

NEW IRRIGATION TECHNIQUES IN ARID LANDS

Howard Wuertz
Sundance Farms
Coolidge, AZ

Here in the arid Southwest, water or the lack of it has always been on our minds. Starting in the fifties leveling the land to a uniform slope and cementing the ditches was the vogue at that time. Shortening the runs and more leveling continued on until the present time.

Sundance Farms continued its search for more water efficiencies by installing a center pivot in 1972 on a 160 acre parcel. A number of crops were grown under the center pivot such as sugar beets, barley, sorghum and cotton. Water savings were realized compared to furrow or flood on all crops but the yields were disappointing.

In 1976 Sundance Farms decided to put in 5 acres of surface drip. The crop chosen was sugar beets. The results produced a 5 ton per acre increase in yield with a water savings of well over 50%. The down side of this experiment was the intensive labor to manage the system and the inability to perform even minimum field operations because of the surface drip lines, valves and feeder sub-mains.

The first subsurface drip system was installed in 1980. It was felt that if the whole system could be buried below the ground; it would permit necessary field operations to be performed without regard to the irrigation system used. This experiment showed us a number of things not the least of which was the depth of 8" to 10" for tube placement and that all the necessary field operations such as bedding, mulching, planting, cultivating and harvesting could be performed without interfering with the irrigation system., With this knowledge under our belt a much larger acreage was installed in 1981. The crop chosen was cotton which produced a yield of 4.5 bales per acre and with water savings of well over 50% compared to the adjoining furrow watered fields. With these encouraging results, hundreds of acres were installed every year and at the present Sundance Farms and related companies have over 2500 acres of sub-surface drip irrigation.

The cost per acre of a sub-surface drip system varies anywhere from \$700.00 per acre up to \$1400.00 per acre. The reason for wide variation in cost results from the selection of the wall thickness of the drip tape, the hand or automated valves, and controls and whether the system is dual or single fed with water from both ends. Other major costs are the tube spacing, such as 40" or 80" or something in between, the size and thickness of the conveyance pipes from filter station to the field plus the sub-mains used to deliver water to the tubes or tapes.

Over the last 47 years, Sundance Farms has used all three methods of flood/furrow, sprinkler and sub-surface drip irrigation. The center pivot was operated for 14 years and sub-surface drip has been in use for 18 years.

The average cotton yields over the years showed furrow irrigation at 1350 lbs. Of lint with water use of 65 acre inches or 20 lbs. Of lint for an acre inch of water. The sprinkler produced average cotton yields of 1200 lbs. Of lint with 42 acre inches of water or 29 lbs. Of lint for each acre inch of water, while the average cotton yields using sub-surface drip were 1890 lbs. With 32 acre inches of water or 59 lbs. Of lint for every acre inch of water used. As you can see the drip resulted in doubling the water use efficiency.

Additional benefits derived from using sub-surface drip are less tillage is required, less horse power is needed because ripping and plowing are both eliminated. Less time is required between crops when double cropping is used. Salts are managed at their best when using sub-surface drip because the water is delivered at the heart of the root zone forcing the salts out and away from the roots just the opposite of furrow irrigation.

For 1997 the best cotton yield on sub-surface drip was 4.25 bales to the acre, with water use of 36 acre inches. The best yield on a furrow watered field was 3.25 bales to the acre, with water use of 60 acre inches. With savings of 24 inches priced at \$3.00 an acre inch or \$72.00 and an additional bale of cotton valued at \$0.70 lb. Or \$350.00. These two add up to \$422.00 per acre. Using average cost of sub-surface drip at \$1050.00 per acre and \$422.00 per year of income and savings; the cost recovery would be during the third year of service for the irrigation system.

Sundance Farms and related companies have pioneered the idea of placing the drip tape deep enough in the soil to permit minimum tillage operations without damaging the drip system. The tape however is placed shallow enough to be able to sprout the crop to be grown. With proper filtration of the water, acid treating the water to prevent precipitation of salts, chlorinating to prevent slime, algae and moss clogging the orifices, maintain proper operating pressure and flushing the lines periodically have made it possible to maintain the sub-surface drip system for many years. Several hundred acres have been in service for 15 years and are still performing satisfactorily. Sundance Farms has literally taken the word disposable out of sub-surface drip tape and replaced it with semi-permanent. Amortizing the cost over a 10 year period makes the sub-surface drip system very cost effective.

Sundance Farms currently grows a number of crops besides cotton. They include durum wheat, barley, sorghum and seeded and seedless watermelons. With watermelons on sub-surface drip , cost recovery of the installation occurs in one year.

In summary here at Sundance Farms we expect to be 100% sub-surface drip by the year 2000, up from the 92% currently. The major benefits of sub-surface drip are reduced water use, along with reduced tillage, much smaller horsepower requirements, less trips through the field,

resulting in less soil compaction. Finally the increased yields of 25% to 50% of all crops grown on sub-surface drip. With the use of the above technologies there is a future for agriculture here in the arid Southwest.