PODCAST

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U.S. Sustainability Alliance

USSA Podcast: Episode 4 Show Notes

A deep dive into water conservation

The fourth episode of the podcast focuses on water conservation, traveling from Weiner, Arkansas to the central valley of California to find out how some of America's farmers and producers are rising to the challenge of climate change and extreme weather by implementing water efficiency measures on their land.

Host Russell Goldsmith opened the episode by catching up with U.S. Sustainability Alliance Executive Director David Green.

David said that USSA had decided to focus on the issue of water conservation because it is critical to farming. With a growing population, urbanization and climate change, the pressure on that water is greater than ever. The question is how can farmers get the water they need to grow their crops?

He went to explain that USSA had decided to profile an almond and rice farmer in particular as both those crops use quite a bit of water – and come under criticism as a result, not only in the United States but in other parts of the world. The interesting thing, he said, will be to see how these farmers are rising to the challenge and improving the efficiency of their water use.

Interview with rice farmer Scott Matthews

We spoke to rice farmer Scott Matthews, from Weiner in Northeast Arkansas. Scott explained that he is from the delta where it's very flat and they raise primarily rice on his particular type of soil. He said that there has been roughly 120 years of agriculture where he is. At one time, they were a larger farm by the standard of farming, and now they've almost become a small farm because they own all their own land, about 1800 acres (circa 730 hectares), and they rotate rice and soybeans in a one-to-one rotation. His farm is extremely flat, which is conducive to growing good rice. It was naturally flat, and they made it flatter by precision leveling. His ground is a real tight dirt. It's good for holding water, which is good for rice, for people familiar with soil types, it's a Henry silt loam. There are almost no hills there.

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Scott added that he grew up in the fertilizer and chemical business, and just finished his 31st crop. There’s always a lot of change, he said, and you’re always looking for that margin of profit. Originally, they started out with no till, which is when you plant a crop in the existing crop without working the ground, and they really had a lot of success with that in the early years, and they learned some things from that. One of the things Scott said he discovered was that when they no tilled or planted on stale seed bed, because the ground was so tight and didn’t have internal drainage, they got extra use of their moisture – soil banked moisture. So, they were actually starting their conservation irrigation practices with no till practices and didn't realize it until later on.

Scott said that water does two things for a rice crop:

1. About eight weeks after you plant it roughly, you put out a nitrogen shot. That is where almost all the yield comes from. Then you flood it as quickly as possible. And what that does is pushes the nitrogen down to the ground, and it holds it; as long as you hold a flood on it, your nitrogen can’t escape.
2. The water also suppresses weeds – it acts as a barrier to keep the oxygen out of the soil and keep the plants from germinating and becoming a problem at harvest or even at the mill for the product that you deliver.

<u>The need for water conservation</u>

In Scott’s 31 years, they have gone from having good water to low water, and what that means is their aquifer is depleting, and they’re now in what is called the critical groundwater area. But even prior to being in the critical groundwater area, Scott said they saw the need to conserve water. Rice is a semi-aquatic, it requires a lot of water, around 30 inches, in some cases a little more – around 38 inches per acre foot. In the past, a lot of water was run out of the fields, which he said was just not good practice. But it wasn’t regarded as bad practice at the time because there was a lot of water and sources for pumping were cheap. But as time went on, they saw this as a waste or a way to conserve money. So, they started building reservoirs and a pit recovery system. When they were irrigating rice or beans, the water that they used would dump into a tailwater recovery system and would ultimately be reused. Every year, they make changes to conserve either the soil or the water in some capacity.

Scott said that their number one crop is rice; it's what makes their living. And so, their (conservation) focus has been on rice. Even though the ground was naturally flat, it still had to be flooded. So as innovations and technologies come along, they got to a point where they were precision leveling the ground, where it's mechanically leveled to a grade. This has not only enabled them to use less water in the rice growing system, it has also allowed for a lot of new technologies to emerge as well.

Scott explained that a levee holds the water from one paddy to another. Levees usually have one or two gates depending on the size of the field, and the gates control the level of water in the paddy. And after Scott had precision leveled his fields, he noticed that they were still cascading the flood – that's where the flood goes from the top, through each field, to the bottom. If you happen to catch a rain, you would still run water out the bottom and you wouldn't be as efficient as you could be. And so, it wasn't long before Scott started using poly tubing. The practice is called multi-inlet rice irrigation, and it runs along the edge of the fields and is a calibration process – he said it's like a math problem.

Irrigation as a mathematical equation

Scott said that years ago when he first started farming, each farm was farmed a lot. He said they got to a point where each field was its own piece of the puzzle. And now they have pieces of puzzle inside a field.

He went on to explain why irrigation is like a giant math problem that involves several different measurements and steps:

- They take a field, he said, and most of their fields are larger than a lot of other places and they measure the actual ground they're planting using the GPS technology they have. So, they know almost exactly the acres inside each field that they plant. That's the first step of the math equation.

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- Then they take a flow meter, which is attached to whatever water source they're using to irrigate that particular crop, and it provides the gallons per minute flow.
- They then take those two measurements and plant their crops, which are usually drilled instead of planted.
- They then build the levees, that are on the contour or the plane or the grade of the field. Most of their ground is precision leveled now in the rice country, but there is still some that is not. And what they have figured out is, when the initial precision level of these fields started, they used to be on the laser and now it's on a satellite, it's on a particular "heading". And that heading is important for building your levee. Indeed, if that heading is off, it cants one way or another and it will cause you to water more than you want to in a particular field.

Scott summarized that they measure the field, the flow of the water, they build the levees, put them on the correct headings. If it's precision level, in the past they used to manually measure the levee. In between the levees is a paddy and they used to measure that to get the correct acres for the math formula. However, in the last few years, they have started using a drone for this. Not only does the drone get the acres even more exact, at the same time, it also has the ability to shoot the elevation. This is important because after harvest they will take these data points from this drone, where it's actually measuring the field, and will overlay it with their yield maps. And if they find a spot in a field, even though it has been graded, that's not getting watered efficiently, they will go back and correct that problem as soon as they possibly can to increase the overall yield of that field.

Results

Scott explained that rice uses about 30 inches of water per acre foot - up to 40 inches. He said, without question, that they have reduced that to 18 inches, a 40% reduction. It will get better, he said, but with what they're doing now, they're able to utilize range more efficiently and they don't run out the bottom. Their tailwater recovery system has actually suffered a little bit because of it. Now it's very rare that they run water out of the field during the growing season, and that has been one of the biggest benefits.

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Wildlife habitat

Scott said that they are in the Mississippi flyway, for those familiar with migratory routes of birds. And they have all the species of ducks and geese, and shore birds. They visit their ground over the winter. They migrate through, go south and they come back, and they stop on their way. But right now, there is just an abundance of white front geese, or speckled bellies. They have thousands visiting their cut rice fields now, and duck season comes in around two weeks. He said they also get the red tail hawks that sit around the edge of the field, and more eagles now than ever before; they sit around the fields picking off the cripples or the strays.

Interview with almond farmer Christine Gemperle

We spoke to almond farmer Christine Gemperle who is based in the Central Valley of California. She began by explaining that her brother is her business partner. Together, they have two orchards, about 135 acres (around 55 hectares) and it's just two of them that do all the work, except for a few days out of the year when they need extra help at harvest. She added that the farming side of the family goes back probably hundreds of years, but not necessarily in the United States. Christine's father is an immigrant from Switzerland who came to the U.S. when he was 27 in the mid 1960's and started a poultry and almond operation with his brother. Back in Switzerland, the family raised pigs and made Swiss cheese, and they still do that today.

Christine says that in California, the stars are aligned for almond growing. They have a Mediterranean climate, so they get all of their moisture during six months of the winter and then the rest of the growing season, they don't see any rain at all. So, because of that, she said they're able to raise the trees with the right temperature and they don't have a lot of disease pressure that rains would bring. They normally have a great supply of water in the mountains, and they have a great system to bring water to different parts of the valley and some of the most fertile soils on the planet.

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Christine explained that contrary to what we’ve been told by the media, almonds aren’t any thirstier than any other crop. The almond tree probably consumes about as much water as any other tree crop, such as an olive, peach, or a prune. However, when you look at an almond, you see a tiny, little dense product, it’s very small, and a lot of people don't take into consideration that there is a hull on the outside of the almond that actually we don't eat, and that’s part of the water consumption. However, it’s not wasted. Christine said that they actually use it in the dairy business, and it helps dairy farmers keep their water footprint down because they are consuming the almond industry’s by-product.

Climate change challenges

Christine said that climate change is real. She explained that we’ve moved into this pattern of weather where we’re seeing either feast or famine, so we could have a year with two hundred percent of normal rain and then it could be followed by three years of drought conditions. And so really, the biggest dilemma in California is how do they harness the rain when they get it? And that’s where they really need to see some major changes. Christine explained that their system was designed for Sierra Snow Melt that melted gradually and filled their reservoirs, but they just don’t have that kind of climate anymore. The weather they see is just huge storms, and some of the cities in California had their highest daily rainfall records ever. They need to capture that when it comes. So that’s part of their challenge going forward.

Water conservation in action

Christine said that some of the practices to conserve water need to be taken on by the state, like reservoirs, but Christine and her brother have done a lot of things on their property to save water. And if they don’t use all their water in one of the water districts where their orchard is, they have the ability to save that water and use it the following year. Christine has about five practices that have really made a huge difference. One of those practices is strategic irrigation. That involves only putting water on the tree when it needs it and in the quantity that it needs, using a lot of sensor data, from evapo-transpiration rates to soil moisture monitoring. She said they're also looking at the development of the almond on the tree at any particular point in time. So, looking at exactly what the tree needs. Another thing they are using is very efficient irrigation equipment. Some people use subsurface irrigation drip lines so that they're eliminating the evaporation of water that you might see, say, through flood irrigation or through some micro sprinklers. That being said, micro sprinklers are still a very efficient way to deliver water to almond trees.

Whole orchard recycling

The newest practice is Whole Orchard Recycling, where they take a whole orchard at the end of its life cycle, grind the whole thing up and turn it back into the ground. Christine has found, through the research funded by the Almond Board, that it can increase the water holding capacity of the soil by up to 20%; that's in addition to all the nutrients that it brings to that soil. She is also cover cropping. She said that you would think that cover cropping would take water away from your crop, but it doesn't because what it's doing is building the soil and helping with that water retention. It creates greater humidity in the orchard as well, not humidity that harms the crop, but humidity that really keeps down the evaporation rates. The last thing, in one of her water districts, they're actually using recycled municipal water. Instead of 'farm to fork', she has 'potty to plate, she added.

Results

Christine said that orchards live for about twenty-five years and so you have to think in that time, how much carbon those trees have pulled out of the environment and is in the woody biomass there. Just that idea of putting that back into the soil is just a carbon sequestering event.

Christine said that across the board, she has definitely cut back on her water consumption by easily 20%. However, this last year, because she redesigned a 20-acre block on her home orchard that she lives on, of the water supply that she uses, which was cut because of the drought, she actually only uses 60% of her water supply. This is because she monitored it so closely and used the strategies that she outlined.

Groundwater banking

One of the big directions that Christine, and most people, are looking for in California is going into groundwater recharge, recharging the aquifers below them. She said they could build recharge basins where they take in excess water at certain times of the year or stormwater, and that filtrates down through the ground into the aquifer. They can also do that in their orchards during the winter as well, because really the orchards in the Central Valley themselves can be used as a recharge basin. And this is what they consider to be groundwater banking, which is a little bit more organized when you actually have a huge pond area and you bring water into it with the express purpose of it going down into the ground and recharging the aquifer. This means that in times of need, like in drought, you can go to that water bank and pull that water out and know that it's there without actually depleting the aquifer. She described it like a bank - you put water in and then you take water out and you have to keep it balanced. She also spoke to her cousin, who is a hydrologist, about reverse engineering a well, as she has two wells on her property. She wanted to know if it was possible to take excess water and instead use those wells for putting water back down into the ground. In order to do that, though, just like the water bank, you have to have a means of accounting for how much you're putting in, so that later on, when you take it out, you don't deplete the aquifer. Anything like that is a huge investment, Christine concluded, because doing the right thing is never cheap!

Observations from USSA Executive Director David Green

David Green said that he was absolutely blown away by what Scott and Christine are doing. He knew that farmers in both sectors were doing a lot in the area of water conservation but was amazed to hear Scott and Christine talk through the almost mathematical approach they have to take. He was struck by how Scott is using levees, is striving to get the ground elevation just right and, in particular, is using drones. And he said that it was just fascinating to hear Christine talk about groundwater recharging as if it were a bank. He made the point that many people don’t understand that farmers are at the front end of production and will look to any tools, technology and innovation in order to produce better – and that includes better use of technologies to conserve their water and make their water use as efficient as possible. Aside from what these farmers are doing, David said that just last week Brazil approved a genetically modified wheat that is drought resistant. It was a technical approval so won’t be going into the flour mills in Brazil any time soon, but it’s another example of how technology is coming in to meet the challenges of water availability. There are already GM corn varieties that are drought resistant and if farmers are to meet the challenge of feeding a growing population, then we’ll need to look at these different technologies a lot more.