

THE STATUS OF SDI IN THE CENTRAL AND SOUTHERN GREAT PLAINS

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Subsurface drip irrigation (SDI) applies water below the soil surface to the crop root zone with small emission points (emitters) that are in a series of plastic lines typically spaced between alternate pairs of crop rows.



Soil wetting pattern.



Installation
of SDI
driplines.



Most driplines in Great Plains are at depth of 12-18 inches.

What is Subsurface Drip Irrigation?

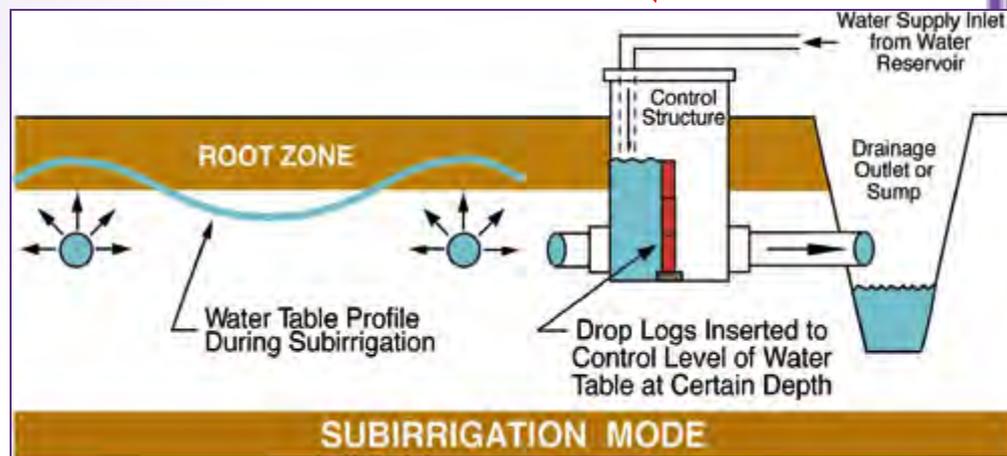
Subsurface drip irrigation is not the same and should not be confused with subirrigation.

Subirrigation applies water below the ground surface by raising the water table to within or near the root zone.

This is SDI



This is subirrigation



No irrigation system can save water without good management imparted by the producer.



Additionally, some systems although perhaps more complicated in design and number of components may inherently result in better water management.

Generally, farmers obtain improvement by moving to the right in figure above.

This concept can perhaps be considered as

“purchasing improved management capabilities upfront”.

It has been said that one of the principal reasons that pressurized irrigation systems such as center pivot sprinklers (CP) and subsurface drip irrigation (SDI) are considered easier to manage than surface irrigation is because they remove the surface water transport phenomenon from the management.

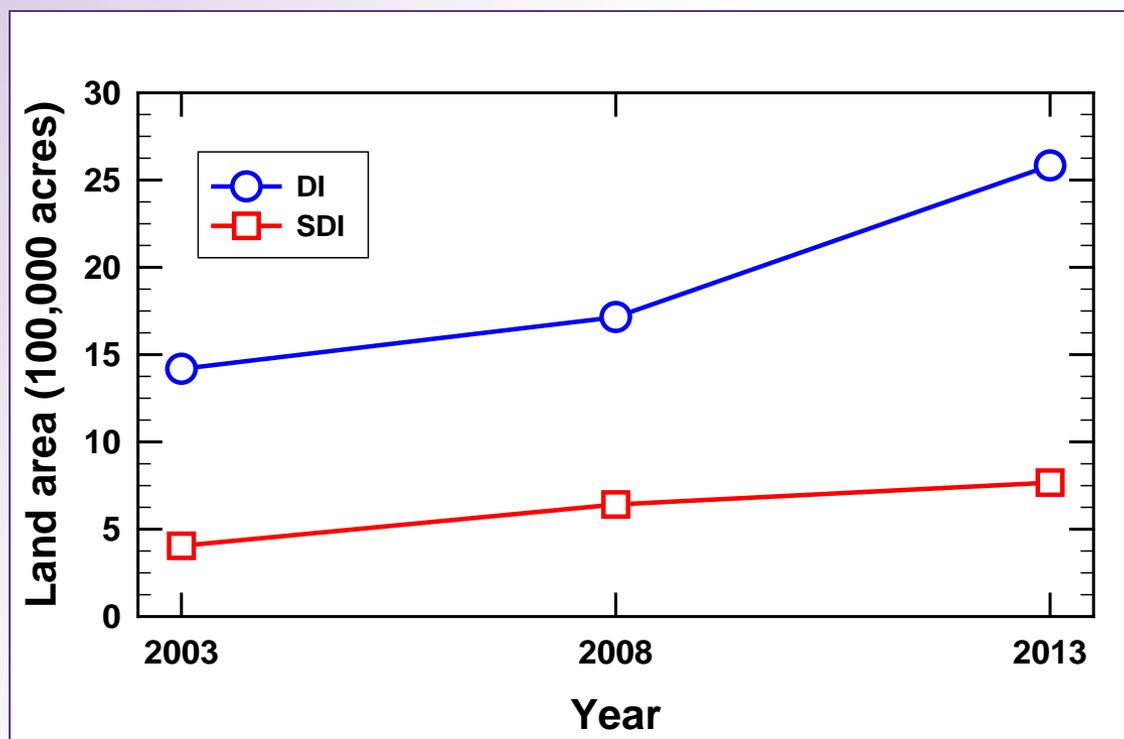
Both center pivot sprinkler irrigation and SDI are well suited for automation (monitoring and control).



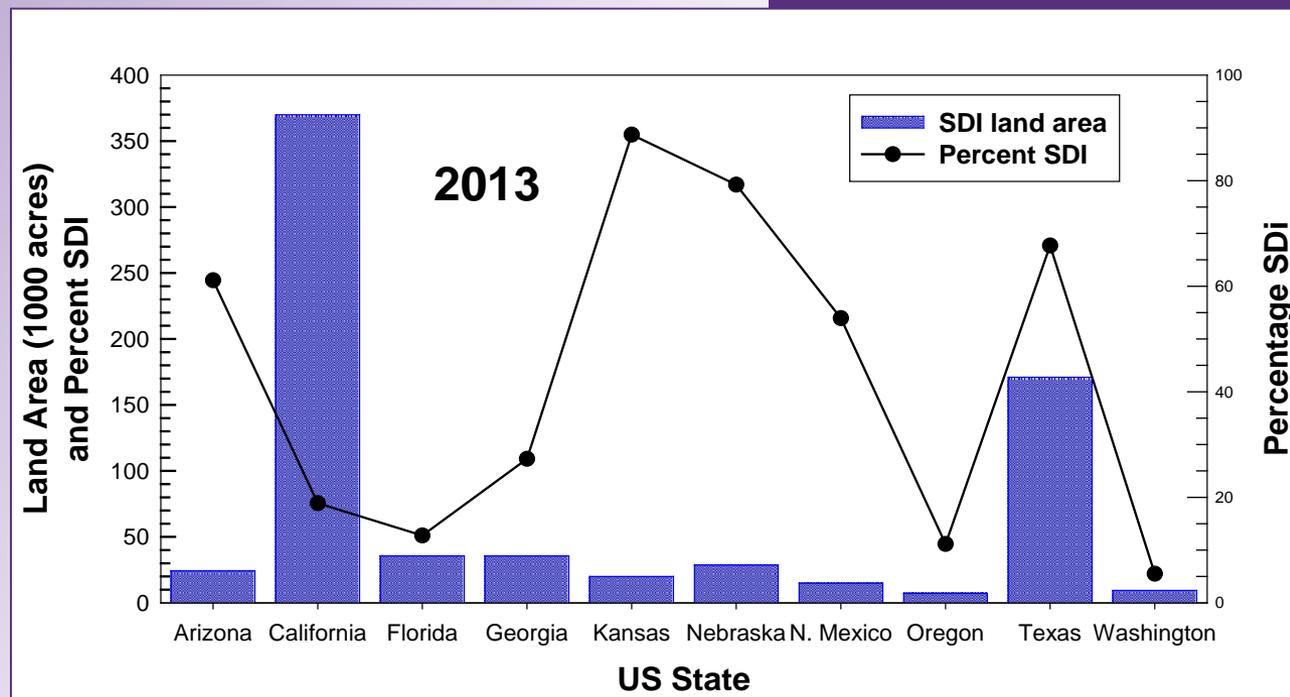
Microirrigation is the overarching term that includes surface drip irrigation (DI), subsurface drip irrigation (SDI), microsprinkler and bubbler irrigation.

The rate of growth of DI and SDI is quite high in the USA.

In the OAP region, we are most interested in SDI because it allows us to consider microirrigation for lesser-value commodity crops such as cotton and corn.



SDI is also of major interest in several other states.



In 2013, the ten USA states with the largest SDI area (716,183 acres) comprise over 93% of the total SDI area but have a wide variation in the ratio of SDI/(SDI+DI) land area.

SDI land area in Kansas and Texas has grown 127% and 28%, respectively in the last 5 years according to the USDA-NASS data.

SDI land area has grown 89% in USA during last 10 years.



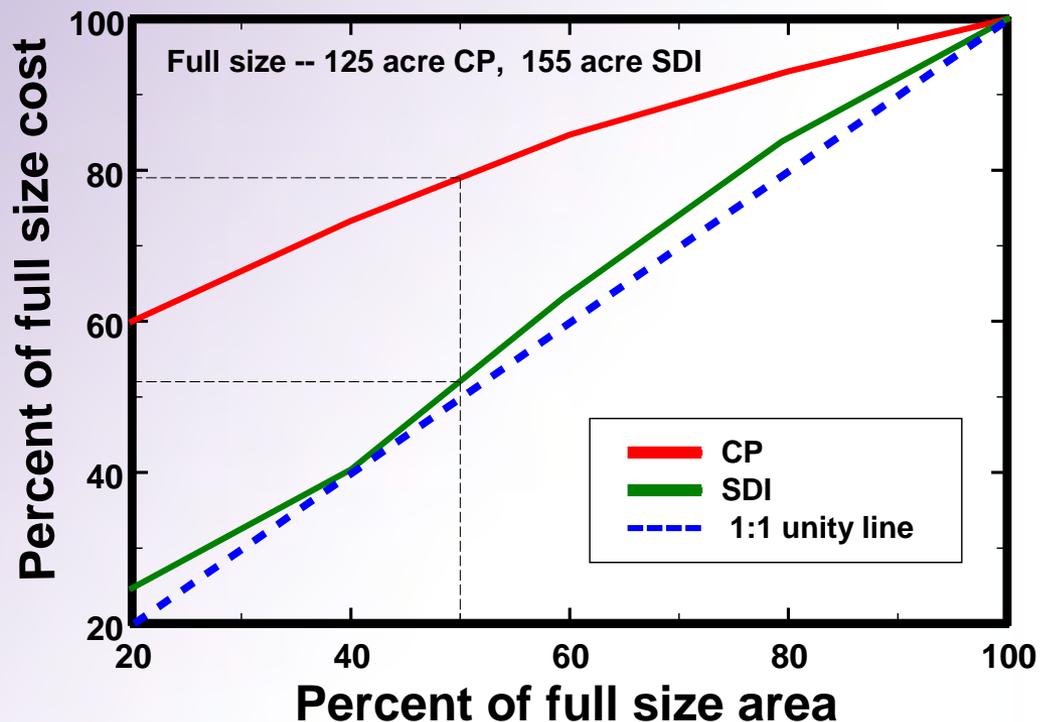
We suspect that NASS is not representing all the SDI area in the Great Plains.

For example, in Kansas NASS only projects about 20,000 acres, where we think 35000 acres might be more realistic. NASS data overtime does not match with installation capacities (2000-3000 acres/year) that seem to be occurring.

In Texas, NASS reported 170,972 acres, while the single High Plains Water Conservation District (2014) shows physical locations for 4263 SDI systems covering 265,299 acres (http://www.hpwd.org/s/SDI_2013.pdf).



The components of SDI systems can be easily and economically designed to accommodate the field size.



Lower-valued commodity crops, such as cotton and corn, may only be profitable with SDI because of the ability to amortize SDI system and installation costs over the multiple years of operation.



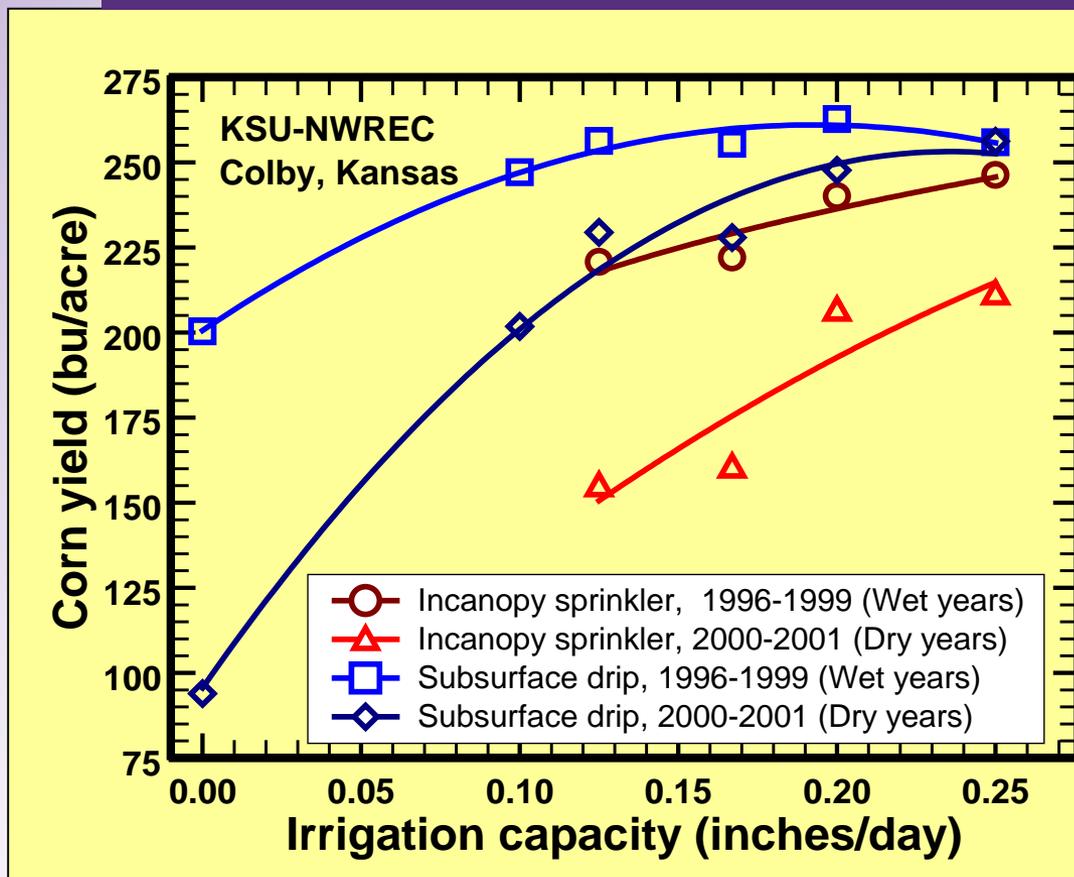
SDI can be used for small, frequent, just-in-time irrigation and nutrient applications directly to crop root system.

The primary ways that SDI could increase crop water productivity (WP), *More crop per drop* are:

- Reduction and/or elimination of deep drainage, irrigation runoff, and soil water evaporation
- Improved infiltration, storage, and use of precipitation
- Improved in-field uniformity and targeting of plant root zone
- Improved crop health, growth, yield, and quality

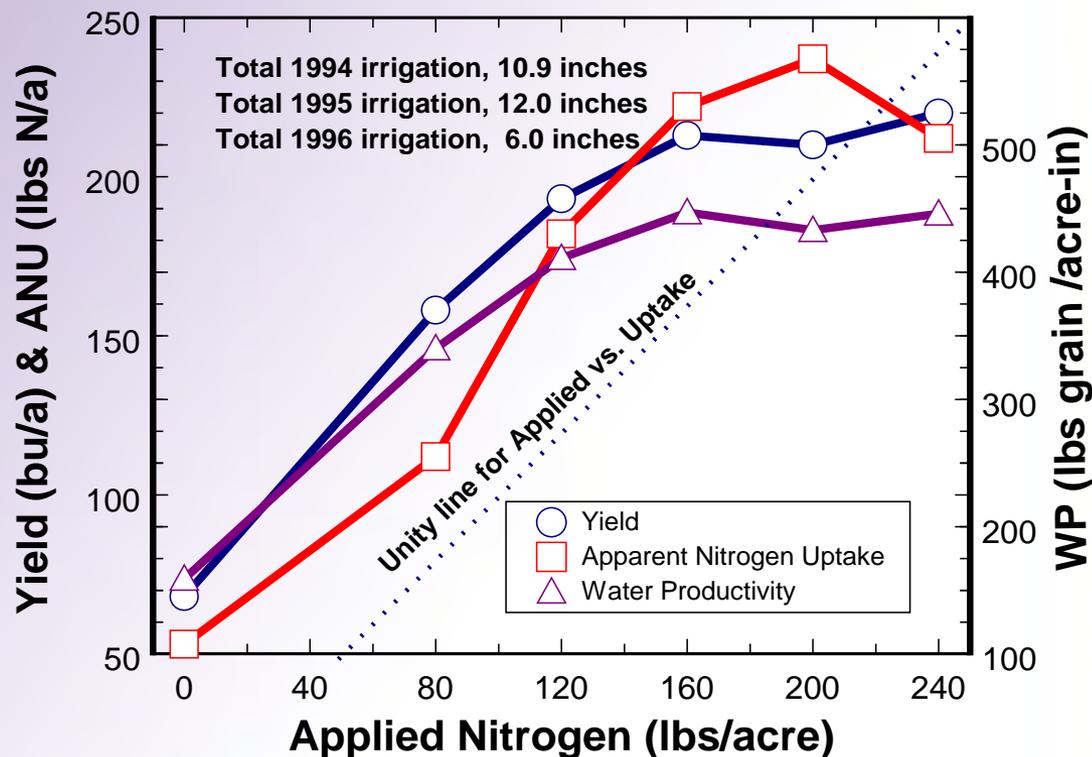


*Does SDI
really increase
crop per drop?*



There is growing evidence from our studies and others in the Great Plains that SDI can stabilize yields at a greater level than alternative irrigation systems when deficit irrigated.

**Does SDI
really improve
nutrient
management?**



Our studies have shown that using 75% of full irrigation with SDI, our corn yields plateaued at approximately 80% of typical nitrogen applications.



What about

SDI and Site Specific Irrigation (SSI)?

Well, this topic heavily dives into the semantics here.

The SDI system consists of a specific number of zones created in the original design and at the time of installation. Although, not impossible, it may be economically impractical to change the zone configurations at a later time.

Breaking the SDI system up into additional zones at the design and installation phases adds costs to the system, but is warranted in some circumstances. Ideally, the zone characteristics are initially carefully considered.

SDI's technical competitiveness with CP systems probably lies more closely with its precise water and nutrient placement.



What are the Greatest Barriers to SDI Adoption in the Great Plains?

In my opinion, the greatest obstacles to adoption of SDI in the Great Plains are:

- **System cost.**
- **Germination and crop establishment.**
- **Prevention of animal and insect damage to driplines.**

Industry, universities, and government agencies are evaluating options that may help reduce these barriers.



Potential to increase economic competitiveness:

- More generic SDI designs and components
- Studies examining system requirements and trying to streamline the design processes
(e.g., Bordovsky et al., 2008 and Rogers et al., 2003)
- Government cost sharing
- Greater overall yields and crop prices



Germination/Crop Establishment Barrier to SDI Adoption

Germination and crop establishment can be a problem under drought conditions prevalent in the semi-arid Great Plains.

Cropping and tillage management can help to reduce this problem. (e.g., [Bordovsky et al. 2012](#))

Fortunately, the problem does not occur in every year.



Rodent damage is probably the largest barrier to greater adoption of SDI systems in the Great Plains.

Of the three mentioned barriers, it is also the one with the least thorough solutions.

It is not that rodent problems are widespread with the majority of systems being greatly affected. The issue is that when a widespread problem occurs on a particular system, it can be frustrating to the irrigator and the damage may lead to system abandonment.

And bad news travels fast.....



Some partial solutions to reduce or prevent rodent damage are discussed in Lamm et al. (2014).

Industry continues to look for more effective solutions to this problem with a focus on materials that might be impregnated in the plastic or injected into the dripline during the irrigation event to serve as a repellent.

- **Scaling the SDI systems to the desired and/or required complexity while addressing the skills of various end-users, locally, regionally, nationally, and internationally.**
- **Optimizing SDI production both in economical and environmentally friendly manners that are socially acceptable.**
- **Breaking the High Tech / Low Tech paradox of SDI that *“Never the twain shall meet.”***



Modern SDI is relatively new to our region with cotton research beginning at TAMU in 1963 and our KSU corn research in 1989. It can be noted that first USA research with SDI can be traced to efforts in Colorado in 1913 **House (1918)**.

Some of the persistent barriers mentioned here today have existed throughout its brief history.

Progress continues to be made at addressing and circumventing these barriers.



Some would say, with 25, 50, or 100 years of research efforts the barriers must be too formidable.

But a growing number of irrigators are *voting* with their time and money that SDI does have a place in our region.

Government cost sharing is being provided to advance the adoption of the technology.

Many talented research and extension teams all across the OAP region are committing time and effort with SDI.



So, maybe we should not let these ***Barrier Bogeymen*** be so loudly trumpeted as reasons to avoid SDI.

Surely, there are enough other technical and social challenges to SDI to keep the conversation continuing.

How about....

Improved irrigation is not synonymous with sustainable irrigation, but both are worthy of our efforts.





*It cannot be overemphasized that
management and technology go
hand-in-hand
and both can only be optimized in the
presence of the other.*

Don't forget
the human.