount of the seeds did germinate and are growing well. No-till practices were used during planting, which could be part of the issue with a sub-par germination as the soil is hard and rocky. The producer plans to keep adding organic matter overtime to help soften the soil. The seeds were planted this fall, so the producer plans to continue monitoring the field, with hopes that with some winter moisture more seeds may germinate this spring.

Scalability: The producer plans to keep moving away from annuals and transitioning more fields into perennial crops. This approach could be adopted on other farms.

Lessons Learned:

Soil preparation is very important to the germination of the perennial grass mix. In very rocky soil, it is extremely hard to do no-till practices and have successful germination.

DROUGHT RESILIENCY PROJECTS

Improve Soil Moisture for Germination Project

Project Type: Soil

Project Location: Boulder County

Grant Amount: \$2,080

Producer Type: Commodity

Irrigation Method: Unknown

Identified Water-related Challenge: Water scarcity and the need for a consistently available water supply to increase soil moisture during crop germination.



Solution: Use silage tarps and floating row covers to increase soil moisture retention and possibly reduce the amount of water for irrigation on germinating seeds for small vegetable operations. Use a water meter to compare the water used for different techniques.

Results: The producer experimented with germinating carrots under three different conditions: (1) under silage tarps, (2) under row cover, and (3) on bare soil. Note that for each irrigation event the producer applied roughly 100 gallons per bed.

Silage Tarp Results:

- Only needed one irrigation, occasionally two, to get excellent germination rates.
- Was able to also take advantage of spring rains and seeded right before the rain and then tarped after the rain to keep from needing to irrigate at all.
- Consistently harvested an average of 500 lbs of carrots.

Row Cover Results:

- Irrigation was still needed, typically every other day to keep enough soil moisture for reliable germination. This resulted in an additional 7+ irrigation events due to the long germination times of carrots.
- Lower yields and spottier germination, specifically in areas where the drip tape was out of alignment with seeding rows.

Bare Ground Results:

- More irrigation than both the other methods.
- Had roughly 40% lower yields on average than the tarped beds and required more hands-on irrigation.
- Harvested on average 300 lbs of carrots, with the largest variability in yield.

Scalability: Could be easily scaled up, the limiting factor is the number of large silage tarps a producer wants to handle. Could also be a productive technique for dryland farms.

Lessons Learned: Tarping allowed the producer to start crops earlier, before ditch water was available, and just rely on a rainfall or snowfall even to germinate a crop. It can be useful on farms relying on flood irrigation, allowing germination without the potential for flood irrigation to wash away seeds. On large farms, tarping may not be a viable technique.

DROUGHT RESILIENCY PROJECTS

Surge Irrigation with Automated Gated Pipe

Project Type: Hay and Forage Project
Project Location: Boulder County
Grant Amount: \$10,984
Producer Type: Commodity
Irrigation Method: Gated Pipe
Identified Water-related Challenge: Need to understand if surge can be useful on forage crop applications.



Solution: Automating gated pipe irrigation with motorized gate valves unlocks the benefits of surging without added labor. This project seeks to demonstrate the benefits of surge irrigation under full automation on a forage field using a side-by-side comparison of surging to continuous flow.

Results: A 20-acre rectangular plot was divided into 8 equal strips (120 ft wide by 900 ft long). Two strips were irrigated with typical continuous flow, followed by two strips surged, two continuous and two surged. Surface water sensors were deployed at the surge section boundaries and at the end of the plot. Each continuous strip was watered until water reached the strip end. Automation allowed all irrigation set changes to be made from a computer or mobile device. The water sensors provided the feedback to know when water reached the desired distance and a change to the next irrigation set was needed. The surge strips alternated each time the water reached a section boundary as indicated by the water sensors, flipping between the East and West sides until water reached the end of both strips.

Water Applied Results - A total of three irrigation runs were applied to the plots. The flow rates were deemed reasonably consistent within each of runs. There was ample spring growth at the time of Run 1, making it particularly difficult to get good irrigation coverage through the dense forage. Runs 2 and 3 showed reduced water and time for the surge plots compared to the continuous irrigation plots. The two surge plots applied approximately 75 to 80% of the water and required time compared to the continuous strips. Total volume of water applied for each area were as follows: Continuous 1: 6.3 ac-ft, Surge 1: 8.1 ac-ft, Continuous 2: 12.8, ac-ft, Surge 2: 9.6 ac-ft.

Yield Results – The first cut was primarily dependent on natural spring moisture, while the second cut provided the best relevance to the irrigation practice. On average, the surge plots yielded 0.9 bales per acre-feet of water more than the continuous plots. Based on the soil moisture sensors Surge 1 plot absorbed significantly less water than Continuous 2, but the yield per acre-ft of water applied was greater in Surge 1.

Scalability: With the right field layout surge and automated gates could be easily used.

Lessons Learned: Leveling and corrugation are critical to successful surging on a forage field. Without a relatively even water front, the benefits of surging are more difficult to achieve as distance from pipe increases. The flow patterns must be well known to effectively place water sensors and leverage automatic set changes. Automated gated pipe allows the implementation of surge irrigation independent of pipe configuration without the burden of added labor.

DROUGHT RESILIENCY PROJECTS

Cover Crop Water Usage

Project Type: Alternative Crops
Project Location: Garfield County
Grant Amount: \$14,591.50
Producer Type: Commodity
Irrigation Method: Sprinkler
Identified Water-related Challenge:

Cover crop seed and irrigation infrastructure are expensive investments for farmers. Need to understand how to establish cover crops in water short systems.



Solution: Deploy soil moisture sensors on a crop cover species in two test blocks. Fully irrigate one of the test blocks and deficit irrigate the other block with half the water.

Results: A one-acre field was divided into two blocks where a cover crop mix of two grass species, a legume, and a flowering legume were drill-seeded. Both blocks received similar water in the beginning of the season (May 31st to June 15th) to allow for successful germination. After germination the deficit irrigated block began receiving half as much water as the full block.

Half water Block Results:

- Approximately 11 inches of water per half acre was applied.
- Slow and incomplete germination, even with receiving the same amount of water as the other block for the first two weeks. The canopy never closed and soil moisture was consistently low.

Full Block Results:

- Approximately 18.2 inches of water per half acre was applied.
- More complete germination, and the cover crop canopy closed. The closed canopy helped keep soil moisture high.

Scalability: The producer plans to use the results of this project and plant a cover crop in a new orchard. Due the results of the project the producer will not plant a cover crop until a reliable irrigation system is established to ensure the cover crop can be established.

Lessons Learned:

- In an attempt to keep the fields receiving the same amount of water in the beginning of the season, the full water block was overwatered in an effort to get the half water block somewhat established.
- The soil moisture needed to be checked daily or weekly to determine the minimum amount of time to irrigate.
- Watering early in the process was crucial to get the cover crops established. Irrigation can

DROUGHT RESILIENCY PROJECTS

Biochar Injection Project

Project Type: Soil

Project Location: Mesa County

Grant Amount: \$2,556

Producer Type: Commodity

Irrigation Method: Dryland

Identified Water-related Challenge:

Improving the water holding capacity of the soil



Solution: This technology, which is currently used in the sports turf industry, will inject liquid and dry media amendments vertically down 6-10 inches into the soil. They will use biochar and inject it into an existing perennial dryland hay crop.

Results:

This project was originally funded in 2023 and is in its third year. Before the 2023 growing season biochar was installed in a hay field using the novel approach. 2023 results showed a 23% increase in soil water holding capacity and 2024 results showed similar holding capacity improvements, along with increased soil biological activity. In addition, treated areas did not require fertilizer. In 2024, there was a roughly 22% reduction in yield, most likely attributed to the reduction in fertilizer two years in a row; however, forage quality was better than the control. In The 2025 project focused on continued data collection to determine if improvements were again seen in year 3. 2025 results were similar to 2023 and 2024, with better soil health and water holding capacity and decreased forage yields compared to the control.

After three years, the project seems to confirm that injected biochar results in significant water and fertilizer savings, with better soil health and forage quality but less yield. The main goal of the project was to determine if the injectable biochar increases water holding capacity quickly, and after three years it can be concluded that it does. Note that the cost associated with the reduced yield may be offset by the reductions in water and fertilizer costs.

Scalability: The participant is currently building a prototype to apply the biochar with liquid nutrients/tees which should improve the nutrient to carbon ratios when applied.

Lessons Learned:

Injectable Biochar has proven to be useful in certain situations but may not be appropriate in other areas or for other uses. If you want poor soil improved quickly, if water is scarce, or if crops are rainfed, this type of biochar could be very useful.

Appendix B Completed Projects Check Ins

The Agricultural Drought Resilience Project has funded many interesting projects where effects can potentially be seen in years after the projects occurred. WWG contacted past participants to document effects of the projects beyond the first year.

| Project | Project Update |
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| <p style="text-align: center;">Black-Eyed Peas Ahead of Winter Wheat Project</p> <p style="text-align: center;"><i>Phillips County 2024 Project</i></p> | <p>Background: Black eyed peas were planted in late May of 2024 in milo stubble and were used as a rotational crop before wheat was planted. The producer found that the peas were drought tolerant and financially viable and hoped they would increase nitrogen in the soil and help save on fertilizer expenses in 2025.</p> <p>2025 Update: The producer did not have to apply as much nitrogen for their topdressing in 2025 as they usually do. They would like to use peas again in their rotation but need to have an outlet for the finished product.</p> <p>The 2024 Project Summary can be accessed Here.</p> |
| <p style="text-align: center;">Bale Grazing to Improve Soil Moisture</p> <p style="text-align: center;"><i>Logan County 2024 Project</i></p> | <p>Background: The producer utilized four different styles of bale grazing to see the impact of the different methods on soil health and water holding capacity.</p> <p>2025 Update: In the spring of 2025, green rings where the bales had been set in the triticale field could still be seen. The plants in that area grew taller and darker green than the plants around them.</p> <p>The 2024 Project Summary can be accessed Here.</p> |
| <p style="text-align: center;">Kernza vs. Alfalfa</p> <p style="text-align: center;"><i>Alamosa County 2024 Project</i></p> | <p>Background: Kernza was planted and compared to Alfalfa in terms of water use, productivity, etc. The producers had trouble planting the Kernza in the fall of 2024 as the seed is very light making it susceptible to wind. The Kernza did germinate with a small amount of irrigation applied. The producer planned to monitor the crop through the winter and hopefully graze yearlings on it in the spring.</p> <p>2025 Update: Only a minor amount of the Kernza survived the winter. The San Luis Valley had an extremely dry winter, and the small patches of Kernza that survived were where snow piled up. The producer believes if they had more snow, that more of the Kernza would have survived. They are still looking at the possibility of using Kernza in the future.</p> <p>The 2024 Project Summary can be accessed Here.</p> |

| Project | Project Update |
|--|--|
| <p data-bbox="228 363 511 428">Kernza and Sainfoin Trials Project</p> <p data-bbox="240 464 500 529"><i>Montezuma County 2024 Project</i></p> | <p data-bbox="561 226 1403 428">Background: In 2023 the producer planted a mix of both Kernza and Sainfoin, but had issues with the irrigation system and crops were overrun with weeds. Only sainfoin re-emerged in spring of 2024. The producer then applied a chemical treatment prior to planting Sainfoin in fall of 2024. The sainfoin had good emergence and no issues with weeds.</p> <p data-bbox="561 464 1382 665">2025 Update: The Sainfoin came back in spring of 2025. Some weed intervention was completed. The producer has found that ground prep is very important for both Sainfoin and Kernza and that weed suppressants are a must as both crops can be easily outcompeted. The producer plans to bring cows down in fall of 2025 and grain the sainfoin.</p> <p data-bbox="561 699 1224 730">The 2024 Project Summary can be accessed Here.</p> |
| <p data-bbox="228 867 511 898">Bale Grazing Project</p> <p data-bbox="240 934 505 999"><i>Boulder County 2023 & 2024 Project</i></p> | <p data-bbox="561 730 1403 898">Background: Beginning in 2023 the producer used ruminant animals with bale grazing on sections of land to disturb the heavy thatch created by brome grass and add a large amount of nutrients to the soil through manure and urine, then plant native grass.</p> <p data-bbox="561 934 1414 1199">2025 Update: The producer has continued to see positive impacts from the previous bale grazing efforts. Soil organic matter was originally 3.6 in 2023 and improved to 3.8 in 2025. The producer is also seeing more plant density and plant diversity in areas that were bale grazed. Both these qualities are important for erosion mitigation and drought resilience. The property was not grazed in 2025 to rest the land, but the producer plans to graze and bale graze the land starting in early 2026.</p> <p data-bbox="561 1232 1224 1264">The 2024 Project Summary can be accessed Here.</p> |
| <p data-bbox="217 1472 522 1537">Orchard Soil Moisture Monitors Project</p> <p data-bbox="285 1572 456 1638"><i>Delta County 2024 Project</i></p> | <p data-bbox="561 1268 1386 1570">Background: The participant installed Soil Scout Soil Moisture Sensor System on a 75-acre orchard. The sensors were utilized to make decisions on how much irrigation water needed to be applied on a weekly basis. The producer found that if the soil water capacity stayed at or above 90 percent of its holding capacity that it would allow for the optimal growth. While growth (vigor) is not a tool you want in a mature orchard, this is still a young orchard, and the trees are not yet fully grown. Certain areas of the orchard had more than three feet of growth.</p> <p data-bbox="561 1606 1403 1808">2025 Update: The producer utilized the Soil Scout Soil Moisture Sensor System again in 2025. The system performed well again and helped the producer with optimal growth. In 2025 most of the trees reached mature size and produced as such. The producer did sell the orchard, but due to how well the system works, the producer plans to move the Soil Scout system to another farm.</p> <p data-bbox="561 1841 1224 1873">The 2024 Project Summary can be accessed Here.</p> |

| Project | Project Update |
|--|--|
| <p>Mapping Ditch Assets</p> <p><i>Fremont County 2023 & 2024 Project</i></p> | <p>Background: In 2023 the participant worked with three ditches to map the ditches using UAVs. From this work, geospatial maps and a geospatial database were developed and ditch managers were trained to utilize these tools. It was realized that the ditches needed an app that is specifically designed for them to help them easily locate infrastructure in the field, make administrative decisions, and note and track issues.</p> <p>2025 Update: In 2024 and 2025 the participant developed the app RecordFlow. The app combines ditch mapping and record keeping and is currently being tested by ditch riders on ditches in Fremont County. A ditch rider can add every structure to the map and include information, notes, etc. The app also provides water rights information. The app is intended to help with ditch company organization, tracking water through the ditch, and tracking infrastructure conditions and other issues. It currently costs \$215 dollars a year.</p> <p>The 2023 Project Summary can be accessed Here.</p> |
| <p>Monitoring Soil Moisture on Different Crop Types</p> <p><i>Larimer County 2024 Project</i></p> | <p>Background: In 2024 the producers installed soil moisture sensors to measure and manage water on four corn fields that utilized different farming practices. The results of the initial study were inconclusive, as the producer’s attempt to determine which fields were retaining soil moisture better after irrigation were inconclusive. The more probes installed, the more time it took to check them and decipher the data.</p> <p>2025 Update: Even though the probes did help to show that decisions on irrigation correlated with the moisture probes, the producers did not see enough cost/ benefit to use them again in 2025.</p> <p>The 2024 Project Summary can be accessed Here.</p> |
| <p>Irrigation Application Project</p> <p><i>Rio Grande 2024 Project</i></p> | <p>Background: In 2024 the producer installed soil sensors to measure both soil moisture and temperature readings. The sensors were installed late in the growing season, but initial data was helpful and the producer was able to tailor the remaining irrigations based on the sensors’ information. Having 10 sensors throughout the field revealed the variability in infiltration rates and soil water holding capacity due to the differing soil types.</p> <p>2025 Update: The producers attempted to use the probes again in 2025. However, they could not get readings from the probes. It is believed to be a communications issue between the probes and the gateway system. A technician from the manufacturer is scheduled to try and remedy the issue. The producer plans to use the probes again in 2026, as they did find them useful and an important tool in their operation even if the results of the 2024 study was inconclusive.</p> |

| Project | Project Update |
|---|--|
| <p data-bbox="240 430 496 464">Perennial Forages</p> <p data-bbox="282 499 457 562"><i>Otero County 2024 Project</i></p> | <p data-bbox="561 233 1398 464">Background: In fall of 2023 the producer planted 59 acres of irrigated farm fields with perennial grasses. The farmer relies on winter irrigation and precipitation through the summer for forage for livestock. Because 2024 was dry, low germination occurred and weeds were abundant in all the fields. Based on past experience from converting annual crop fields to perennial crops, the producer expected it to take a few years to get a good stand.</p> <p data-bbox="561 499 1406 898">2025 Update: The fields that were planted in fall of 2023 are continuing to develop. The success of the fields has been directly proportional to the amount of irrigation water that the producer has been able to apply and the condition of the soil before planting. The fields that had better soil and irrigation systems have performed the best, while those that are harder to irrigate have been slower to develop. The fields that struggled have a mixture of perennial grass and annual weed species. The fields will continue to develop over several years as the grasses get established. In the future the fields will support their cattle operation through grazing and/or baling. The producer plans to continue converting fields to perennial grasses over time.</p> |
| <p data-bbox="240 1037 496 1100">Perennial Forages Mesa Project</p> <p data-bbox="282 1171 457 1234"><i>Mesa County 2024 Project</i></p> | <p data-bbox="561 905 1406 1199">Background: In November of 2023, 50 acres of a perennial forage crop was planted into the alfalfa stubble using a no till drill. The crop had good emergence and despite dealing with extreme drought conditions in the are the producer was able to get one good cutting and then grazed it again in the fall. A comparison of consumptive use using OpenET (etdata.org) showed that the planted field had roughly 4 inches less of ET compared to alfalfa field on the ranch. The producer planned to plant more fields with the perennial forage mixes in future years.</p> <p data-bbox="561 1234 1414 1503">2025 Update: Both 2024 and 2025 turned out to be very difficult years, with hardly any winter precipitation and drought conditions in the summer. In 2025 the producer had almost no irrigation water for most of the growing season. Still, they did observe some germination early after seeding the perennial forage mix again with a no-till drill. Due to the drought, the producer has not observed much growth after germination and does not expect things to improve in 2026 due to continued drought conditions.</p> |

| Project | Project Update |
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| <p data-bbox="217 464 522 527">Compost and Biochar Project</p> <p data-bbox="224 562 516 625"><i>Weld County 2023 and 2024 Project</i></p> | <p data-bbox="561 226 1414 590">Background: The project began in 2023 by implementing a composting system that improved soil moisture retention on both dryland fields and irrigated fields. The compost mix was composed of manure, straw chaff, brewer’s yeast salvage, and biochar. In 2024 the project continued with more acreage and refined application techniques. In 2024 the producer saw the soils Cation Exchange Capacity increase by three percent, which indicates higher soil fertility and ability to supply nutrients to plants. The producer’s 2024 Winter Wheat yield increased by roughly 20 percent. The producer planned to continue with additional treatments into 2025.</p> <p data-bbox="561 632 1406 989">2025 Update: Like many of the other projects, the producer was impacted by drought in 2025, with two of their water sources going dry. The producer was still able to plant dryland forage oats and dryland Hard Red Winter Wheat on two fields that had been treated with the compost biochar mixture. The forage oats yields were roughly two tons per acre, which was 50 percent more than expected based on previous crops. The winter wheat yielded roughly 60 bushel/acre, which was a 20 percent increase from prior harvests. In 2026 the producer plans to apply a new biochar compost tea mixture to see how it does compared to the previous biochar compost mixture.</p> |