## Subsurface Drip Irrigation

## Part 2

## Season 1, Episode 10

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**John McMaine:** Thanks for joining us on Streamlines, your source for water knowledge. I’m your host, John McMaine with South Dakota State University Extension. This is Episode 10.

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**John McMain**e: Welcome back to Part 2 of Subsurface Drip Irrigation. I’m John McMaine.

**Anthony Bly:** And I’m Anthony Bly.

**John McMain**e: Last time, we ended on kind of the challenges and potential downsides of subsurface drip irrigation systems. With that in mind, Anthony, would you consider adding subsurface drip irrigation to your operation?

**Anthony Bly:** I don’t think it could cover the whole farm.

**John McMain**e: Would it, would it be feasible to include management into your kind of existing field operations.

**Anthony Bly:** I think it’s very soil specific or field specific. Water source, maybe a few acres. A percent of the farm.

**John McMain**e: I mean I guess I could see someone getting kind of buyer’s remorse with this. If they put a system in but then if the management is more than they bargained for then.

**Anthony Bly:** What do you do?

**John McMain**e: What do you do, yeah? He has this expensive system in the ground and now you don’t want it anymore. It’s kind of like getting a hummer or something back in the day when gas was $7 a gallon.

**Anthony Bly:** Right.

**John McMain**e: And, then you’re like, oh I got this fancy vehicle that could go, you know, climb Mount Everest but it costs $100 a week to drive it around.

**Anthony Bly:** Yeah, there’s, there’s a lot of obligations here to fulfill.

**John McMain**e: But it does make your system more resilient from a water perspective and, and drought is a significant consideration especially here in Eastern South Dakota.

**Anthony Bly:** Yeah, I’d like to see the, the yield advantages over a ten year period or maybe longer.

**John McMain**e: Yeah, I bet you would Anthony.

**Anthony Bly:** Yeah, I would.

**John McMain**e: So, speaking of ten years or longer, that’s one of the questions I asked Todd. Is what’s the lifespan of these systems, right? I mean, you want a system that’s resilient enough that it’s going to be able to withstand the ground for long enough that you can get paid back for sure, but long enough that you don’t have to frequently change things out and continually update the system, from that perspective.

**Anthony Bly:** Right.

**Todd Trooien:** SDI systems are, are expensive to install. They represent significant investment upfront to get to, to buy really. This technology that is uniform and efficient. One of the best ways to get a good return on investment is to get that system last for many years. To make it last then we really need to implement the five-step program to, to prevent emitter clogging. And then we can expect that these systems will, will last for twenty years perhaps. That the drip lines themselves are buried and protected from sunlight. We need to protect them from rodents and other burrowing creatures. But if we can do that, then that plastic should be in good shape for many years. One of the early research plots in western Kansas applied water, lasted twenty-seven years before they replaced it. So it had a twenty-seven year life length. The economics looked pretty good. Even though the initial investment in the SDI system is quite high.

**Anthony Bly:** Wow, that’s a long time.

**John McMain**e: That’s a long time. And that makes it more worth it. And it’s not, I guess it’s not outrageous maintenance. It’s just keeping an eye on things and making sure you don’t have catastrophic failures.

**Anthony Bly:** Right.

**John McMain**e: But yeah, twenty-seven years. I mean your kids are going to be out, out of the house by then.

**Anthony Bly:** That, that’s a professional career.

**John McMain**e: That’s a professional career.

**Anthony Bly:** It bothers me you can’t see it.

**John McMain**e: Yeah, I mean that, like, just from a gut feeling, like a gut check. It’s hard to keep an eye on your SDI system when you can’t keep an eye on the SDI system because you can’t see it.

**Anthony Bly:** Flow meters, you got to trust the flow meters and the amount of water you used.

**John McMain**e: You’ve got to set up a good monitoring plan and trust it.

**Anthony Bly:** And follow the protocols.

**John McMain**e: Yes. So, we talked about maintenance, and we talked about upfront things. Let’s dig into design more. So, design is very important. You got a lot of variables, right? You got your emitters, you got your tube size, you got your spacing, you got the topography. All these things are variables that go in to design a system. I asked Todd to comment on this and this is what he said.

**Todd Trooien:** We want these systems to last for many, many years. So, we want to make sure that our system design is, is appropriate right up front. And so, some of the design things that we’ll think about would be things like drip line depth, drip line spacing, how far laterally between drip lines we want. And another factor then to consider is the topography of your field and we can overcome some topography changes in the field by using pressure compensated emitters and so we slightly overpressure the entire system then and allow these compensating emitters to, to restrict the flow in the lower areas where the pressure on the emitter would be higher than just because of the change of topography. So, these pressure compensating emitters give us a lot more flexibility to, to overcome some topography. Again, we need to be really careful with our maintenance program and, and implementing the five-step program to keep those emitters from clogging. Just like any other emitters, especially if we’re working with pressure compensated emitters.

**John McMain**e: Engineers dream.

**Anthony Bly:** Yeah, no kidding.

**John McMain**e: You got a problem; you can solve that problem with changing pieces and parts that go into the puzzle.

**Anthony Bly:** Right.

**John McMain**e: That is the nice thing about SDI systems, subsurface drip irrigation systems, is similar to subirrigation. The concepts are the same, but you can innovate around a system based on your, your specific site. And it’s, it’s much less dependent on the site as compared to subirrigation.

**Anthony Bly:** It’s adaptable.

**John McMain**e: It’s adaptable, exactly. And so, since this is a conservation drainage series, and subsurface drip irrigation isn’t necessarily something that we usually think about related to conservation drainage. I asked Todd if we could use subsurface drip irrigation in combination with some of our conservation drainage practices like drainage water recycling or controlled drainage, that type of thing. And really the biggest thing is just like any irrigation, it requires a water source. And so, when combining it with conservation drainage, we can as the water source.

**Todd Trooien:** SDI requires a water source, and that water source can be captured drainage water that is recycled drainage water. We have to have a, a reservoir or some sort of containment to hold that water until we want to apply it again through the irrigation system. One of the other consideration then is salinity. And the drainage water will remove some salts from the roots zone, from the soil profile when it drains the water so we, we may want to either monitor the salinity directly or indirectly in the soil. One of the advantages we have here where were marrying drainage systems and subsurface drip irrigation is that we are flushing some of those salts out then using the drainage system. So even if we reintroduce some of them with the subsurface drip irrigation system, we can rely on, on flushing again in the next drainage cycle but we will want to monitor or track or somehow be aware of salinity issues that may or may not crop up when we recycle the drainage water through an SDI system.

**John McMain**e: So, it can work well with drainage and conservation drainage specifically drainage water recycling but there are some considerations for that. And, if we think about our conservation drainage objectives. One is kind of the water resilience piece. But then the other one is reducing nutrient loss downstream. And I think this is a place where subsurface drip irrigation really shines. So we can use fertigation, we can place the nutrients specifically where the roots are going to use it and where they need it. And we can do it throughout the season. It doesn’t have to be only when we can get into the field with an applicator, we can do it throughout the season through the irrigation line.

**Anthony Bly:** Right, yeah.

**John McMain**e: So, I pitched this to Todd, as kind of a ‘Hey should we include SDI as a conservation drainage practice because of this efficiency?’ So, this is what he had to say about kind of uniformity and fertigation in general and how it improves nutrient efficiency.

**Todd Trooien:** The big benefits of SDI is the very high uniformity of water application across the field and so we can use that uniformity to also uniformly apply nutrients to the field. And SDI systems are, are very good for introducing nutrients whether you’re fertigating or recycling drainage water that is, that has some nitrate nitrogen concentration in it already. When we use SDI to apply that back to the field then, that gets applied uniformly to the field which brings us benefits in terms of less losses because of inadvertent overapplication in various locations. Also, then we, we can apply the nutrients in the water during the growing season and target specific growth stages. So, we don’t have to have the nutrients waiting for the crop in the field. But we would be delivering the nutrients just in time and so the nutrients aren’t just sitting in the field and exposed to potentially losses due to leaching or, or whatever losses you might have. But when we can apply the water and the nutrients at specific growth stages and get the nutrients to the roots just in time, then they get used again very quickly and are not potential contaminates elsewhere in our ecosystems. We need to be really careful if we’re, we’re fertigating. I mean I need to make sure the fertilizer form that you’re using is water soluble, not all fertilizers are water soluble and if you try to introduce something that is not water soluble that could very easily clog your emitters and cause loss of your irrigation system.

**Anthony Bly:** An IV for plants.

**John McMain**e: Pretty much.

**Anthony Bly:** Not direct injection, but pretty close.

**John McMain**e: Pretty close. Is that a marginal improvement or is that a game changer? So, if you put in nutrients in the fall or in the spring, kind of typical nutrient application, versus if you put it in how much you need when you need it during the growing season. Is that make a huge difference, you think?

**Anthony Bly:** Well, you know, we, we got to remember that we’re relying on the soil to grow that plant. And the soil is weathering and releasing nutrients as well. And so, where’s the trade off? What is the soil really going to be ultimately for in a drip irrigation system? Is it just hydroponics then? Or are we relying on the soil for its biological processes at the same time? So, where’s that relationship? That’s what I think of.

**John McMain**e: I guess as much as we think we know, we don’t know what’s going to be released from the soil. Like that’s still a complex process, even if we’re delivering nutrients when it’s needed, it’s still a complex process of that nutrient cycle within the soil.

**Anthony Bly:** Yeah, our current recommendations, nutrient recommendations, are based on, on soil calibration work. So now we’re putting in a new dynamic, which is fine. Which is very innovative. But how do we know how much to put through that system.

**John McMain**e: Yeah.

**Anthony Bly:** That’s my point. Which we can figure out.

**John McMain**e: What’s the nutrient efficiency typically for say, nitrogen?

**Anthony Bly:** We’re, you know, we’re looking at probably .8 to 1.1 pounds of nitrogen per bushel of corn.

**John McMain**e: Okay and of that that’s applied, how much gets used versus how much gets loss.

**Anthony Bly:** Well, we in South Dakota really rely on nitrogen from the soil as well. So, it takes our fertilizer nitrogen plus our soil nitrogen.

**John McMain**e: Sure.

**Anthony Bly:** For optimal yield.

**John McMain**e: Sure. If we used something like fertigation, could we drop that applied nitrogen?

**Anthony Bly:** I think we could, yeah. That’s going to increase that efficiency.

**John McMain**e: Yeah.

**Anthony Bly:** Yeah.

**John McMain**e: Think it would be significant?

**Anthony Bly:** I don’t know.

**John McMain**e: It’s hard to say.

**Anthony Bly:** I’m not going, I’m not going to go out there.

**John McMain**e: You’re, you’re not going out on that limb?

**Anthony Bly:** No, I, I’d like to know. I mean, it’s a very intriguing point when it comes to nutrient management.

**John McMain**e: Yeah and, and that’s, I think that’s something that I don’t often think about with subsurface drip irrigation. I think about the water side, but because you have a delivery source, delivery mechanism at the root zone, it has a lot of other potential as well.

**Anthony Bly:** And you could probably get it there really quickly, too.

**John McMain**e: Yeah.

**Anthony Bly:** You know.

**John McMain**e: And it’s in a soluble form.

**Anthony Bly:** Right.

**John McMain**e: It’s that IV to the plant. So, one of the biggest things about SDI, or really about farming. Kind of the two biggest things are resilience and variability. I mean maybe resilience is one of the biggest buzzwords next to soil health.

**Anthony Bly:** Right.

**John McMain**e: But.

**Anthony Bly:** Regenerative ag.

**John McMain**e: Yeah, next to regenerative ag. But resilience is basically that system being able to help weather extremes I would say.

**Anthony Bly:** Right.

**John McMain**e: And then variability is the extremes. I mean its SDI. I asked Todd about this. Like in his mind, what’s the biggest benefit with SDI to approach system resilience and to overcome variability of, of all the variables that are out there.

**Todd Trooien:** So regardless of the irrigation system we use here, just the fact that we’re going to be able to apply water if and when the crop needs it means that we can reduce some of our year-to-year variability. That is reduce the variation of our yields from year to year. And so, when we can rely more strongly on good production that helps our decision making all, all across the farm and across, across the community, I mean in many ways. Using SDI as our irrigation system brings additional benefits. Water efficiency and water uniformity and elsewhere in the United States in more heavily irrigated areas, we’ve seen that we can actually use a little bit less water with a SDI system compared to say, center pivots for many factors but not the least of which is the reducing that evaporation loss because we’re not spraying the water through the air or, or letting the water sit on the soil surface. That may or may not be a consideration for us here in the Northern plains where our water supply is not as limited and our periods of irrigation are, are little shorter during the growing season but it might be during severe years where stretching the water supply will bring us additional benefits. That is in addition to just being able to irrigate it all during that dry period.

**John McMain**e: He makes a strong case.

**Anthony Bly:** Yeah. Yeah, that’s pretty strong there.

**John McMain**e: Yeah, its compelling. I mean even getting into like economic benefits across a community, you know. And especially on the farm, you can better count on a yield, a certain yield year in and year out because you have consistent water conditions. One of the biggest variables is weather and if you can keep that consistent with an SDI system, now you’ve reduced variability. You can count on that cash flow because of that reduced variability.

**Anthony Bly:** Stabilization. Economic stabilization.

**John McMain**e: How much does that matter? So, we can think about going for the homerun and that’s a good thing right? But year to year variability, if we can reduce that, is that as important as kind of getting that homerun yield?

**Anthony Bly:** Well, you know, you look at price fluctuations as well. And sometimes when you have an abundant crop it’s not a very good price versus the other way. So, if you can stabilize your yield and then those years where the price is, is good, because there’s a short supply and you got it, then that’s, I think that’s the homerun.

**John McMain**e: Yeah, there’s more to the equation that just bushels per acre.

**Anthony Bly:** Yeah, you’re going to get the homerun through the stabilization. There’s more to the equation than just bushels.

**John McMain**e: Yeah. Absolutely. So, Todd is a water engineer, he’s an ag engineer. Works with water. I’m a water management engineer. I think about hydrology a lot and there’s a lot we can’t control with hydrology. And there’s a lot we can, how our soils function, things like that. But if we think about it structurally, there’s two pieces that change the hydrology of a field and it’s getting water away, which would be drainage, either surface or subsurface drainage. And it’s adding more water to the field. And so, I asked Todd just to kind of sell me on SDI and how I can better manage the hydrology of a field.

**Todd Trooien:** So, we see in the landscape increased interest and use of subsurface drainage to handle our excess water conditions. A logical step then is to add irrigation systems to that water management system so we can manage water during that entire growing season, whether it’s wet or dry. And we know we have dry periods where we can benefit from additional water. The use of SDI then, subsurface drip irrigation, represents the best technology that we have right now. The most uniform, the most efficient irrigation system that we can use to allow us to manage all the components of the water balance for our fields.

**John McMain**e: Subsurface drip irrigation is an investment. There’s an upfront cost.

**Anthony Bly:** It’s pretty high.

**John McMain**e: But some things I was surprised to hear is how long it can last.

**Anthony Bly:** If you follow those five steps.

**John McMain**e: Todd was very adamant about following those five steps.

**Anthony Bly:** He mentioned them several times.

**John McMain**e: Yes, so that’s very important. And one of the biggest benefits, I think, was something you talked about with the stability of yield because of subsurface drip irrigation.

**Anthony Bly:** Correct.

**John McMain**e: And to me, as someone who doesn’t farm, I don’t, that’s not at the top of my mind. But I can imagine, like you talking about that, it makes, it makes a lot of sense. You can count on a yield, year in year out. That’s huge versus not knowing what you’re going to get.

**Anthony Bly:** Oh, it stabilizes inputs and other expenses really well.

**John McMain**e: Yeah, you have a yield goal that you can expect to hit every year.

**Anthony Bly:** Right.

**John McMain**e: So, you can base inputs around that. So, subsurface drip irrigation: upfront investment if maintained properly, that investment pays off. Not just in higher yields but more yield stability and greater efficiency for water and nutrient use.

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**John McMain**e: Thanks for joining us today on Streamlines. We sure had a lot of fun today, hope you did too. If you want to learn more about anything you heard today, head on over to the SDSU Extension Website. But for now, I’m John McMaine.

**Anthony Bly:** And I’m Anthony Bly.

**John McMain**e: And we’ll catch you next time.