Agriculture Water Demonstration, Research, And Implementation Pilot Program (AG-DRIP)

2025 Annual Report

Utah State University Extension – Matt Yost, Burdette Barker, Elisa Flint, Silas Ekadu

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Executive Summary

The Agricultural Water Demonstration, Research, and Implementation Program (AG-DRIP) is an irrigation research outreach program, funded by the Central Utah Water Conservancy District and the Colorado River Authority of Utah to promote sustainable water management practices in agriculture in the Colorado River Basin of Utah**.** The basin continues to face the brunt of drought leading to water scarcity, resulting in constraints to meet the competing demands from agriculture sector, urban areas and the ecosystem. The program was launched in 2023 and enrolls 25 to 32 participants annually; to date 77 participants have joined (21 in 2023, 25 in 2024, and 31 in 2025). The participants are provided soil moisture sensors, a smart flow meter or monitoring device, and weather stations with telemetry for real-time data monitoring to enable them make informed decisions on irrigation scheduling/management plans. Irrigation evaluations were conducted on 15 participants farms and will continue when the season resumes. The AG-DRIP program is one of Utah's Agricultural Water Optimization efforts addressing water scarcity challenges in the State through innovative leveraging of technology advancements in water resources management. This report highlights AG-DRIP's progress and achievements for the year 2025, such as; enrolling 31 participants, having increased interaction with soil sensor data, successfully installing flow meters and telemetry systems for enrolled participants, having participants utilize more of their seed and irrigation credits, and interacting with participants through winter workshops and field days to continue in education outreach about the program and other agricultural topics.

Contents

Background

The AG-DRIP program is an irrigation research outreach program at Utah State University, designed to help increase agricultural resiliency to drought and conserve water in the Colorado River Basin. The five-year, 5 million USD grant, launched in 2023 is co-sponsored by the Central Utah Water Conservancy District and the Colorado River Authority of Utah and is aimed at helping farmers and ranchers in the Colorado River Basin of Utah. Many farmers and ranchers in this region faced the brunt of the mega-drought of 2020-2022, with massive losses in farm production and profits. The program leverages advancements in technology to improve irrigation management and measurement.

The program is located in the Colorado River Basin and Central Utah Water Conservancy District boundaries within the state of Utah (Figure 1). Each year, approximately 25 growers are enrolled in the program. While the program originally planned to include water managers, the focus changed at the end of 2024 to work with only farmers and ranchers. Due to this shift, as of 2025, up to 32 farmers can be enrolled as participants each year, and current participants are able to enroll a second field when slots are available. To date, the program has a total of 77 participants, with 14 of those participants having two fields enrolled in the program. Each participant has a soil moisture sensor station and flow meter or monitoring device installed at a specific field of their choosing and a weather station installed, if applicable. Instruction on how to navigate and use the data from the flow meters, sensor and weather stations are performed throughout the year through personal and group zoom meetings, as well as in person instruction and workshops. Each participant is asked to develop an irrigation management plan of at least 5 years for their farm to help them establish irrigation management and measurement goals for the future. This plan is simply for them and the directors and managers of the project are available to assist with any questions or suggestions they may have for their specific goals.

Each participant receives a $2,000 credit to purchase seed of their choosing that has characteristics of improved water efficiency or a crop that may be better suited to their area that they have previously not attempted to grow. This credit can be used anytime during their time participating within the program, as many participants have their own schedules of crop rotation and production plans. Irrigation evaluations are also performed at each participant's field to assist farmers in understanding irrigation uniformity within that irrigation system and what steps can be taken to improve irrigation application at that specific field. At the end of each calendar year, participants are required to complete an annual report form that determines progress of implementation of each of the aspects of the project. The majority of participants to date have completed this survey at the end of each year. This report form assists the program directors to know how to better accommodate the participants in any areas additional aid is needed, as well as provides most of the data provided in this report. When participants complete their annual report forms, they are eligible for an annual $750 irrigation credit at an irrigation or crop input dealer of their choosing. These irrigation credits are available to assist farmers on a yearly basis with irrigation maintenance and upgrades.

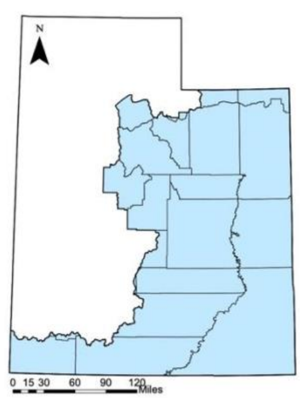

Figure 1. Boundary limits of the Agricultural Water Demonstration, Research, and Implementation Pilot Program (AG-DRIP) are shown in blue

Farmer Participants

2025 was the third of the five-year AG-DRIP pilot program. To date, the program has 21 participants who signed up in 2023 and have completed their third year, 25 participants who signed up in 2024 and have completed their second year, and 31 participants who signed up in 2025 and have completed their first year (77 total, Figure 2a). For each participant enrolled, a representative field was selected by the participant to use for irrigation management and measurement. On some participant's fields, this was a field with average conditions and for others it was one of their most problematic fields that had soil or irrigation issues. The participants in 2023, 2024, and 2025 covered a large variety of farm sizes, crops, soil types, irrigation systems, and climates throughout the program area (Figure 2b, Appendix Tables 1 – 6 & Figure 1). Many of the representative fields were alfalfa and grass hay, but there are also a few fruit and vegetable fields.

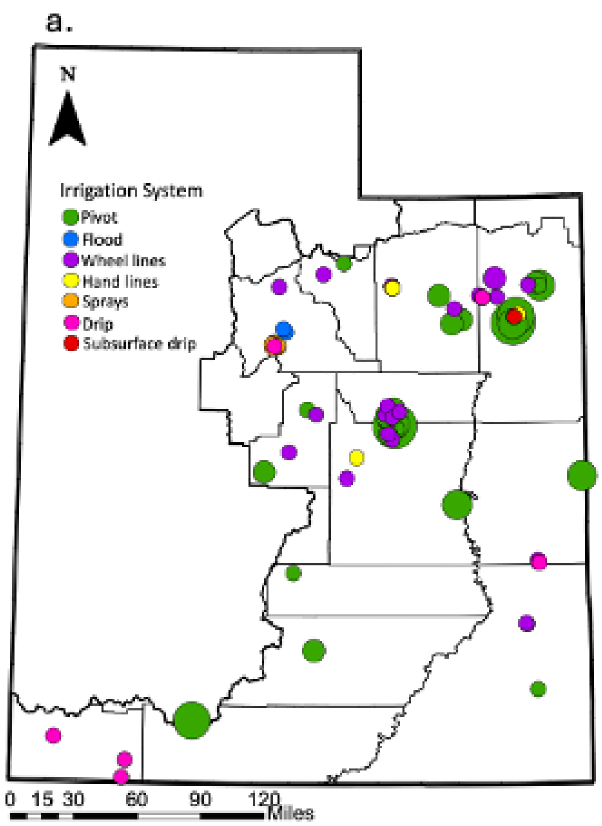

Figure 2. All current participant locations with their specified irrigation systems colored circles (a) and crop type in colored circles (b)

Farm Soil and Water Sample Analysis

Soil and irrigation water samples were collected at each participating field to provide the AG-DRIP participants with a baseline of information regarding their salinity and sodium absorption rates (SAR) that can impact irrigation management and crop production (Figures 3-4). Nutrient levels were also provided on the reports for the participant's reference and individual use. Soil and irrigation water samples were sent to the Utah State University Analytical Lab (USUAL) for analysis and interpretation. Soil reports included pH and salinity from a saturate paste, texture via the texture by feel method, Phosphorus (P) and Potassium (K) using the Olsen Bicarbonate method, Nitrate (NO_3-N) using Calcium Hydroxide method, all micronutrients [Zinc (Zn), Manganese (Mn), Iron (Fe), Copper (Cu), Chlorine (Cl), and Boron (B)] using the diethylenetriaminepentaacetic acid (DTPA) extract method, Sulfate (S) using the Calcium Phosphate method, and organic matter (OM) using the Walkley-Black method. Water reports included information about electrical conductivity (EC), nutrient concentrations (Ca, Mg, Na, B, SO4, and Cl), as well as SAR and bicarbonates (Table A4).

From the soil reports, 96% of participants who had soil SAR tested resulted in levels below the sodic level of 13 and 86% of participants had soil salinity levels below the saline level of 4 dS m^{-1} (Figure 3) (Barker et al., 2023; Hopkins et al., 2007). From the irrigation water reports, 8% of participants had a high risk of infiltration problems when examining their ratio of irrigation SAR and EC levels (Figure 4; Barker et al., 2023; Hopkins et al., 2007). Participants that did have high risk salinity and sodic levels in either of their soil or irrigation reports were notified and provided with the Utah State University fact sheet linked here and input from AG-DRIP team members and Utah State University's extension soil specialist. This input includes advice on how to best amend their soils and irrigation water, if necessary, or what crops to grow in those conditions.

While 74% of participants have yet to adjust any fertilization rates and/or apply any soil amendments, there has been positive feedback from participants receiving the soil and irrigation reports about interest in making the necessary adjustments to improve their production. Every participant received their reports via email shortly after the AG-DRIP team received their soil and irrigation water reports. If participants reported that they did not receive or understand their reports (Figure 5), we plan to resend reports and follow up to make sure they understand their soil and irrigation water data. Soil and water nutrient reports are available in the appendix (Appendix, Table 1 – 4).

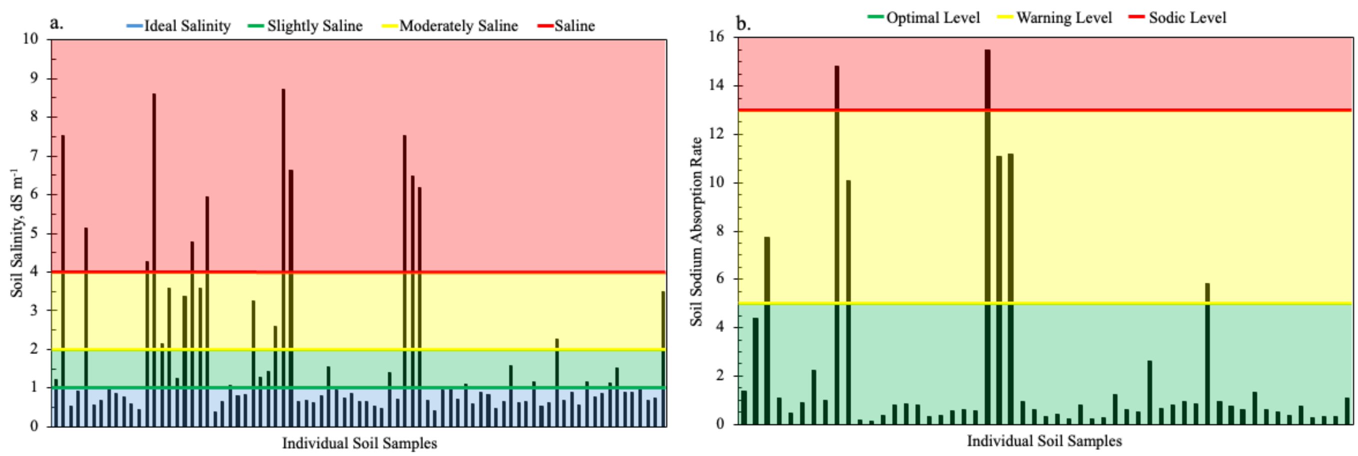

Figure 3. Soil salinity (a) and sodium absorption rate (SAR) values (b) at all participant farm locations from soil reports

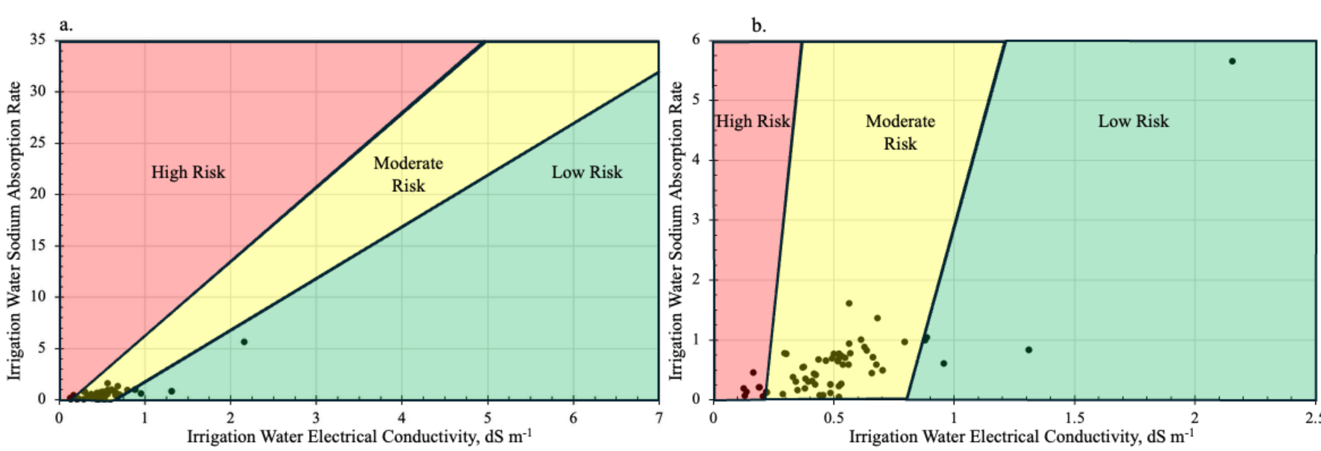

Figure 4. Scatterplot of irrigation water Sodium Absorption Rate (SAR) and irrigation water electrical conductivity (a) and the same scatterplot zoomed in (b) at all participant farm locations from irrigation water reports to show the risk of water infiltration problems

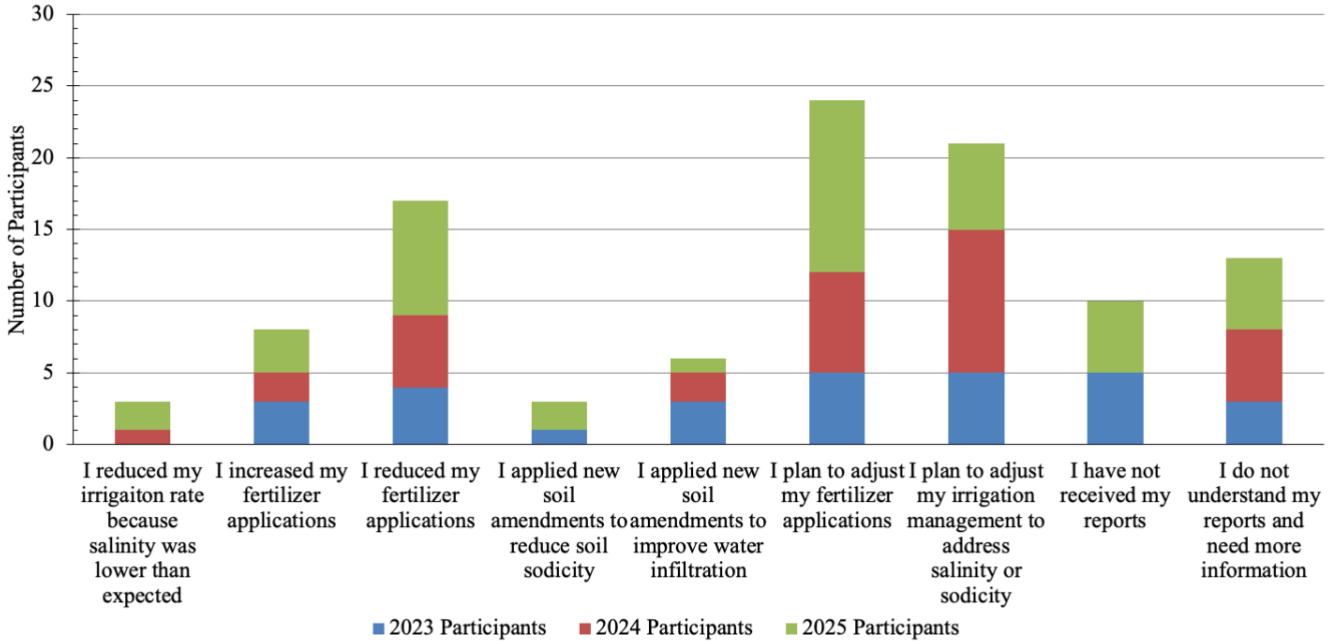

Figure 5. Survey responses from 2023 participants (blue), 2024 participants (red), and 2025 participants (green) on use of soil and irrigation water reports

Farm Soil Sensor Data and Implementation

Soil moisture sensor stations (Meter Group TEROS 10 and TEROS 21 soil moisture and matric potential sensors) were installed on the representative field at each farm for 2023, 2024, and 2025 participants. In-field soil sensors serve many purposes. First and foremost, sensors help participants make data-informed decisions about irrigation scheduling (when and how much water to apply). Irrigation scheduling was the primary focus (of the work with participants, including zoom meetings, individual phone calls and field days) in 2023, 2024, and 2025. Soil sensors can also be used to estimate soil water balance for estimating evapotranspiration (ET). In 2026, AG-DRIP staff will compare soil data with other ET estimation approaches using the weather stations and OpenET (Figure 6 & 11).

*Figure 6. Soil sensors and data logger installed in fields during the 2023 and 2024 growing season*s

In total, a soil moisture sensor was installed for each of the 21 participants in 2023, each of the 25 participants in 2024, and each of the 31 participants in 2025. With a wide variety of crops, irrigation systems, water turn schedules, and time availability of the participants, there has been varying levels of sensor adoption and implementation for irrigation management. While some participants have shown genuine interest in utilizing the sensor data for irrigation management and have incorporated the data into their irrigation management, others have not investigated it yet (Figure 7). Lack of adoption may be due to sensors being installed mid- or late-irrigation season, or possible lack of interest, time, or understanding of the benefits of the sensors. At the end of 2025 growing season, participants indicated in their annual report how frequently they checked their soil moisture sensors and why they may not have utilized them if they did not check them. Of the 77 participants, 49 had checked their soil moisture data daily, weekly, or before each irrigation event (Figure 7). From the 2023 and 2024 participants, those who checked their soil moisture sensors have increased from last year by 14 and 4%, respectively. It is anticipated that use and utility will continue to increase in 2026 once more personal training has been provided during winter workshops and participants have received support for an entire irrigation season. Participants who did not check their sensor data typically forgot, but a few either did not have time, found it difficult to login, or did not understand what the data was telling them (Figure 8).

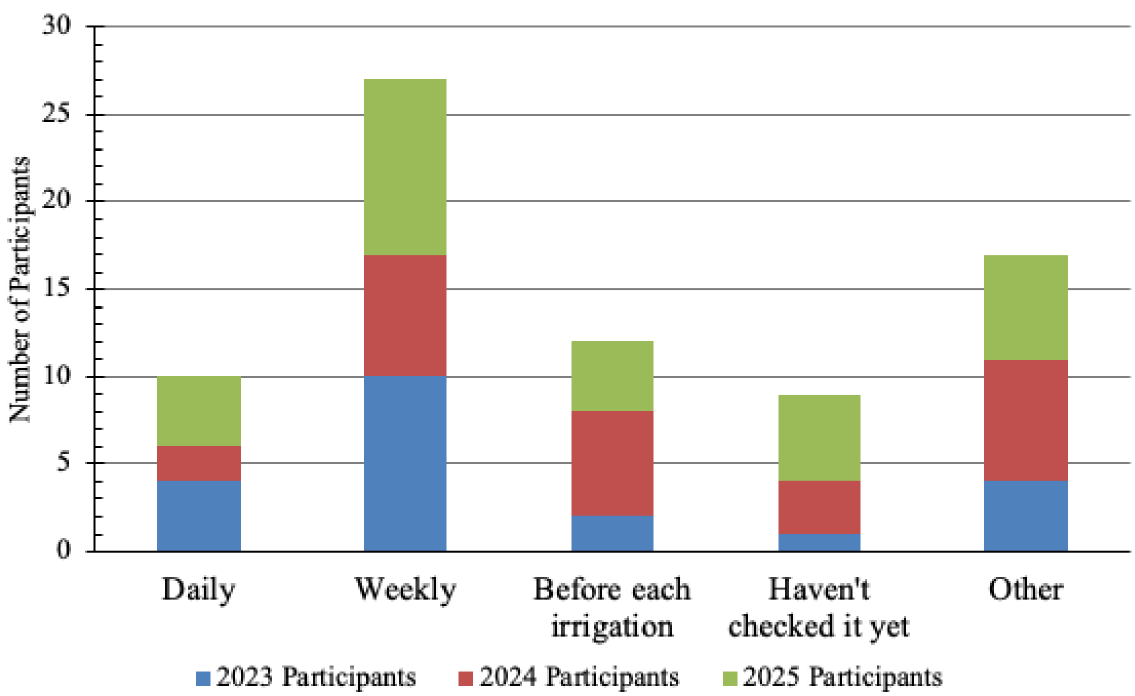

Figure 7. Report from 2023 participants (blue), 2024 participants (red), and 2025 participants (green) on frequency of checking the soil moisture sensor data online during the 2025 irrigation season

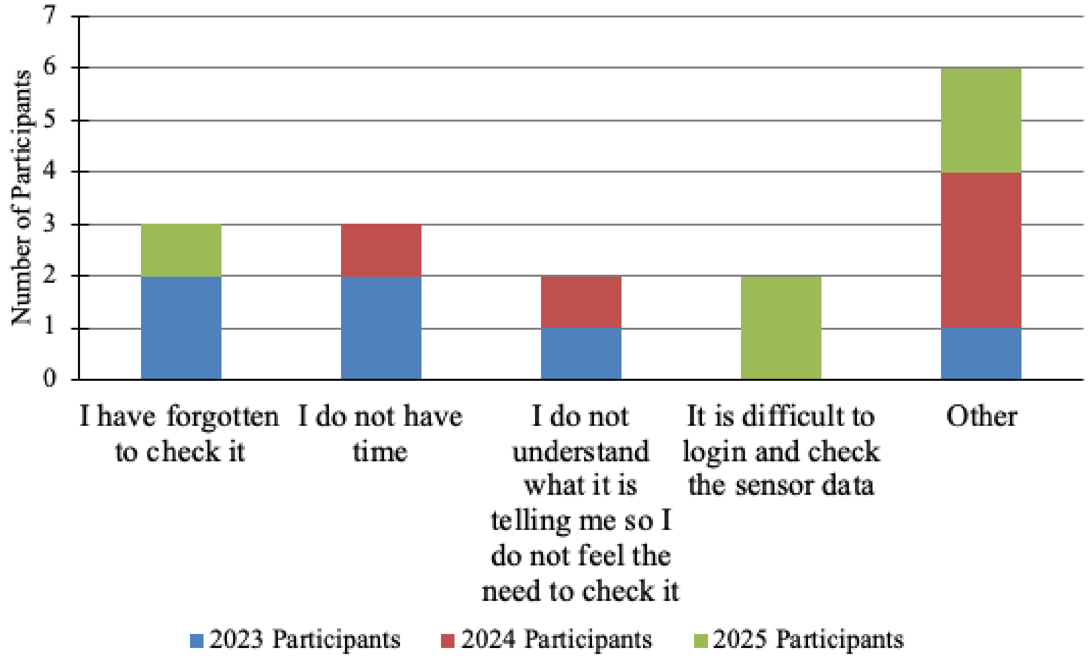

Figure 8. Report from 2023 participants (blue), 2024 participants (red), and 2025 participants (green) on reasoning for not checking soil moisture sensor data, if applicable

While adoption of utilizing the soil moisture sensors for irrigation management is still underway, participants were asked how they have adjusted water management based on their soil sensor data. Some participants applied more irrigation water, and some applied less (Figure 9). Some participants have also adjusted the timing of their irrigation events based on soil moisture sensor readings (Figure 9). Fourteen participants, four who enrolled in 2023, six who enrolled in 2024 and four who enrolled in 2025 have not changed their irrigation rates, which could be due to a lack of understanding of the soil moisture sensor data (Figure 9). Winter workshops and continued one-on-one meetings are intended to help farmers understand the soil moisture sensor data and the potential benefits the data has in assisting with irrigation management.

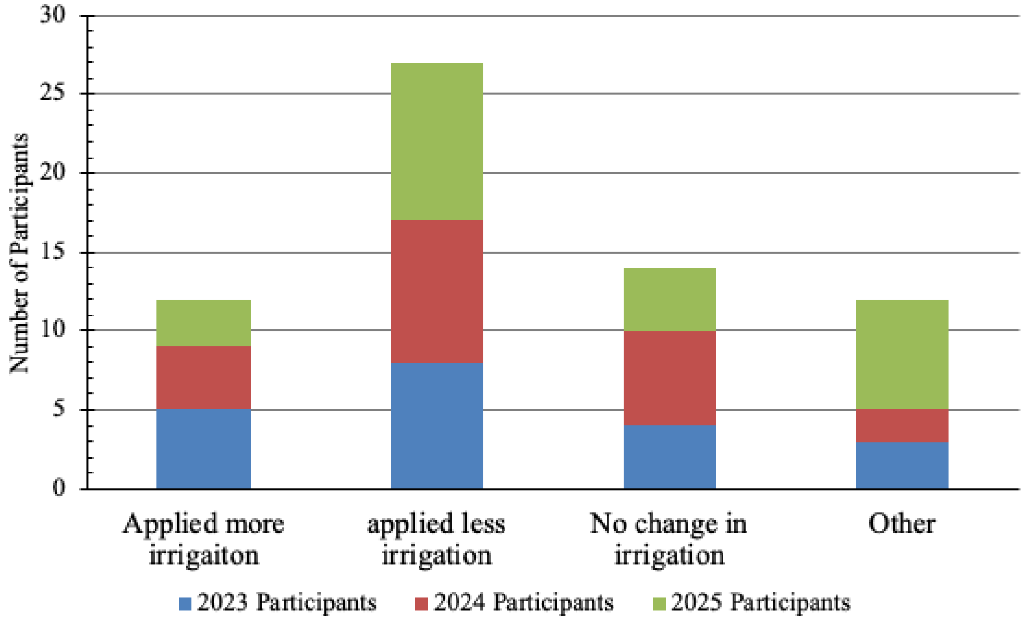

Figure 9. Report from 2023 participants (blue), 2024 participants (red), and 2025 participants (green) on change in irrigation from soil moisture sensor data

Graphs of soil moisture sensor readings from the 2025 growing season for two 2025 enrolled participants, one 2024 enrolled participant and one enrolled 2023 participant are shown in Figure 10. All four participants have taken time to understand the soil moisture sensor data based on individual meetings to review the sensor data and their participation in the monthly AG-DRIP meetings for all participants. Figure 10a is an example of soil moisture sensor data from a 2025 participant under pivot irrigation growing silage corn under a priority call-in water turn system in Sanpete County. The 6 inch water content was typically below the 6 inch field capacity during the irrigation season and only during the very hot portions of the growing season did the 6 inch matric potential fall below the refill point. This refill point of -50 kPa for corn indicates that when the matric potential levels reach -50 kPa or below, the crop needs water or yield could be negatively impacted. The 18 and 30 inch depths were each above their calculated field capacity values from their historical sensor trends. The 18 and 30 inch depth field capacity values are not shown in the figure, as this is estimated with limited data.

Figure 10b is an example of soil moisture sensor data from a 2023 participant under pivot irrigation growing field corn under a call-in water turn system. The farm is located in Uintah County and the participant consistently checked the sensors and made irrigation decisions accordingly. This particular grower has his sensors in a sandy loam soil, and he has seen benefits to his production by increasing his irrigation based on the sensor data. The 6 inch water content was consistently between its respective refill and field capacity values during the growing season. While field capacity and refill values were estimated for the 18 and 30 inch depths (values not shown in figure), it is assumed these depths were within their respective values during the growing season. The matric potential value at the 6 inch depth for this participant was typically above -50 kPa, showing that the majority of the time during the growing season, the crop was not experiencing crop stress that could negatively impact yields. If matric potential values did go below -50, it is clear that the participant either had water coming shortly after, or knew to call in water to move the crop out of a stressed state.

Figure 10c is an example of soil moisture sensor data from a 2025 participant. The participant from Figure 10c grew alfalfa under wheel line irrigation in Carbon County. This participant utilized his sensors to adjust his irrigation set time by keeping his matric potential value above -150 kPa. An alfalfa crop is considered to be in a stress state if the matric potential readings in the soil go below -150 kPa and could negatively impact yields. This grower shared that he historically irrigated in two 24-hour sets before each cutting. This year, due to the sensor data, he cut back his second irrigation set from a 24-hour set to a 12-hour set. He mentioned that he saved water and improved yields in comparison to historical yields on his farm. The 6 inch water content was over the field capacity value shortly after watering, which is typical for the 6 inch sensor, as water is moving into the deeper depths of the soil profile. The matric potential did not drop below the -150 kPa value unless it was during the stage of cutting and bailing hay. The 18 and 30 inch depths were potentially above field capacity at different times of the irrigation season (values of 18 and 30 inch refill and field capacity levels not shown in figure). This could be due to irrigating in 24 hour sets, and adjustments could be made in the future to keep water from flushing through the 30 inch sensor.

The participant from Figure 10d is a 2024 participant, who grew alfalfa under wheel line irrigation in Utah County. The 6 inch water content did go past the field capacity a few times for that participant's field. The 18 inch depth was above its estimated field capacity value after most irrigation events, but only the first few irrigation events caused the 30 inch depth to go above it's field capacity level. The participant noted that he is planning on changing his irrigation scheduling next year to review the differences in sensor and yield data from this current year to the next year. The matric potential value at the 6 inch depth also reached levels below -150 kPa, representing crop stress. While some of these events with such low matric potential values were during the cutting and bailing process, others were not. This participant has had multiple individual zoom meetings and phone calls with the Ag-DRIP staff towards the end of the growing season to understand the sensor data. He is hopeful to evolve his irrigation management, especially his set timing, based on the sensor data.

Four of the monthly AG-DRIP participant meetings in 2025 have been dedicated to teaching participants how to navigate the soil moisture sensor data and manage irrigation events. Phone calls, recorded videos, and in-person consultations with participants who were not able to attend the monthly meetings have also been offered to instruct participants on navigating the online software program where soil moisture data are available (METER Group's ZENTRA Cloud). Increased utilization of the soil moisture sensor data is anticipated as workshops, trainings, and assistance is provided to participants.

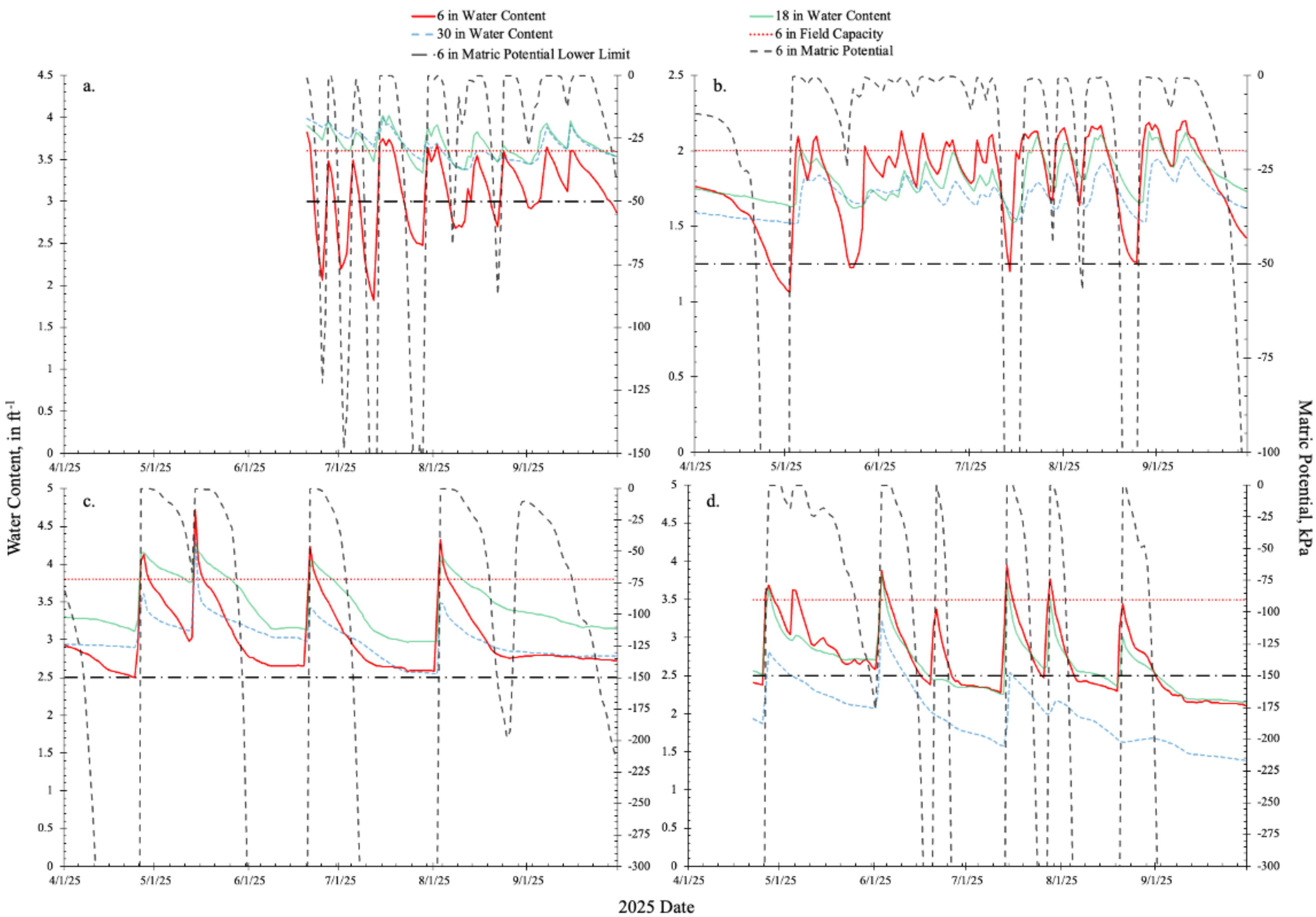

Figure 10. Examples of soil moisture sensor data from 2025 participants (a. & c.) a 2024 participant (d.) and a 2025 participant (b.) during the 2025 growing season. Red solid lines represent the 6 inch water content sensors, transperent green lines represent the 18 inch water content sensors, and dashed, transparent blue lines represent the 30 inch water content sensors. Dotted upper red lines represent the 6 inch field capacity. Black dashed lines represent the matric potential values at the 6 inch depth. Dashed and dotted black lines represent the lower limit of matric potential at the 6 inch depth for triggering irrigation events.

Farm Weather Stations

At farms where there was not a nearby weather station, an automated weather station was installed (METER Group ATMOS 41W sensor) near the representative field (Figure 2b, Figure 11). Participant feedback was mixed on whether or not they have utilized the weather station data for irrigation management and if there are any barriers to using the weather station data (Appendix, Figures 1 – 2). Winter workshops and continued one-on-one meetings focusing on utilizing weather station data may also improve participant use of weather data.

Figure 11. ATMOS 41W weather station installed

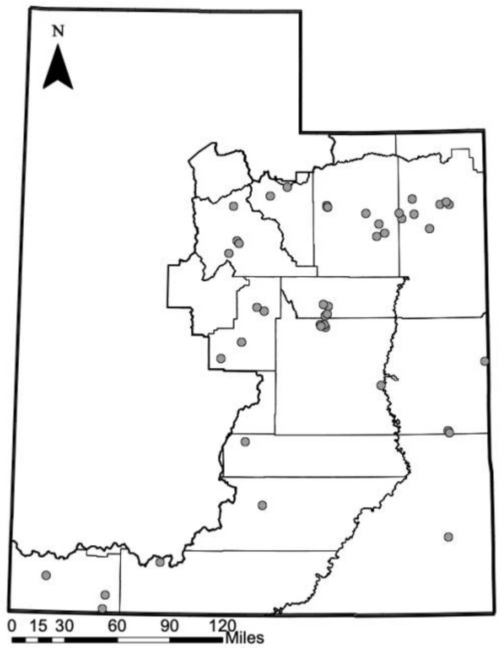

Figure 12. Weather station installations of 2023, 2024, and 2025 AG-DRIP participants

Flow Meters and Telemetry

The Ag-DRIP program leverages high-accuracy flow measurement and real-time telemetry to transform "estimated" water use into "documented" water management. A total of 33 magnetic flow meters were procured and installed on irrigation systems in spread across all counties southern Utah (Utah, Carbon, Emery, Sanpete, Duchesne, Wasatch, Grand, Kane, Washington and Uintah) where participants are located. The sites were surveyed to determine the ideal location for mag-meter installation. A straight section of pipeline with sufficient upstream and downstream lengths was selected in each case to insure stable flow conditions. All the installed meters have Modbus communication protocol for transmitting flow data accurately and efficiently. The meters can read and transmit various operational parameters, such as instantaneous flow rate, cumulative flow, velocity and alarm status. Data will continue to be collated when the irrigation season begins. Utilizing Modbus for mag-meters allows for efficient and robust communication in industrial settings, ensuring accurate data transmission and system monitoring.

Out of the 33 participants who have installed flow meters, benefits such as reducing irrigation (9 participants) or increasing irrigation (3 participants) has already been utilized to optimize crop production (Figure 13). Three have even stated that the flow meter has assisted them in finding system leaks or inefficiencies (Figure 13). While 20 participants have not used the flow meter for irrigation management yet, these flow meters were most likely installed after the 2025 growing season was completed (Figure 14). Many participants have voiced their interest in utilizing the flow meter in the 2026 growing season. Seven participants are still working on gaining access to their data (Figure 14). Only a few have forgotten to check their flow data. Discussing the usage of flow meter data for irrigation management is a topic that has been reviewed in monthly meetings and will continue to be reviewed as growers have flow meters installed on their farm. Many more flow meters are currently being installed during the winter of 2025-2026 for growers to use in the upcoming growing seasons.

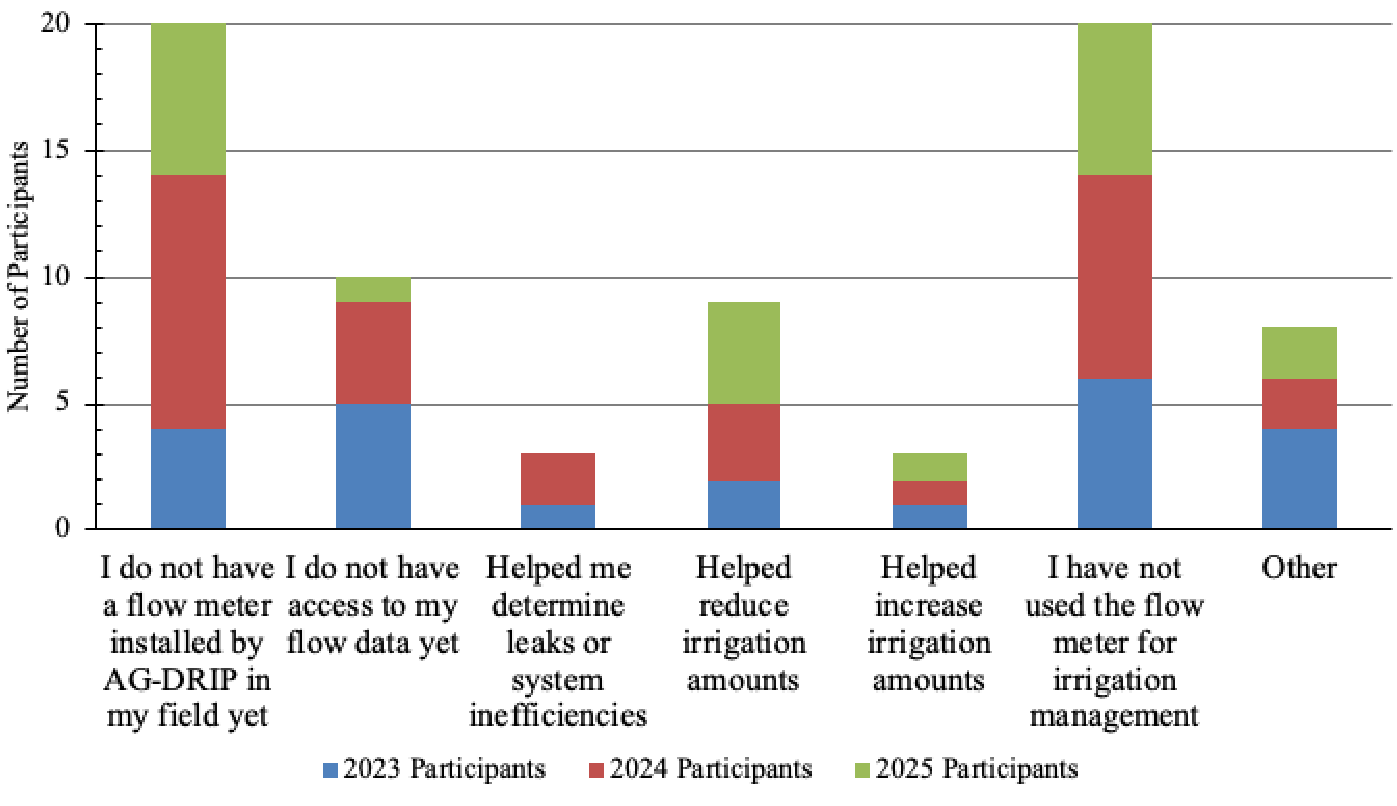

Figure 13. Report from 2023 participants (blue), 2024 participants (red), and 2025 participants (green) on how their installed meter (if applicable) assisted in irrigation management this year

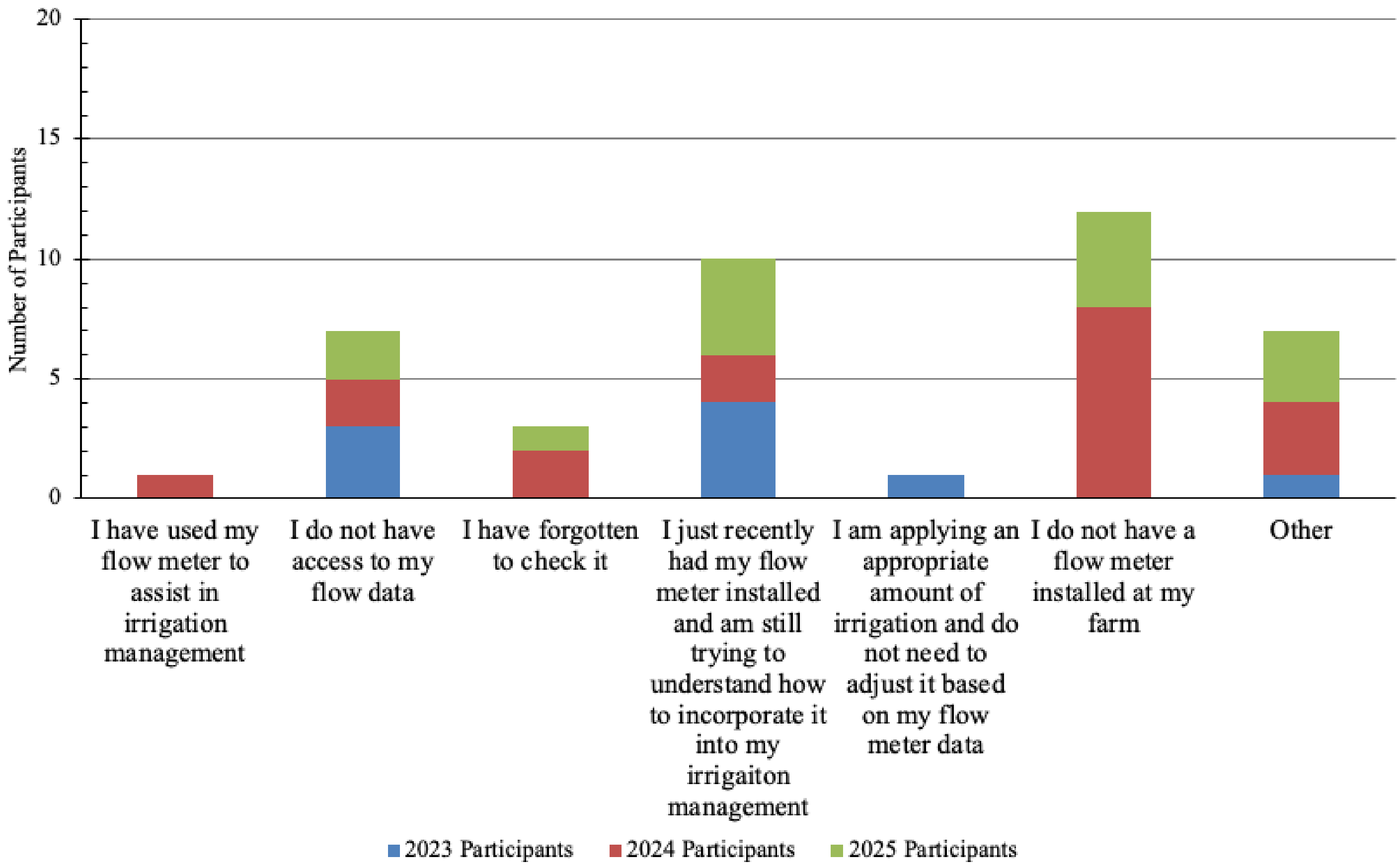

Figure 14. Report from 2023 participants (blue), 2024 participants (red), and 2025 participants (green) on why they have not used their installed flow meter to assist in irrigation management this year

Forty nine SignalFire Ranger telemetry devices have been procured and twenty one units have been installed through 2025, and installation and account setup is ongoing for new participants SignalFire Ranger telemetry offers a versatile and efficient solution for remote monitoring and control of field data, enhancing irrigation water management through precise monitoring of irrigation systems. Each participant will have an account set up for them so they can access their seasonal irrigation water usage data. The data will be stored in the SignalFire cloud.

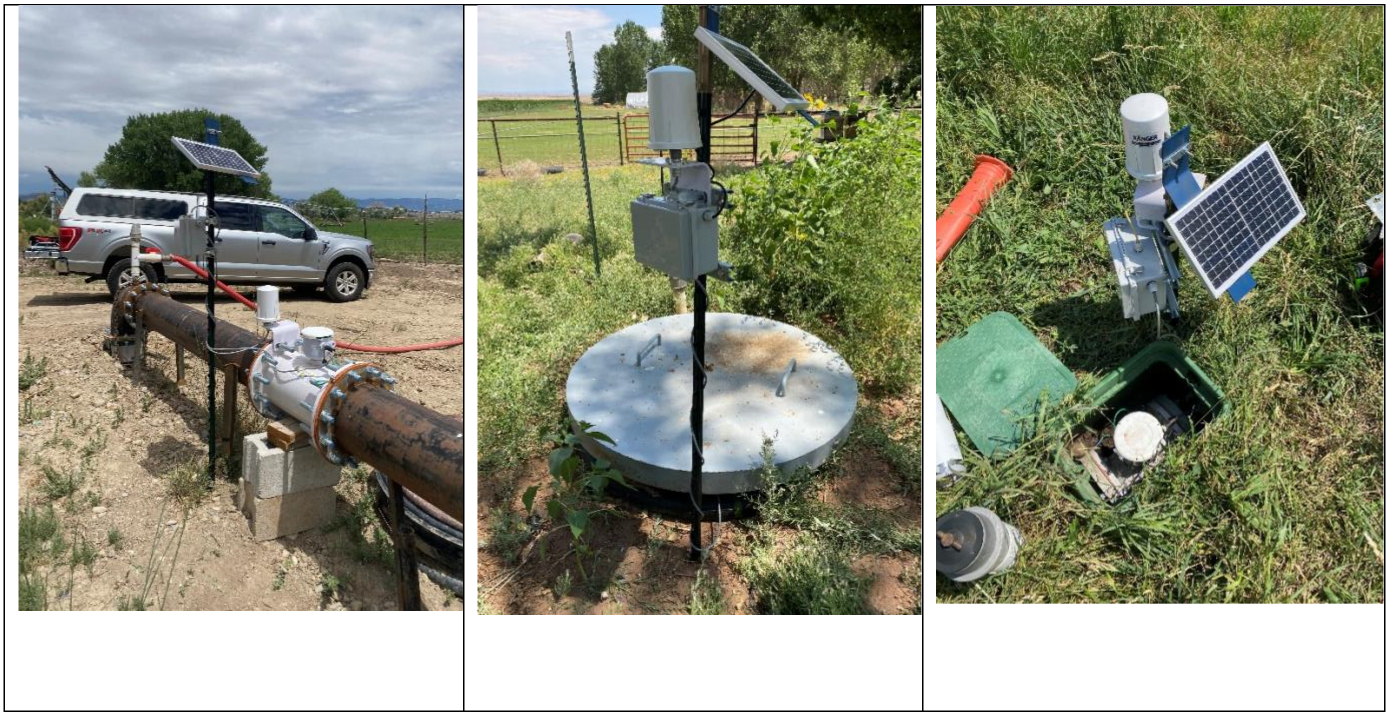

Figure 15. Flow meter installation with SignalFire Ranger telemetry inset

Alternative Crops

AG-DRIP provides up to $2,000 in seed credit for each participant at a rate of $200/acre for up to 10 acres for participants to test alternative crops with lower water requirements. The credit enables participants to test alternative crops before investing in large areas of alternative crops. In their annual report, participants indicated which crops they have tried, if any, and which they may be interested in implementing with their alternative crop credit (Figure 16). Ten of 2023 participants, two of the nine 2024 participants, and twelve of the 2025 participants have used some or all of their seed credit (Figure 16). For those who have used their seed credit, the most common alternative crop chosen was the ‘other’ alternative crop, followed by the ‘alternative variety of their original crop’ from the options listed in the annual report form. AG-DRIP staff will continue to remind participants to utilize the seed credits and discuss with participants how they might incorporate them into their crop rotations. Many participants have plans to trial cover crops, drought tolerant crop varieties, clovers, sorghum-sudangrass, small grain forages, and other crops.

In the 2025 annual report form, participants were asked to indicate **why they selected the alternative crops and how they might benefit their operation.** Participants indicated they expected the crops to help improve drought tolerance, reduce water use, combat salinity, improve cash crop establishment, add biodiversity, increase nitrogen fixation, increase soil health (improve soil aggregation and organic matter), reduce soil erosion, reduce weed pressure, provide forage for cattle, and other related benefits.

Participants were also asked if they **plan to expand the acreage of alternative crops and if so on how many acres?** Forty-six participants have not tried an alternative crop yet but some said they planned to expand acreage if the alternative crops perform well. Some participants (via communication and not via the annual report) indicated they plan to expand the acreage of alternative crops on 1 to 100 acres on each farm.

Finally, participants were asked **whether alternative crops have reduced their irrigation water needs?** Thirteen participants indicated it was too early to tell or they had not yet trialed their crops. However, of the 13 participants who have tested alternative crops, one noted “Plant longevity has increased”, “The cows did great on the crop”, and “I have found that the most effective way to utilize a cover crop is to roll a cool season crop onto the soil surface, and allow it to act as mulch, preventing evapotranspiration”.

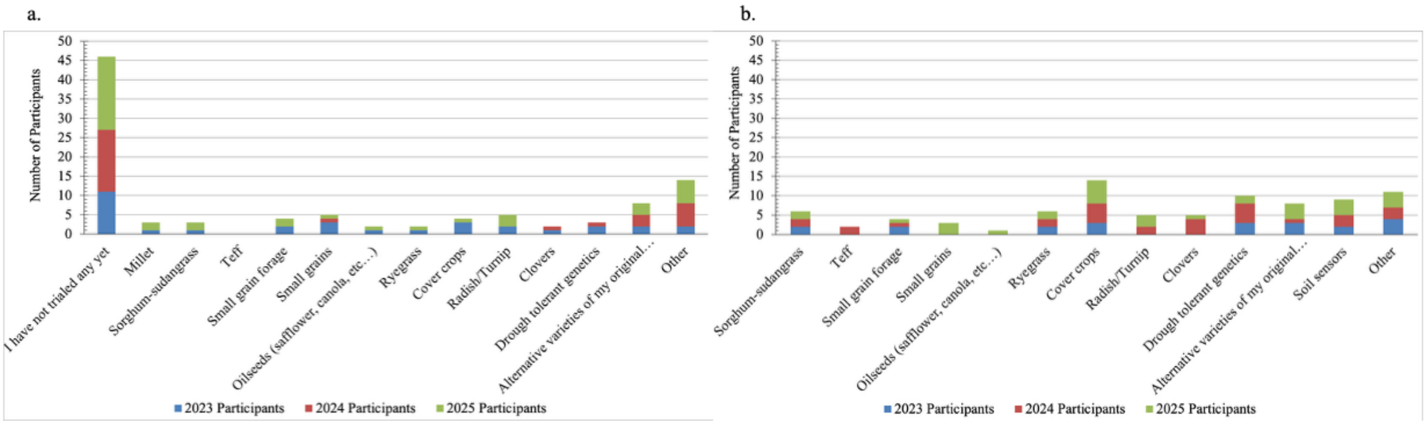

Figure 16. Annual report from 2023, 2024 and 2025 participants on the types of alternative crops they have trialed (a) and plan to trial (b)

Irrigation Evaluations

Irrigation system evaluations form a foundational component of Ag-DRIP, enabling participating producers to identify inefficiencies, quantify performance, and implement targeted improvements for water optimization. Conducted by Utah State University Extension specialists, these professional onsite evaluations assess pressurized systems (primarily center pivots, wheel lines, and fixed sprinklers) common in Utah's Colorado River Basin agriculture. Evaluations follow established USU Extension protocols, adapted from standardized catch-can testing and pressure assessments for agricultural sprinklers. Over twenty farms have been evaluated through to 2025 and more will be done during the forthcoming season. Onsite irrigation system evaluations in Ag-DRIP provide actionable insights that lower barriers to efficiency improvements, fostering voluntary conservation in arid agricultural systems. By quantifying performance gaps and linking to IMPs, these assessments support scalable water savings contributing to Colorado River Basin resilience.

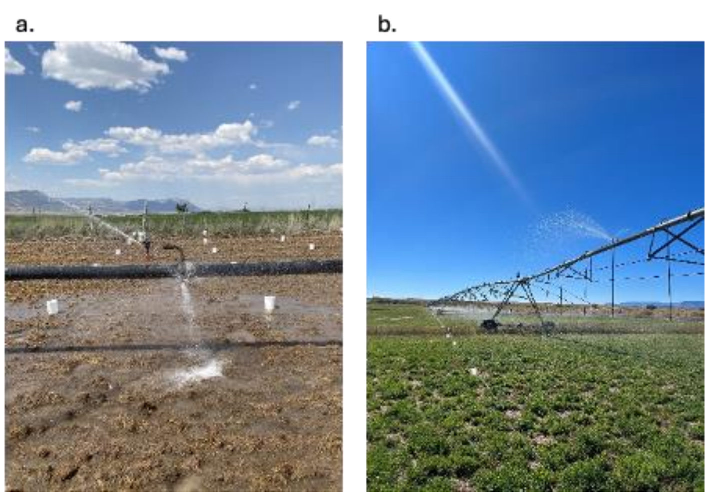

Figure 17. Irrigation evaluation on a wheel line (a) and a center pivot inset (b) for AG-DRIP participants

The evaluations have been a beneficial part of the program, informing participants of any maintenance needs on their irrigation systems and if they are applying the proper amount of irrigation for their crop. Of the 20 participants who have had their irrigation systems evaluated with the catch-can test, 13 have stated that they have already replaced the necessary irrigation parts to improve irrigation uniformity in their field (Figure 18). Nine have stated that they plan to replace any parts needed to improve their irrigation uniformity. Many have stated that they have adjusted their irrigation rates or timings based on the results of their evaluations. For those who do not understand their report, they will be contacted to have the chance to discuss the results and any questions they may have. Many more irrigation evaluations will be conducted in the 2026 growing season to account for those who have not had an evaluation performed yet.

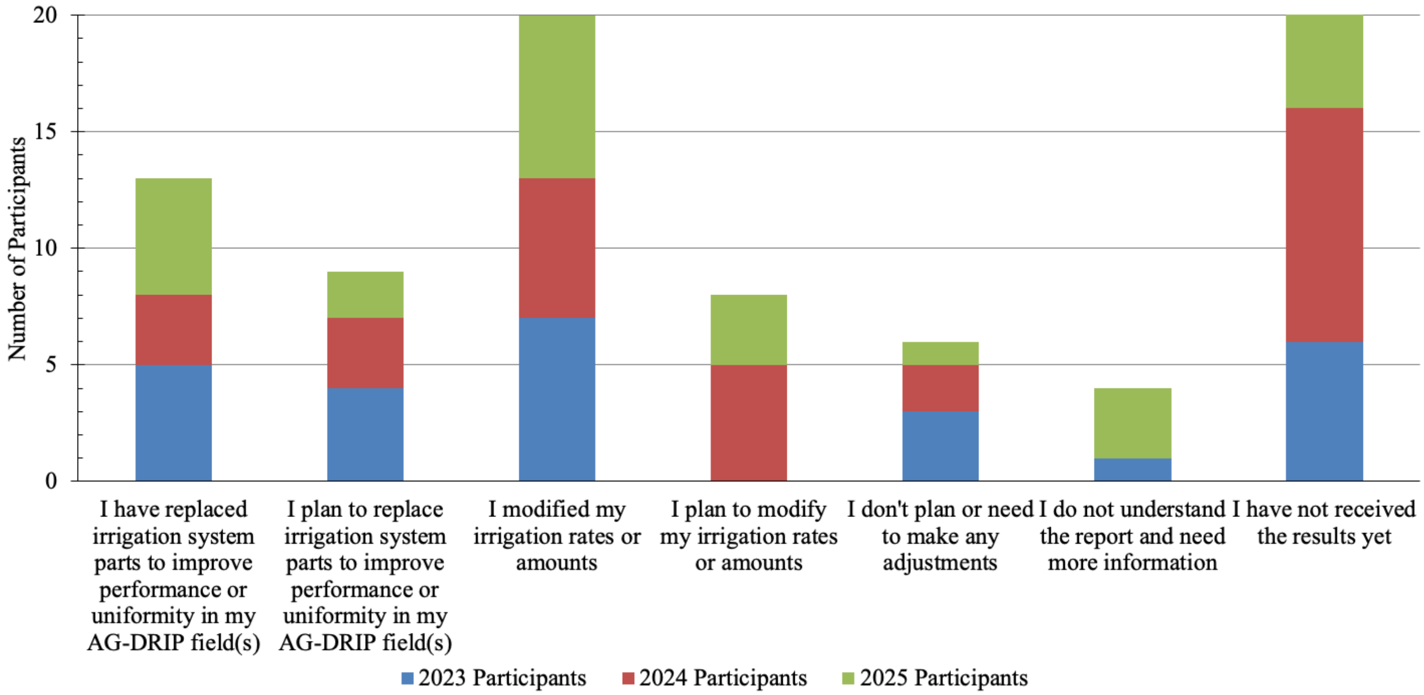

Figure 18. Report from 2023 participants (blue), 2024 participants (red), and 2025 participants (green) on how they have used their irrigation system evaluation results

Irrigation Credits

Participating farmers who report on their irrigation management plan and progress of implementation receive an annual $750 credit at an irrigation dealer of their choosing. Currently, 25 participants have credit accounts set up at Mountainland Supply Company and 13 at Intermountain Farmers Association (IFA). There are six participants who are using other irrigation dealers closer to their location and the rest have used multiple dealers. Many participants have utilized some or all of their credit accounts under Mountainland Supply Company, purchasing service parts and accessories for their irrigation systems. Five participants have utilized their IFA credit during this previous year. More participants are expected to utilize their credit in 2026 now that all of the participants from 2023 are able to use their third year's allotment of the $750 irrigation credit from completing their annual report, all of the participants from 2025 are able to use their second year's allotment of the $750 irrigation credit, and 30 of the 31 participants from 2025 will be able to use their first year's allotment of the $750 irrigation credit from completing their annual report. Of the 2023 and participants who did not use their first and/or second year's irrigation credit, that allotment has rolled over into the following year for them to use with their second and third year's allotment of irrigation credits.

Workshops/Field Days

Water Managers

The AG-DRIP team organized what is now an annual water managers working group at the Utah Water Users Workshop in March 2025. Similar to the 2023 and 2024 workshop, there were about 40 managers who participated in discussions about the needs of water managers. Managers communicated their appreciation for the working group.

The Ferron Reservoir and irrigation Company hosted an AG-DRIP tour at their shop in Ferron, Utah, on July 8, 2024, with about 18 attendees (Figure 19a). The tour included a description of the company's piped distribution system and a tour of Millsite Dam. The automated piezometric surface monitoring system on the earthen dam's face was a highlight for many attendees. Several attendees noted their knowledge increased, and the intended to use the information provided.

The Ashley Highline and Upper Canal Companies also hosted an AG-DRIP tour near Vernal, Utah, on August 28, 2024, with about 18 attendees (Figure 19b). Attendees learned about the large-scale canal piping projects both companies have completed.

The AG-DRIP team will continue to organize water company tours. Feedback from hosts and attendees has been positive, participants mots appreciate the opportunity to learn from one another's experiences.

a b

Figure 19. Water manager training and field days hosted by the Ferron Reservoir and Irrigation Compnay on July 8, 2024 (a) and the Ashley Highline and Upper Canal Companies on August 28, 2024 (b)

Farmers

Based on feedback from participants and the AG-DRIP team, two field days were held on participants' farms during the growing season. The first was on June 10, 2025 in Santaquin, Utah, with about 15 participants, and the second field day was on July 21, 2025 near Bridgeland, Utah, with about 25 participants. During these field days, soil sensor usage, cover crops, irrigation evaluations and flow meters were discussed and demonstrated. While many workshop participants were enrolled in AG-DRIP, there was some interest in the program from growers who attended (Figure 20).

In addition to the summer field days, four winter workshops were planned and implemented at local locations for AG-DRIP participants in the early months of 2025. Workshops were performed on February 11, 2025 in Payson, February 19, 2025 in Price, February 26, 2025 in Vernal, and March 19, 2025 at the Water Users Conference in St. George. The workshops provided in-depth individual training on sensor data and usage, helped participants understand irrigation evaluation reports and how to implement changes, and helped participants understand and utilize flow meter data to better maintain and manage irrigation systems. The workshops are intended to enhance water resiliency within agriculture, and provide opportunities for participants to network, share experiences, and plan additional investments in and adoption of data-informed water management. Multiple workshops are currently being scheduled for the early months of 2026 to reach as many of the AG-DRIP participants as possible.

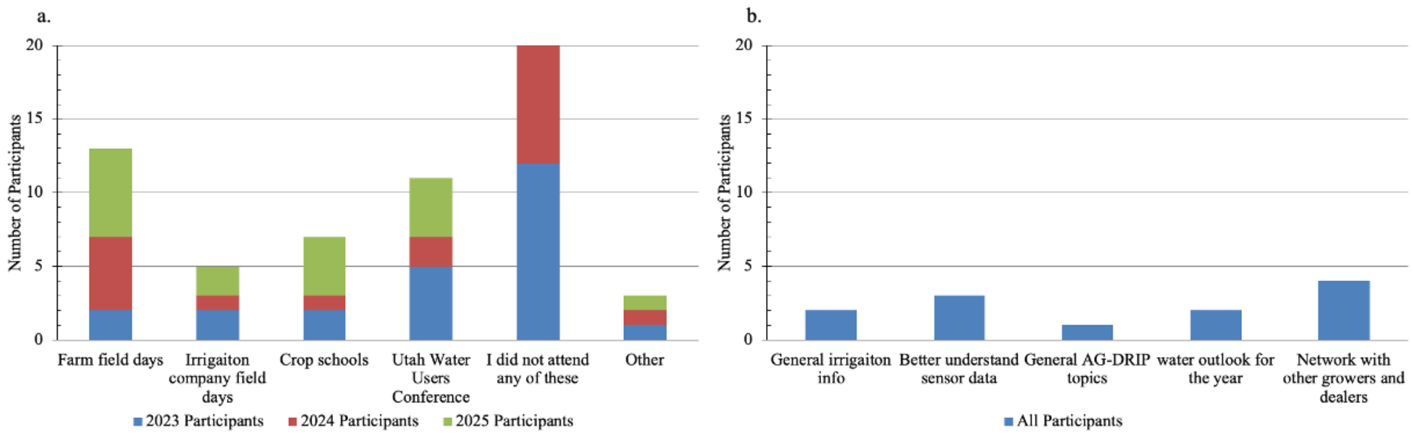

Figure 20. Reports from 2023 and 2024 participants crop school, field day, and conference attendance and their takeaways

Educational Outreach

In 2024, the irrigation system depletion change estimation tool was finalized and published to assist farmers and water managers in knowing how irrigation system changes might impact water depletions. The tool is located here: https://extension.usu.edu/crops/tools/conversion-calculator. The tool is being used by the Utah Department of Agriculture and Food's Water Optimization Program, Utah Division of Water Rights, and several other agencies and organizations in Utah. The tool is also a reference for the Agricultural Water Resiliency Study conducted by Jacobs Engineering and subconsultants on behalf of Central Utah Water Conservancy District and the Colorado River Authority of Utah, and for the Utah Demand Management Pilot Program being administered by the Colorado River Authority of Utah with support from Jacobs Engineering Group and subconsultants. The AG-DRIP team conducted several meetings with these partners to evaluate the best available methods to estimate water-saving potential from various management changes throughout Utah.

Also in 2024, the AG-DRIP created a website specifically for AG-DRIP participants linked here and is continually being developed to deliver resources for best management practices, different options for irrigation scheduling management and specific AG-DRIP items of business.

Resources such as the depletion change estimation tool are valuable resources to current participants in understanding the need for careful practice in water optimization and crop management. Current fact sheets are linked below, and future fact sheets will be published for the benefit of farmers and irrigation management.

- Yost, M., C. Anderson, and B. Barker. 2025. Utah surface irrigation water optimization opportunities and barriers. Utah State Univ. Ext. [Fact Sheet]. https://digitalcommons.usu.edu/extension_curall/2520.
- Barker, B., M. Yost, and S. Bildim. 2025. Quantifying depletion differences from irrigation practice changes in Utah. Utah State Univ. Agric. Exp. Station [Fact Sheet]. https://www.usu.edu/uaes/publications/research-projects/.

Presentations, listed below, were given to educate those within the agricultural industry about AG-DRIP.

Workshops

- Yost, M., E. Creech, C. Ransom, and B. Barker. 2025. Industry and Extension crop advisor workshop. 5 Feb. 2025. St. George, UT (45 attendees).
- Yost, M., D. Larson, and B. Barker. 2025. Training for irrigation dealers and NRCS. 20 Aug. 2025. Grace, ID (80 attendees).

Extension events

- Feb 12, 2025. “Irrigation and water related research”. Idaho Water Workshop. Boise, ID (40 attendees).
- Jan 21-22, 2025. “Sprinkler technology research”. Mountainland Irrigation Agstravaganza. Roosevelt and Richfield, UT. (100 attendees).
- Jan 9, 20225. “On-farm precision irrigation and fertilization trials in the Intermountain West”. NC-1210 Annual Meeting. Tampa, FL (40 attendees). Invited.

Interviews

- Nov 10, 2025. Water optimization in Utah. Harvard Business School Course: Reweaving Ourselves: New Perspectives on Climate Change. Interviewer: Nicole Marie.
- Oct 7, 2025. Deficit irrigation. Irrigation Today. Interviewer: Katie Navarra.
- Aug 13, 2025. USU and water optimization impacts. KSL TV. Interviewer: Angie Denison.

2026 Participant Goals

The AG-DRIP team is actively recruiting the 2026 cohort of participants by advertising in meetings, newsletters, email list-serves, in-person events, and many other outlets. In 2024, AG-DRIP was re-focused more on farmers than water managers and the budget was restructured to allow for more total fields to be enrolled each year (32 instead of 25), and for each participant to be allowed to enroll up to two fields. Given the program’s adjusted focus, the goal for 2026 is to enroll 32 new fields, to reach a total of 114 enrolled fields. Participants will be enrolled as soon as possible to allow sufficient time to make arrangements before the irrigation season begins.

References

Barker, B., Cardon, G., Yost, M., Stock, M., & Gale, J. (2023). *Managing Saline and Sodic Soils and Irrigation Water.* Utah State University Extension. https://extension.usu.edu/irrigation/research/managing-saline-and-sodic-soils

Hopkins, B. G., Horneck, D. A., Stevens, R. G., Ellsworth, J. W., & Sullivan, D. M. (2007). *Managing Irrigation Water Quality for crop production in the Pacific Northwest*. A Pacific Northwest Extension publication. https://extension.oregonstate.edu/sites/extd8/files/documents/pnw597.pdf

Appendix

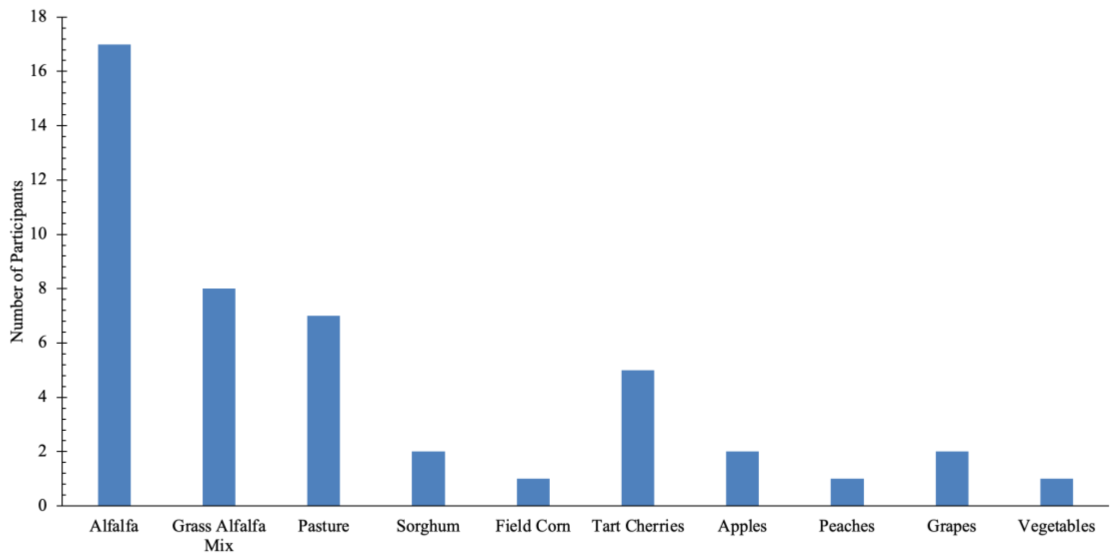

Figure A1. Crop types of all current participant's fields

Table A1. Background soil sample properties to 12 in depth for AG-DRIP participants in 2023 at time of soil sensor installation.

Field ID	County	2023 Crop	Texture	pH	Salinity	OM	NO_3-N	P	K	S	Zn	Fe	Cu	Mn	SAR
					dS/m	%	mg kg^{-1}								
A	Carbon	Alfalfa	Silty Clay	7.8	1.2	2.8	6	16	103	27	1.1	17	1.0	3	
			Silty Clay	7.8	7.5	2.7	2	7	190	527	0.7	22	1.3	5	
B	Duchesne	Pasture	Clay Loam	7.7	0.5	3.7	2	6	195	6	0.7	15	1.0	5	
C	Duchesne	Pasture	Sandy Loam	8.2	0.9	3.4	3	13	124	6	0.8	49	1.4	7	
D	Uintah	Peaches/apples	Sandy Clay Loam	7.6	5.1	1.7	20	23	551	89	0.5	3	0.8	5	
E	Uintah	Field Corn	Sandy Loam	7.9	0.6	1.2	4	2	49	5	0.4	4	0.2	3	
F	Uintah	Apple Trees	Sandy Clay Loam	7.9	0.7	2.7	2	7	187	6	0.6	4	0.4	6	
G	Washington	Vegetables	Sandy Loam	7.8	1.0	1.1	3	6	255	23	0.2	2	0.5	5	
H	Duchesne	Alfalfa	Silty Clay Loam	7.8	0.9	4.1	13	25	150	20	4.4	12	1.1	4	
I	Sanpete	Pasture	Clay Loam	7.6	0.8	4.7	4	19	182	15	1.8	26	1.8	2	
J	Utah	Tart Cherries	Loam	7.8	0.6	2.2	6	27	108	12	1.5	8	0.9	4	
K	Grand	Alfalfa	Loamy Sand	7.7	0.5	1.2	6	17	60	3	2.8	5	0.2	5	
L	Uintah	Pasture	Sandy Loam	7.7	4.3	2.1	2	7	215	174	0.8	12	0.5	2	1.4
			Clay Loam	8.0	8.6	2.8	3	16	391	779	1.6	37	1.6	9	4.4
M	Emery	Sorghum	Clay Loam	7.9	2.2	3.2	32	22	311	70	0.7	13	0.7	2	
N	Carbon	Alfalfa	Silty Clay Loam	7.6	3.6	2.5	5	5	103	196	0.5	11	0.6	4	
O	Wasatch	Alfalfa	Clay Loam	7.0	1.2	4.8	8	9	912	12	0.7	23	0.9	17	
P	Emery	Alfalfa	Silty Clay Loam	7.5	3.4	3.4	4	24	402	74	1.1	21	0.7	2	
			Silty Clay Loam	7.6	4.8	2.9	9	29	425	203	1.0	16	0.7	3	
R	Carbon	Alfalfa	Silty Clay Loam	7.6	3.6	2.2	6	20	173	91	1.0	13	0.6	3	
S	Carbon	Sorghum	Silty Clay Loam	7.9	5.9	2.7	5	7	196	351	0.8	17	1.0	3	7.8
T	Boulder	Pasture	Loamy Sand	7.8	0.4	1.0	3	2	35	2	1.1	4	0.9	4	
U	San Juan	Alfalfa	Sandy Loam	8.1	0.7	1.4	3	5	179	5	0.3	3	0.2	6	
			Loam	7.9	1.1	2.5	5	8	235	9	0.6	5	0.3	7	
			Loam	8.0	0.8	1.4	6	7	206	8	0.4	4	0.2	6	

OM - organic matter
SAR - sodium adsorption ratio
dS/m - decisiemens per meter

Table A2. Background irrigation water properties for AG-DRIP participants in 2023 at the time of soil sensor installation

Farmer ID	County	Crop	EC	Ca	Mg	Na	B	SO4	Cl	Carbonate+ Bicarbonate	Residual Sodium Carbonate	SAR	SAR Adjusted
			umhos cm^{-1}	- - - - - - - - - - - - - - mg L^{-1} - - - - - - - - - - - - -						- - - - - - - mmolc L^{-1} - - - - - -			
A	Carbon	Alfalfa	793	59.7	33.1	37.7	0.08	57.3	28.3	5.31	0	0.97	2.27
B	Duchesne	Pasture	485	34.6	9.5	3	0.01	19.3	3.4	2.13	0	0.12	0.2
C	Duchesne	Pasture	205	11.9	1.4	0.8	0.01	2.3	2.4	0.75	0.04	0.06	0.04
D	Uintah	Peaches	455	59.7	15.3	2.6	0.03	7.6	4.8	4.05	0	0.08	0.17
D	Uintah	Peaches	702	68.6	37.1	20.9	0.13	126	12.5	4.37	0	0.5	1.16
E	Uintah	Field Corn	302	22	11.7	18	0.04	30.7	7.9	1.97	0	0.77	1.17
F	Uintah	Pasture	189	19.4	5.8	4.1	0.02	15.4	4.7	1.31	0	0.21	0.26
G	Washington	Vegetables	957	138.6	26.6	30.1	0.04	247.7	27.2	4.19	0	0.61	1.47
H	Duchesne	Alfalfa	681	56.2	29.2	50.8	0.31	97.1	20.5	4.47	0	1.37	3.03
I	Sanpete	Pasture	522	55.8	33.7	8.8	0.02	60.6	4.2	4.04	0	0.23	0.51
J	Utah	Tart Cherries	302	22	11.7	18	0.04	30.7	7.9	1.97	0	0.77	1.17
K	Grand	Alfalfa	220	38.3	5.6	3.5	0.01	17.3	8.8	1.93	0	0.14	0.22
L	Uintah	Pasture	1310	137.8	66.3	48.1	0.27	492.3	16.9	3.19	0	0.84	1.99
M	Emery	Sorghum	485	60.1	19.5	8.9	0.04	38.5	10.9	3.67	0	0.26	0.54
N	Carbon	Alfalfa	547	53	19	23.3	0.07	46.9	15.6	3.55	0	0.7	1.43
O	Wasatch	Alfalfa	409	51.9	13.5	6.2	0.01	15.2	4.8	3.11	0	0.32	0.39
O	Wasatch	Alfalfa	394	50.8	12.4	5.8	0.01	14.8	4.8	3.04	0	0.31	0.37
P	Emery	Alfalfa	492	59.4	18	8.9	0.03	32.9	11.3	3.35	0	0.69	0.53
Q	Carbon	Unplanted	523	53.7	21.2	26.2	0.06	49.1	18.3	4.21	0	0.76	1.64
R	Carbon	Alfalfa	520	5.18	21.3	26.1	0.05	47.4	15.9	3.59	0	0.77	1.59
S	Carbon	Sorghum	520	5.18	21.3	26.1	0.05	47.4	15.9	3.59	0	0.77	1.59
T	Garfield	Pasture	165	14.4	6.6	8.4	0.01	7.3	1.32	1.32	0.05	0.46	0.54
U	San Juan	Alfalfa	417	48.4	14.5	13.5	0.04	23.5	5.4	3.17	0	0.44	0.85

SAR - sodium adsorption ratio
EC - electrical conductivity
umhos cm^{-1} - micromhos per centimeter

Table A3. Background soil sample properties to 12 in depth for AG-DRIP participants in 2024 at time of soil sensor installation.

Field ID	County	2024 Crop	Sample ID	Texture	pH	Salinity	OM	NO_3-N	P	K	S	Zn	Fe	Cu	Mn	SAR
			(if applicable)			dS/m	%		mg kg^{-1}							
A	Uintah	Alfalfa		Sandy Loam	7.6	0.8	1.5	3	13	155	14	3.0	6	0.6	3	1.1
B	Uintah	Pasture		Sandy Clay Loam	7.6	3.2	3.2	8	8	132	85	0.6	9	0.6	2	0.5
C	Duchesne	Alfalfa		Clay Loam	7.5	1.3	3.5	43	16	124	21	0.7	15	1.5	2	0.9
D	Washington	Grapes	Main Area	Sandy Loam	7.5	1.4	1.9	2	2	98	25	0.9	18	0.5	3	2.2
			West Side	Sandy Loam	7.5	2.6	1.5	2	3	129	62	0.6	11	0.6	3	1.0
E	Duchesne	Alfalfa	North	Clay Loam	7.9	8.7	2.6	5	39	356	647	0.6	8	1.1	3	14.8
			South	Clay Loam	7.8	6.6	2.4	4	17	140	505	0.5	23	1.4	3	10.1
F	Iron	Alfalfa		Clay Loam	7.5	0.7	4.3	7	30	130	14	1.5	17	1.0	4	0.2
G	Sanpete	Grass Alfalfa Mix		Clay Loam	7.6	0.7	4.0	7	8	147	4	0.8	12	0.8	10	0.1
H	Emery	Alfalfa		Clay Loam	7.3	0.6	2.8	4	36	106	8	1602	14	0.6	2	0.4
I	Carbon	Alfalfa	East	Clay Loam	7.8	0.8	2.4	4	6.7	174	14.5	1.00	12	0.7	2	
			Mid	Loam	7.7	1.6	2.1	2	10.7	136	39.1	0.79	10	0.5	2	0.8
			West	Loam	7.9	1.0	1.8	18	3.8	104	15.1	0.78	13	0.5	2	
J	Carbon	Alfalfa	N	Clay Loam	7.8	0.8	3.4	21	53.1	126	10.4	1.42	18	1.0	3	0.8
			S	Sandy Loam	7.8	0.9	2.1	16	28.9	109	9.1	1.17	21	0.7	2	0.8
K	Utah	Alfalfa		Loam	7.8	0.7	2.3	19	39.4	107	4.5	3.35	9	1.8	6	0.3
L	Washington	Grapes		Loam	7.7	0.7	2.1	4	10.9	371	8.4	0.72	4	0.8	12	
M	Utah	Cherries		Clay Loam	8	0.5	3.0	6	15.2	502	7.5	2.30	5	4.5	6	0.4
N	Utah	Tart Cherries		Clay Loam	7.9	0.5	2.4	4	11.4	183	6.6	3.30	9	1.0	7	0.5
O	Utah	Apples		Loam	7.7	1.4	2.9	38	23.5	206	60.2	7.29	8	2.0	6	0.6
P	Utah	Tart Cherries		Loam	7.7	0.7	2.7	19	64.4	292	17.2	5.33	9	1.3	7	0.6
Q	Emery	Alfalfa Mix	SW	Sandy Clay Loam	7.7	7.5	0.8	9	9.5	191	440.0	0.22	4	0.3	2	15.5
			East		7.9	6.5	0.8	10	14.6	236	189.0	0.30	4	0.3	2	11.1
			NW		7.8	6.2	0.9	13	15.8	257	205.0	0.35	5	0.3	2	11.2
R	Utah	Apples		Silty Clay Loam	7.9	0.43	2.0	2.26	6.57	171	3.50	1.77	6	1.0	7	0.18
S	San Juan	Grass Alfalfa Mix		Sandy Loam	7.6	0.7	1.0	1	4.1	70	11.8	0.22	8	0.5	10	0.9
T	Utah	Tart Cherries		Loam	7.7	0.4	2.3	3	28.1	219	7.0	4.32	12	2.0	10	0.6
U	Uintah	Grass pasture	Rest of Field	Sandy Loam	7.8	1.0	1.8	11	9.7	132	16.7	0.52	19	0.5	20	0.3
U	Uintah	Grass pasture	SE side of field	Sandy Loam	7.8	1.0	1.4	16	9.9	120	13.2	0.49	9	0.4	11	0.4
V	Summit	Alfalfa		Silt Loam	6.2	0.7	4.0	26	58.3	257	24.7	5.56	85	1.0	37	0.2
W	Carbon	Grass pasture		Clay Loam	7.4	1.1	2.7	4	4.1	251	17.9	1.29	20	0.9	6	0.8
X	Grand	Grass alfalfa mix		Sandy Loam	7.9	0.6	1.6	8	19.5	62	7.8	2.85	10	0.5	5	0.2
Y	Duchesne	Alfalfa		Clay Loam	7.5	0.9	3.1	8	8.7	78	7.9	0.55	14	0.7	8.5	0.3
Z	Carbon	Grass alfalfa mix		Sandy Loam	7.7	0.82	0.9	5	14.3	156	8.9	0.81	15	0.4	3.2	1.2

OM - organic matter
SAR - sodium adsorption ratio
dS/m - decisiemens per meter

Table A4. Background irrigation water properties for AG-DRIP participants in 2024 at the time of soil sensor installation

Farmer ID	County	Crop	EC	Ca	Mg	Na	B	SO4	Cl	Carbonate+Bicarbonate	Residual Sodium Carbonate	SAR	SAR Adjusted
			umhos cm^{-1}	- - - - - - - - - - - - - mg L^{-1} - - - - - - - - - - - -						- - - - - - - - - - - - mmolc L^{-1} - - - - - - - - - - -			
A	Uintah	Alfalfa	466	45.7	13.6	19.7	0.04	28.5	10	3.39	0	0.66	1.28
B	Uintah	Pasture	131	18.8	3.9	1.4	0.01	5.6	1.4	1.12	0	0.07	0.08
C	Duchesne	Alfalfa	878	85.3	30.5	42.3	0.09	253	9.6	2.76	0	1	2.11
D	Washington	Grapes	561	62.7	15.5	20.2	0.02	45.6	26.5	3.53	0	0.59	1.22
E	Duchesne	Alfalfa	613	53.3	23.5	35.2	0.21	79.1	12.4	4.03	0	1.01	2.15
F	Iron	Alfalfa	521	45.9	39	1.8	0.01	23.7	3.2	5	0	0.05	0.11
G	Sanpete	Grass Alfalfa	441	58.5	18.6	2.7	0.01	8.8	2.2	7.88	3.41	0.08	0.19
H	Emery	Alfalfa	658	62	30.8	17.4	0.02	61.1	7	4.72	0	0.45	1.03
I	Carbon	Alfalfa	627	53.4	27.4	31.9	0.07	44.8	19.2	4.81	0	0.88	1.98
J	Carbon	Alfalfa	636	57.8	27.6	30.9	0.06	43.2	18	4.01	0	0.83	1.9
K	Utah	Alfalfa	381	48.9	11.1	10.4	0.02	32	13.5	2.52	0	0.35	0.64
L	Washington	Grapes	342	39.5	16.3	9.3	0.03	16.7	6.9	3.25	0	0.31	0.61
M	Utah	Cherries	424	56.5	17.2	14.1	0.02	24.6	13.1	3.92	0	0.42	0.88
N	Utah	Tart Cherries	532	61.1	22.1	26.3	0.04	43.1	20	4.2	0	0.73	1.59
O	Utah	Apples	661	78.1	27.1	28.6	0.03	58.1	27.8	4.75	0	0.71	1.64
P	Utah	Tart Cherries	520	63.1	22	24.9	0.04	40.8	18.7	4.31	0	0.69	1.51
Q	Emery	Alfalfa Mix	295	29.7	9.7	19.3	0.04	52.4	7.7	1.81	0	0.78	1.2
R	Utah	Apples	288	38.1	16.0	3.0	0.00	10.1	4.8	3.07	0	0.10	0.19
S	San Juan	Grass Alfalfa	331	52.2	5.4	10.9	0.03	17.5	5.4	3.03	0	0.38	0.72
T	Utah	Tart Cherries	515	62.6	20.8	23.3	0.04	39.1	18	4.28	0	0.65	1.43
U	Uintah	Grass Pasture	125	16	4.1	3.2	0.01	7.2	4	1.12	0	0.19	0.2
V	Summit	Alfalfa	138	19.6	3.8	2.6	0	4.8	3.5	1.24	0	0.14	0.17
W	Carbon	Grass Pasture	499	49.6	21.4	25.8	0.06	43.1	14.8	4.65	0	0.77	1.67
X	Grand	Grass Alfalfa	371	40.6	14.1	15.6	0.02	69.5	9.4	2.27	0	0.54	0.94
Y	Duchesne	Alfalfa	379	42.9	15.2	5.6	0.02	48.2	6.7	2.96	0	0.19	0.36
Z	Carbon	Grass Alfalfa	437	46.1	19.6	21.9	0.06	42.1	13.6	3.83	0	0.68	1.4

SAR - sodium absorption rate
EC - electrical conductivity

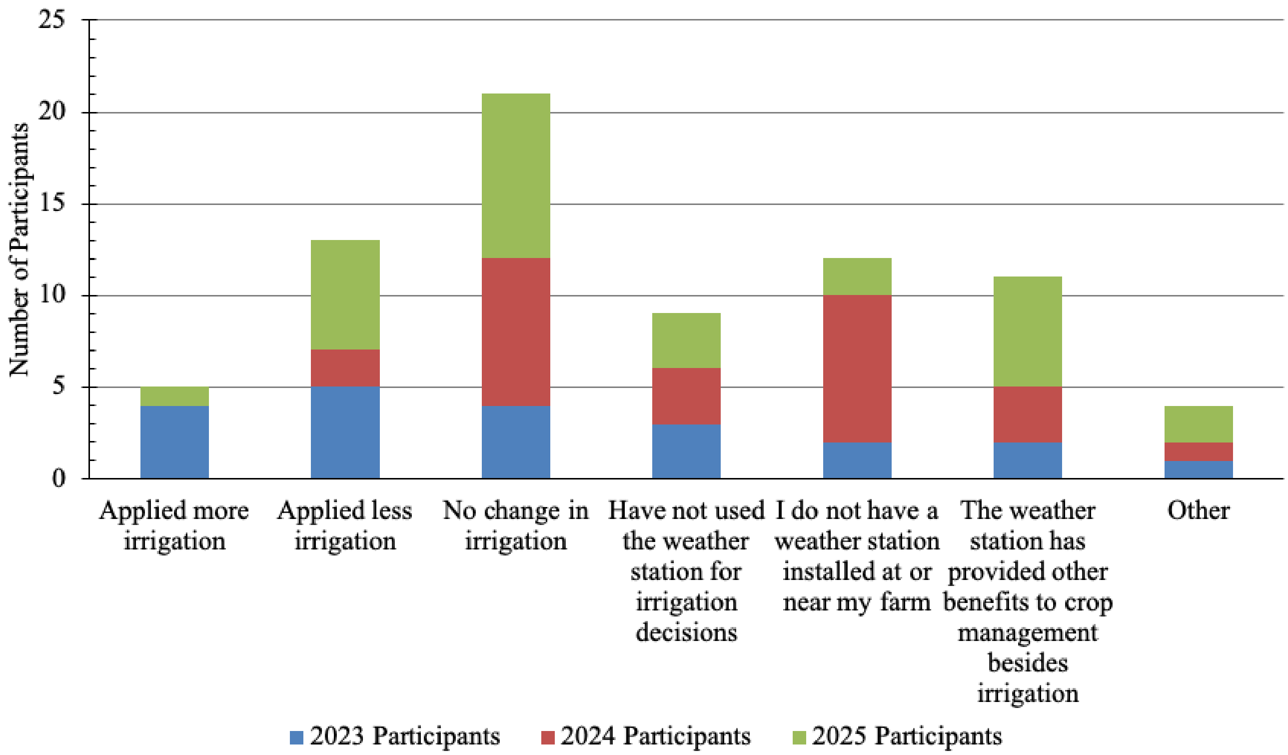

Figure A2. Responses from 2023 (blue), 2024 (red) and 2025 (green) participants regarding if irrigation was modified based on weather station data

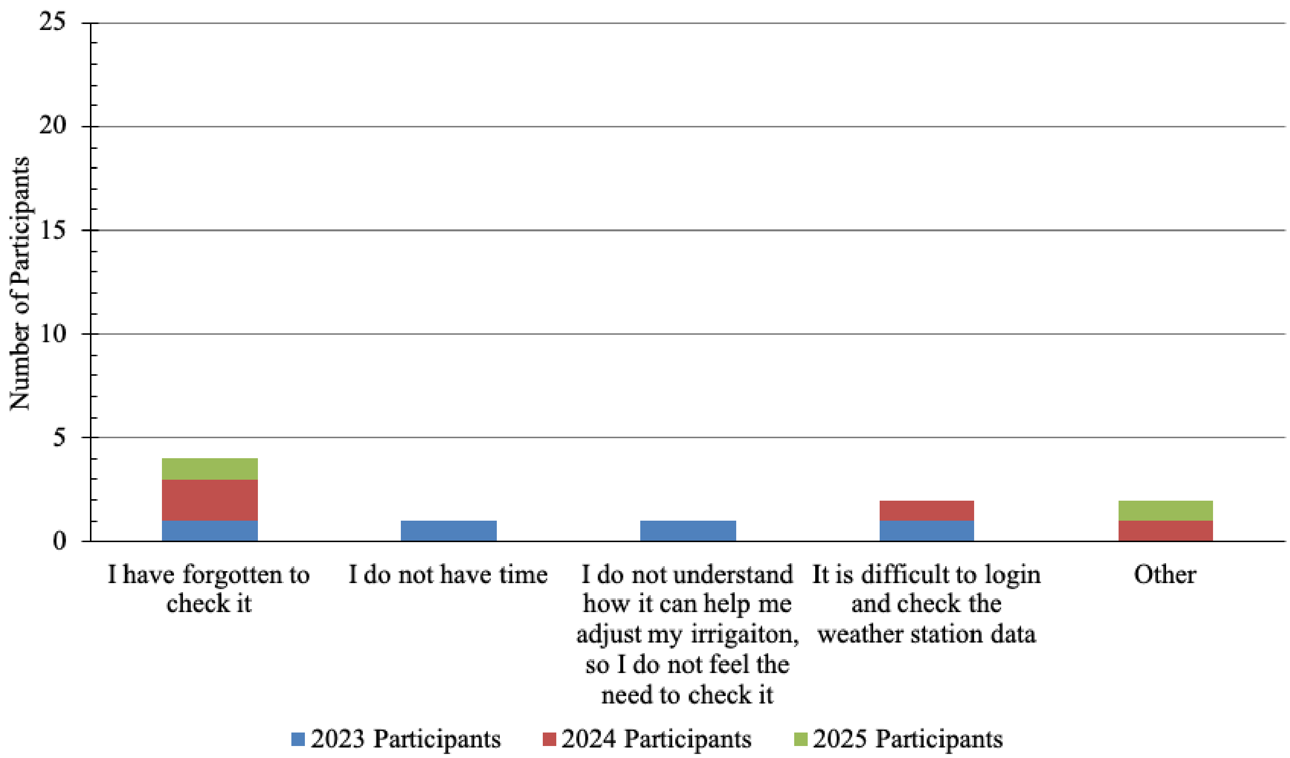

Figure A3. Responses from 2023 (blue), 2024 (red) and 2025 (green) participants as to why they have not modified their irrigation based on weather station data