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Surviving These Drying Times: The Role of a Desert Agricultural Extension Agent in Helping Farmers Face Drought

Abstract

Cooperative Extension should work with state policy makers to create well-crafted programs to address the needs of producers. By doing so, the statewide extension system can provide local county agents with a key to building trust and long-term relationships with producers. As producers face a myriad of risks and challenges, that relationship allows the county agent to invite academic specialists onto the farm to address specific issues and improve on-farm operations. Starting in 2022, the Cooperative Extension team at the University of Arizona leveraged a sizeable grant to support water irrigation efficiency on drought-stricken farms, deepening relationships between local county agents and the producers they serve.

Introduction

While the west faces the worst drought in history, it is a historic opportunity for Cooperative Extension to step in, create programs to help farmers find the resources and knowledge to survive and thrive. The 2022 On-Farm Water Efficiency Project was initiated by the University of Arizona Cooperative Extension, in conjunction with leaders in the Arizona State Legislature, to help farmers conserve water through research and installation of more efficient irrigation systems. In less than a year this program, administered by the Arizona Cooperative Extension, has grown from a $30 million grant to a robust $63 million program. It has already helped farmers transition over 18,000 acres from flood irrigation to more effective systems such as sprinkler, drip, or micro sprinklers, while maintaining soil health and crop productivity, and is projected to conserve over 36,000 water acre feet (WAF) annually. This program highlights the many strengths of Cooperative Extension, notably in terms of applied science, local relationships, and statewide credibility.

Methods

Addressing state water issues: an Extension view for the state office

In 2020, twenty years of drought conditions and overdraft of the Colorado River resulted in a critical water shortage declaration on Lake Mead. This critical body of water provides water to cities and farmers in Pima, Pinal, and Maricopa Counties through the Central Arizona Project. Over five million people and numerous farms were facing a looming water crisis in the desert. In 2021, the Central Arizona Project (CAP) allocation for growers in Pinal County was eliminated (Nabhan et al., 2023). At this point, many farms faced bankruptcy. State legislative leaders invited the University of Arizona's Cooperative Extension staff to help craft a solution to support farmers and conserve Arizona's water. As a state administrator, Dr. Ethan Orr invited irrigation specialists to work with the Speaker of the House, Rep. Rusty Bowers, and other legislative members to create an On-Farm Water Irrigation Efficiency Project. Initially the legislature funded $30 million to the University Extension system to research and implement water

irrigation savings. This program was so successful that in the second year, the legislature funded an additional $15.2 million. Farmers then matched the grant funding with another $17 million in private sector funds.

From a systemwide standpoint, Dr. Ethan Orr, Associate Director for Agriculture, Natural Resources and Economic Development, focused on statewide issues, often serving as a bridge between stakeholders and state policy makers. Administration at the state level is removed from the individual farmer; the county agent is relied upon to understand and encapsulate the voice of the community, meeting directly with community stakeholders. By passing this information to state administrators, the voices of individual stakeholders are then passed to policy makers, as if they were speaking directly to their district constituents. Additionally, as a representative of the University of Arizona, the administrator can bring agent research data into the policy discussions, even up to the level of crafting legislation.

By addressing a critical state issue at a systems level, Dr. Orr also created a tool for Arizona county agents. This program was perceived as being so valuable for farmers that they invited county agents directly on-farm to talk about the program and its benefits, which led to an opening for the University of Arizona Extension agents and specialists to assess needs and introduce other valuable programs.

Genius of the Extension system

Over 70% of extension staff are housed at the county level (Rasmussen, 2002). Proximity, with the right people, can create valuable relationships and intelligent interfaces between county-based agents, the farmer, and the extension researcher. However, for a new agent, gaining access to the farm and the farmer can sometimes be difficult and daunting. Effort is different from effect, and by equipping the county agent with knowledge of and access to valuable programs, the extension system can better support county agents in collaborating with farmers.

Other challenges facing the farmer

Farmers face endless risks: production risk, market risk, institutional risk, personal risk, and financial risk (Komarek et al., 2020). The county extension agent is ideally positioned to help farmers face and address risks as they inevitably occur. Dipping into a deep reservoir of hands-on experience and access to a broad variety of academic specialists and research data, the agent allows stakeholders to make better informed decisions that mitigate risk (Rasmussen, 2002). A conduit is built between farmer, producer, academic, government, and industry, freeing the flow of ideas between groups. The thirst for knowledge drives desire for realistic solutions that coordinates and facilitates positive change; by quenching this thirst, Cooperative Extension builds the foundational trust needed to achieve the mutually beneficial goals of positive on-farm change.

Results

Yuma, Arizona: a case study in success

The University of Arizona's Cooperative Extension provides a service to the community by assisting one individual at a time. A county extension agent's job focuses on the individual, making connections one-on-one, person-to-person, mouth-to-ear. For an extension program to be successful, it must be built on trust and hold credibility with the stakeholders. Assistance from agents with tools and training that result in positive on-farm change builds additional trust with the farmer. For an agent, understanding the risks, rewards, and challenges facing a farmer is the foundational step in building trust and developing the community.

Robert Masson started at Yuma County Cooperative Extension (YCCE) as an Assistant Agriculture Extension Agent in November of 2019, right before the COVID-19 pandemic. Travel restrictions, social distancing, and masking mandates caused YCCE to focus efforts on providing field research and online education, foregoing on-farm activities for sake of public safety. Extension agents across the state were just as isolated as the

growers they were trying to reach. As the effects of the pandemic lessened and site visits resumed, the YCCE group struggled to find ways to transfer research and education into demonstratable on-farm change. The growers had gotten used to being socially distanced, where they had learned to rely on ‘trusting their gut,’ developing on-farm solutions independently. A good reason was needed to get county agents back on the farm - and the irrigation efficiency grant turned out to be exactly what was needed to achieve that goal.

Discussion

Navigating resources requires trust

Trust in the source is essential to information being deemed trustworthy. Recent survey data show a developing trend of misinformation, or “mis-regionalized” information produced by self-appointed or viewer community-appointed online “experts,” leading to bad choices made on-farm (Rust, et al. 2022). The voice of science-backed lessons from traditional agents, formally trained and supported with regional specialists is often drowned out by more entertaining online content. Trust between teacher and student is needed to explore risk together before new ideas are implemented, and when the time is right the trust is tested and measured by success or failure. Additionally, farming practices have changed from an era of input intensive production that valued yield overall towards a more sustainable model designed to facilitate continued production over time. During times of situational change, conflicting information is often found that causes confusing cognitive dissonance and uncertainty (Rust, et al. 2020). During this time of change, the community needs a county agent to help manage risk in many different ways. First, as a respected member of the community who has on-farm relationships with multiple growers, a county agricultural agent assumes some of the proximal benefits of being both a peer to academics and peer to the farmer, able to function as a liaison to both worlds. Second, access to and understanding of the latest research puts the county agent in a position to help the farmer identify sources of information, providing validity, and confirming practical applications of applied research.

And third, the county agent has a historical role as a respected source of information to provide both education and research.

Dealing with the water crisis

The Arizona Governor's Office tasked the University of Arizona Cooperative Extension to administer the $30 million grant, both researching irrigation systems and administering the application and evaluation process for the farmers. The Arizona Cooperative Extension formed an irrigation grant approval board comprised of a diverse group of agents, specialists, and growers. The board issued grant money from the State Legislature to the growers to spend on approved irrigation system upgrades. Under the guidance of principal investigator Dr. Ethan Orr, the board selected Robert Masson (Assistant Agricultural Extension Agent), Dr. Diaa Eldin Elshikha (Assistant Irrigation Specialist), Dr. Debankur Sanyal (Statewide Soil Health Extension Specialist and Assistant Professor), Jay Subramani (Research Associate), and Hector Munoz (Irrigation Technician) to conduct on-farm site visits with growers across the state to help them identify the best irrigation equipment to invest their grant money. In Yuma, Robert was invited on-farm to supply irrigation recommendations to growers based off peer-reviewed publications and extension team advice, irrigation supply vendors, and other growers participating in the program. Dr. Elshikha was called on by Robert repeatedly for advice and was a great asset for calculating irrigation requirements and applying his knowledge about calculating efficiencies of different systems, which he outlined in several publications of his own (Elshikha et al. 2021; Elshikha et al. 2022). Dr. Elshikha was extremely effective in reviewing and optimizing systems before they went in place; with one farm he was able to shave $300,000 of the price of a center-pivot, eliminating unneeded systems and streamlining the rest, allowing the grower to stretch their grant money even further. By helping farmers fund and optimize these projects, members of the Cooperative Extension were able to reconnect with the stakeholders in the community and offer growers something they could not achieve alone.

Long term change

The program was designed by the State Legislature to include three years of on-farm visits from Extension to promote system optimization, address concerns, and facilitate a smooth transition to new technology. The committee gave special attention to reducing water use while minimizing the negative impact on soil health. Water is life, and when it is removed from the soil microbial activity slows, harming soil health. In most desert cropping locations, organic matter from crop residue will not decompose without irrigation; they desiccate instead. Additionally, soil salts build to toxic levels at the soil surface as water evaporates in a concentrated layer, requiring heavy irrigation to dissolve and push salts to a lower soil horizon away from germinating seed and developing rootzone, negating water savings of irrigation improvements. It could be said that irrigation efficiency and soil health are at odds with each other, requiring a balanced and wholistic strategy for success. In the coming years, Extension Soil Health Specialist, Dr. Sanyal, will be needed to advise on ‘how low can we flow’ before we create situations that threaten production sustainability. Soil health in the desert is generally accepted as being desirable, but currently difficult to track for improvement. The best lab tests and optimal values for soil health indicators are not yet apparent in the desert, as most research originates from farming systems located in more humid regions. The irrigation grant has provided an excellent opportunity for Dr. Sanyal to get on-farm and work towards creating a baseline for soil health testing in the different regions across the state. In one separately funded project, Dr. Sanyal, and Mr. Masson, worked together to compare healthy and unhealthy fields in Yuma, self-identified by the grower. Soil samples were collected from irrigation grant participants and analyzed in the Sanyal Soil Health Lab, where three soil health indicators showed promise: permanganate oxidizable carbon (Pox-C), potentially mineralizable nitrogen (PMN), and soil protein (Sanyal et al. 2023). Growers will continue to use water management knowledge passed on by Cooperative Extension to make well-informed decisions, resulting in new water-saving equipment and irrigation techniques, while at the same time managing risks to soil health and beyond.

On-farm needs assessment

The irrigation efficiency program was highly successful in getting Cooperative Extension face-to-face with farmers to share their expertise with both drought and non-drought issues. Over 62 farms joined the program so far, with many of the irrigation systems just recently installed, prompting even more regular site visits from the Extension group. While on-farm Cooperative Extension has, and will continue to, take advantage of the opportunity to circulate needs assessment surveys to farm employees to find out about other non-drought related issues that may not have been apparent before. For example, a vast gap in needs assessment knowledge remains from people in career paths that were historically underserved by the University of Arizona, such as, commercial irrigators (Canales, Esprinkeros, Zanjeros, Ditch-riders), equipment operators (Tractoristas, Forklifteros, Troqueros), and harvest crews (Piscadores), whose needs have often gone unheard. By involving these groups in the conversation and allowing them to communicate their needs from the very start, Extension will be better able to assist in the end. Early polling results from Yuma farms have shown a marked desire for worker safety training and streamlining the U.S. and Mexico border crossing process, which many farm workers do twice a day going to and from work. Time will tell where this needs assessment will lead, but without the irrigation grant allowing Cooperative Extension farm access, agents and specialists would be left guessing at details instead of having direct knowledge, hampering the Arizona Cooperative Extension's ability to help.

Conclusion

Lessons learned over time

The authors have approached dealing with the drought in Arizona differently based on their Extension appointments and life experiences. Dr. Ethan Orr has developed a wide-angle view of the drought situation, leading committees, organizing working groups, and understanding political discussions at the State Capital. Robert Masson provides local

on-farm support, leveraging his experiences working in agriculture, harvesting crops, and conducting field research trials. Different approaches were combined to maximize the success of this program and reduce overall water use. By empowering growers with the finances to purchase systems of their choice, the irrigation grant program was able to invest $23 million dollars of the first $30 million allocated to this project directly into on-farm irrigation infrastructure; this was matched by $17 million originating from the farms themselves. In this way, 42% of funding came from the private sector and resulted in direct annual savings of over 36,400 acre-feet so far. With an acre-foot supplying a year's worth of water to an average of three homes in the Phoenix metro area the total savings so far would be comparable to supplying 109,200 homes with their annual consumptive demands (AZ Department of Water Resources 2023). This year, the State Legislature has allocated an additional $15.2 million to the project and Cooperative Extension is galvanized at the prospect of saving even more water. Many producers may wait to install upgrades until their water allocations are reduced from the irrigation districts, but most growers in Yuma, and across the state of Arizona are forward thinking enough to experiment with new methods before the problem worsens. This project demonstrates clearly that the Cooperative Extension can partner with the state legislature to implement successful research-based solutions. In addition, creating successful statewide programs gives county-based agents additional tools to bring directly to the farmers. By connecting with people and providing science-backed financial incentives, the State Legislature and Arizona Cooperative Extension continues to empower the growers of this state to bring about much-needed change.

Literature Cited

Arizona Department of Water Resources. 2023. *How Many Homes in Arizona, on Average, Share an Acre-Foot of Water?* https://new.azwater.gov/news/articles/2021-19-04

Elshikha, D.M., D.J. Hunsaker, P. M. Waller, K.R. Thorp, D. Dierig, G. Wang, V.M.C. Cruz, M.E. Katterman, K.F. Bronson, and G.W. Wall. 2021. Growth, water use, and crop coefficients of direct-seeded guayule with furrow and subsurface drip irrigation in Arizona. *Industrial Crops and Products* 170: 113819 10.1016/j.indcrop.2021.113819.

Elshikha, D.M., G. Wang, P.M. Waller, D.J. Hunsaker, D. Dierig, K.R. Thorp, A.L. Thompson, M.E. Katterman, M.T. Herritt, E. Bautista, D.T. Ray, and G.W. Wall. 2022. Guayule growth and yield responses to deficit irrigation strategies in the U.S. desert. *Agricultural Water Management* 277: 108093 10.1016/j.agwat.2022.108093.

Komarek, A.M., A. De Pinto, and V.H. Smith. 2020. A review of types of risks in agriculture: what we know and what we need to know. *Agricultural Systems* 178: 102738 https://www.sciencedirect.com/science/article/pii/S0308521X18312034

Nabhan, G.P., B.D. Richter, E.C. Riordan, and C. Tornbom. 2023. Toward water-resilient agriculture in Arizona: future scenarios addressing water scarcity. *Lincoln Institute of Land Policy*. Cambridge, MA.

Rasmussen, W.D. 2002. *Taking the University to the people: Seventy-five years of cooperative extension*. Purdue University Press.

Rust, N.A., P. Stankovics, R.M. Jarvis, Z. Morris-Trainor, J.R. de Vries, J. Ingram, J. Mills, J. Gilkman, J. Parkenson, Z. Toth, R. Handsa, R. McMorran, J. Glass, and M.S. Reed. 2022. Have farmers had enough of experts? *Environmental Management* 69: 31-44.

Sanyal, D., C. Stackpole, and R. Masson. 2022. Yuma Soil Health Survey 2022: A discussion on POX-C, PMN, and soil protein. *University of Arizona Cooperative Extension AZ2059*.