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Subsurface Drip Irrigation: Status of the Technology in 2010

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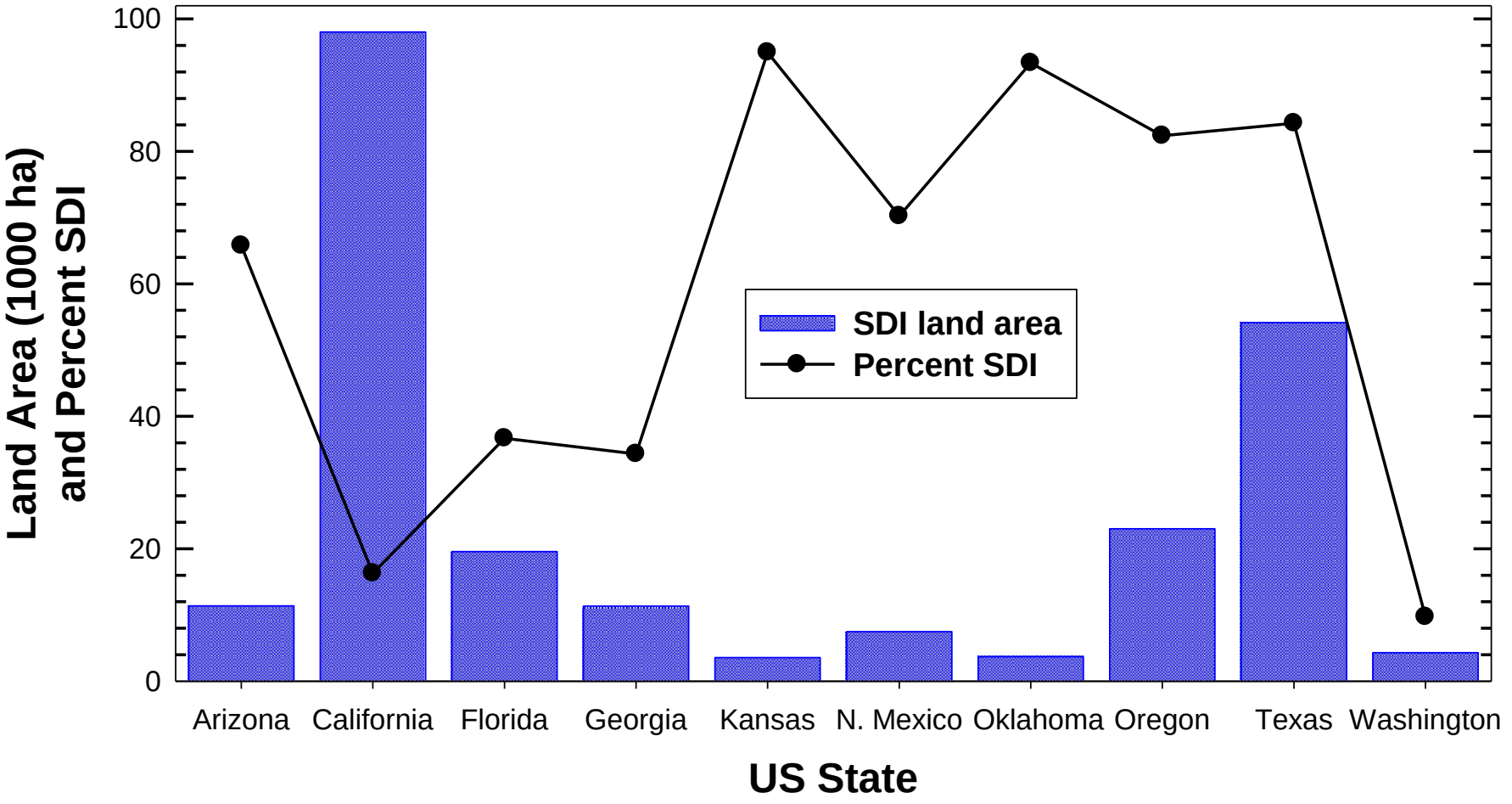
Growth Status of On-Farm Systems

The use of SDI in the United States has increased from 163,000 to 260,000 ha in the five-year period 2003 to 2008, an increase of 59% according to the latest USDA Farm and Ranch Irrigation Survey (USDA-NASS, 2009). In comparison, the DI land area increased from 566,000 to 694,000 ha, a more modest increase of 23%.

Nationally, SDI accounts for only about 27% of the land area devoted to the combined DI and SDI area (Note: microsprinkler and bubbler irrigation not included in these totals). However, this comparison can perhaps be skewed by the fact that some of the SDI land area being reported is shallow, annually removed systems



Characteristics of SDI usage in the ten U.S. states having the largest land area devoted to SDI. The percentage of SDI refers to the ratio of SDI to total SDI and surface drip irrigation (DI). Data summarized from USDA-NASS (2009).

Challenges to SDI Adoption and Successful Use

A list of SDI challenges was developed based on the multiple authors' perceptions, experiences, and discussions with producers in their region of the United States.

Although this listing cannot be considered all inclusive or scientifically authoritative, it may provide a general perspective of specific problems in different regions of the country as well as problems common to all regions.

Design and Installation Challenges

Challenge	Southeast (Humid and Semi-Humid)	Great Plains (Generally Semi-Arid)	West (Generally Arid)
Designers, Dealers, Installers, After-Sale Support	Small number of qualified designers, dealers and installers. Some systems are installed by growers and there is some tendency to find less expensive options that may increase risk of system problems. Growers often don't understand sensitivity of system to hydraulics.	Large improvement in number of designers, dealers and installers and their qualifications in last ten years, particularly in southern Great Plains. After-sale support is important and could use further improvement.	Generally not a problem in California, but still smaller numbers of qualified companies in Pacific Northwest.
Installation depth	Generally about 0.25 to 0.30 m dripline depth. Some concern about appropriate depth on variable soil types within fields. Overburden in non-bridging coarser, sandier soils may cause difficulties in "opening" driplines after installation	Some movement away from deeper installation depths of 0.35 to 0.45 m towards shallower 0.25 to 0.3 m depths in hope of improving germination and early crop growth. Heavy soil textures may limit installation depth.	Some deeper (>0.2 m) systems for trees and vines, but greater use of install & remove systems for row crop fruits and vegetables. Power requirements for deeper installations in tree and vine crops.
		Deeper installations increase difficulty in finding and repairing dripline leaks. Concerns about root intrusion.	
Dripline spacing	Generally, alternate row middles (one dripline centered between adjacent pairs of crop rows), but grower questions arise on variable soil types and where crops of different row spacing are rotated.	Almost exclusively alternate row middles, except for some shallow rooted vegetables, crops grown on coarse sandy soils or where soil salinity is an issue.	Some issues about where to put driplines and how many driplines are required for tree crops. Lack of understanding how soil texture changes can affect design.
	GPS installation should be used for all row crop installations to increase tillage options and to reduce crop germination and growth problems.		

Operational and Management Challenges

<table>
<tr><th>Challenge</th><th>Southeast
(Humid and Semi-Humid)</th><th>Great Plains
(Generally Semi-Arid)</th><th>West
(Generally Arid)</th></tr>
<tr><td rowspan="2">Monitoring and evaluating performance</td><td colspan="3">Fewer visual indicators of performance and no wet soils qualitatively indicating amount of irrigation.
Uncertainty about trusting performance to flowmeters, pressure gauges, and other sensors.
Reluctance to learn new management styles and to accept new techniques of evaluating irrigation amount and performance
Growers have less overall understanding of performance they can’t see.</td></tr>
<tr><td></td><td></td><td>Lack of trust in performance indicators leads to abandonment or lack of adoption of SDI in favor of DI.</td></tr>
<tr><td rowspan="2">Irrigation scheduling and management.</td><td colspan="3">Difficult for growers to learn and adopt new management strategies required for SDI, which are usually quite different from gravity or sprinkler irrigation
Minimizing drainage losses when irrigation scheduling is not used or is handled inappropriately.
Water redistribution issues on coarse soils and fields with varying soils.</td></tr>
<tr><td></td><td></td><td>More studies and information are needed to manage regulated deficit irrigation (RDI) with SDI although microirrigation will probably be a perquisite for RDI.</td></tr>
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Cropping Challenges

Challenge	Southeast (Humid and Semi-Humid)	Great Plains (Generally Semi-Arid)	West (Generally Arid)
Crop germination and establishment	Can be a problem in all regions, but is generally a larger problem in semi-arid and arid regions.		
Build-up of salinity	Typically not a problem in humid regions.	Usually only a concern for a few crops grown under poor water quality, especially under deficit irrigation.	Can be a major problem. Crop rows and zones of soil salinity must be carefully managed.
Crop rotations	Peanuts, typically one of the irrigated rotational crops with greatest net returns, is not well-suited for permanent SDI (harvesting issues)	Generally not a problem with grain and fiber row crop production. In far-south Great Plains there can be issues in vegetable producing areas and sometimes shallow install/remove SDI or DI systems are used.	Multiple crop types with different row spacings, cultural practices and irrigation management may favor install/remove DI over permanent SDI. Growers may lease fields or only return with higher value crop after a few years
Crop development and growth	Peanuts may not peg properly into dry soil Tomato yields were lower with SDI than with DI grown on soils with excessive deep percolation in Florida.	Unexplained evidence from Kansas that kernel set in field corn may be decreased with SDI compared with LEPA sprinklers in extreme drought years.	
	Harvesting of some root crops (e.g., potato and onion) are difficult with SDI		

Maintenance Challenges

Challenge	Southeast (Humid and Semi-Humid)	Great Plains (Generally Semi-Arid)	West (Generally Arid)
Filtration/ water treatment	All regions need good and reliable filtration systems and water treatment strategies that are cost-effective for the crops that are being grown. Growers often put off maintenance until problems are severe. Unproven water treatment technologies are being aggressively marketed. This may delay use of proven technologies and frustrate growers with greater expenses.		
Clogging	Biological clogging concerns when surface water is being utilized.	Manganese clogging problems occurring in some regions of Texas.	Biological clogging concerns when surface water is being utilized.
	Iron bacteria and other associated iron problems arise in some locales. Often water chemistry and biological problems are site or region specific. There is often a dearth of expertise for the specific problem and the scale of the problem in newer microirrigation regions may not be able to attract the expertise that is needed.		
Root intrusion and root pinching		Alfalfa and other grasses are probably the only major concern, unless deficit irrigation is routinely practiced.	Potato, asparagus and celery and some permanent crops can present root intrusion problems Root pinching can occur in trees and vine crops.
Rodents	**One of the most difficult maintenance issues to address when it occurs. All regions are susceptible.**		
Longevity	Mixture of rotational crops may require considerable system longevity to justify adoption of SDI.	System longevity is crucial when considering lower-valued commodity crops such as cotton and corn.	Usually of less concern for greater value crops such as fruits and vegetables.

Maintenance is often perceived to be a less glamorous task by growers and may be neglected until SDI system problems are severe. Additionally, growers may not be monitoring their flowmeters and pressure gauges regularly enough and noticing that problems are beginning to occur.

In the larger microirrigated regions (e.g., Florida and California) there has been an increase in the number of quality service companies that can help assess and remediate maintenance concerns.

However, and particularly so in the smaller microirrigation regions where the SDI industry has not matured, buyers still need to beware of unproven technologies that may exacerbate the maintenance problems and add unnecessary costs.