WHAT I'VE LEARNED FROM IMPLEMENTING DRIP IRRIGATION ON MY FARM

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INTRODUCTION

DeJager Farms Inc. is a custom farming and management operation that is located in Chowchilla, Ca and is responsible for the management and supervision of over 17,000 acres of mostly forage crops along with permanent and other rotational crops. Included in the mix is an average of 8,500 acres of alfalfa hay annually, that is harvested for internal use by the 8 family dairies we are responsible for feeding. In 2009, amidst a growing concern for a need to become a more efficient user of water, we decided to begin the exploration of the use of subsurface drip irrigation on our most water consumptive crop, alfalfa. Since the installation of our first system on an 80 acre block of alfalfa in the fall of 2009, we have since converted roughly 1,100 acres over to SDI for alfalfa and another 600 acres to SDI for silage corn and wheat production. Along the way we have made many observations and learned many lessons on the benefits that alfalfa grown on SDI can have for our operation and our bottom line. It seems as though we continue to learn something new every year and continue to look for ways to improve upon our management of our SDI systems and evaluate what we can do to continue to keep them profitable and functional for years to come. Below is a brief summary of some of our observations and results after 8 years of SDI implementation.

SITE SELECTION AND INSTALLATION

The selection of the site and the subsequent installation of the drip tape can be two of the biggest factors that affect whether or not you will be successful with your SDI system and be able to reap the benefits of your investment. All of the sites that we have initially chosen for our installations have been fields that had been flood irrigated and conventionally tilled for many years prior to the drip tape being installed. We have also tried to avoid sites that are surrounded by native habitats or land that has been fallowed for many years whenever possible. With this site selection process we have been very successful at limiting the presence of a burrowing rodent population that can potentially wreak havoc on a system and if not properly controlled can eventually lead to the abandonment of the tape due to the high labor costs for system repairs.

Also, by selecting sites that have been flood irrigated for many years, we have had the ability to leach salts from the top profile of the root zone, which could pose a problem for the germination of some crops. We have encountered one situation where we purchased a newly installed SDI system from a neighbor, who installed it on converted native rangeland. After three years the tape was in such bad shape and the labor costs were becoming so much that we pulled the tape out because it was no longer profitable to continue on. After three years of conventionally cultivating and flooding the field we have gone back in with new tape and have great success with our rodent control. On all of our systems our philosophy is to monitor, trap and bait the perimeters of the fields very aggressively in hopes of preventing the population from moving

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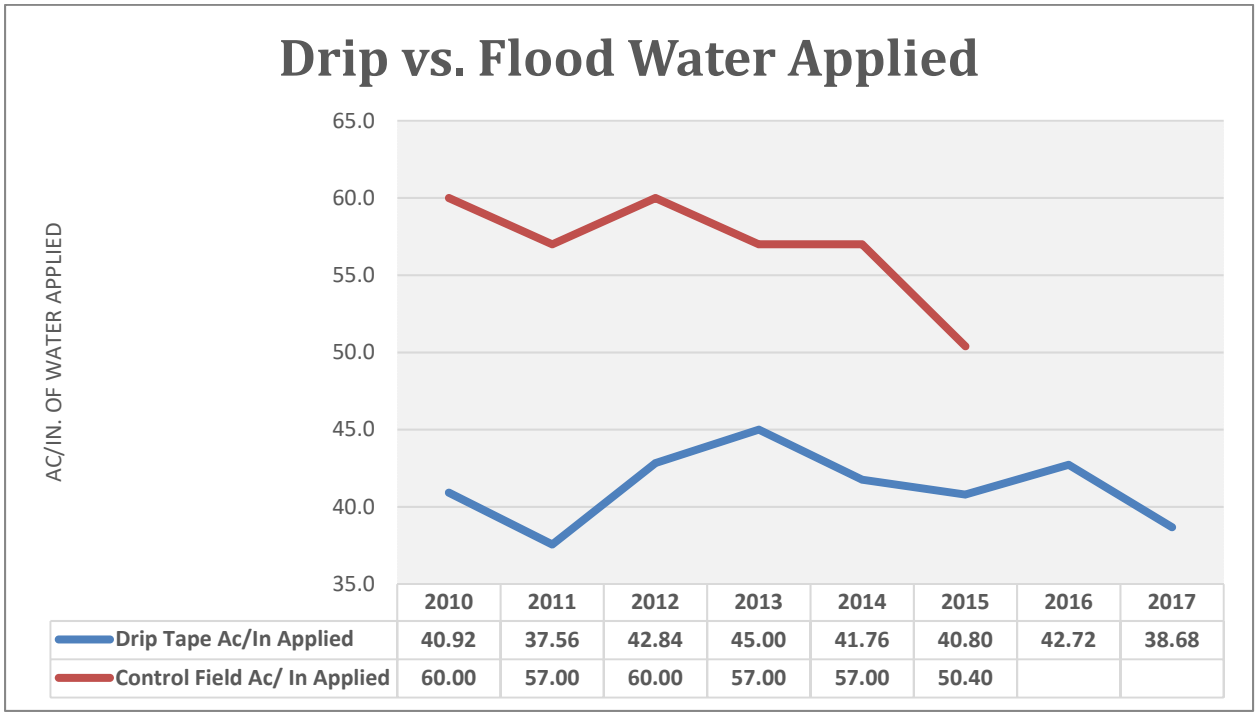
into the field. Rewarding employees for their "daily catch" has also seemed to provide a bit of an incentive and morale boost for what can sometimes feel like an erroneous task.

The installation of the tape itself is another topic that can be a candidate for much discussion. The biggest change that we have made over the years is the depth at which we place the tape. On our first installations, we buried the tape at a depth of 14" – 15", on a 40" tape spacing. While we have had success with these installations, in the subsequent years we began to place the tape shallower to compensate for the lack of lateral and upward water movement in our sandy loam soils. With most of our tape being placed at a 10" – 11" depth now, we see a lot less of a "striping" effect in the first two years of stand establishment. We have also begun to look at using a larger tape size (.990 vs. 7/8) to increase the uniformity of the system and maximize our distribution uniformity across the entire field. With our tape runs generally being a quarter mile or longer, all of our most recent systems have been with .990 tape. The quality of the tape is just as important as the installation itself. If you want to get 10 years or more out of the tape, then you must put a quality product in the ground. We have had experience with one particular system, with trying to "cheapen up" the price of a system and cut some corners in terms of the quality of the tape that we put in the ground. After about four years we started to see a large amount of emitter plugging due to soil ingestion, which is essentially fine soil particles working their way into the emitter pathway from the outside in. We decided to pull the tape on that system after six years. After identifying the problem and returning to the use of a higher quality and better designed product we have eliminated this problem. Flushing, charging and running water through the system to allow the tape to occupy its space in the soil profile is also another important factor during installation. If equipment passes are not kept to a minimum before the tape has a chance to expand and contract and homogenize itself with the soil around it, while being run at proper operating pressures, excessive equipment passes, especially turning on headlands or field edges, can lead to compaction of the tape and reduced flow through it.

IRRIGATION SCHEDULING

In our initial years of managing the irrigation schedule of our SDI systems we started out running anywhere from 8 to 10 to 12 to sometimes 24 hour irrigation sets. Along with our tape being buried at a 14' depth, we saw what I call "striping", where we would have considerable growth in about a 20" – 24" strip above the tape and then reduced growth in between, which appears to be stressed from insufficient water. As we began to experiment with different irrigation run times, we found that anywhere from a 3 to 8 hour set on more frequent occasions, gave us the ability to move the water where we wanted in the soil profile. Coupled with the addition of soil moisture monitoring equipment, we are now able to see the water movement in the profile of our different soils, and this allows us to keep the water in the upper portion of the soil profile during the initial establishment of the fields and create a much more uniform stand. We have also found over the years that we consistently end up irrigating almost all of our fields to about 85% - 90% of actual ET of a grass crop. In the past, we have run schedules where we would irrigate to full ET and found more often than not we were over saturating our crop and bringing water to the surface on a regular occasion. We did not see any yield increases with irrigating this way and in fact began to see an increase in weed pressures due to the continual wetting of the surface and germination of those seeds. Over the past 8 years we have seen about a 25% - 30% savings on

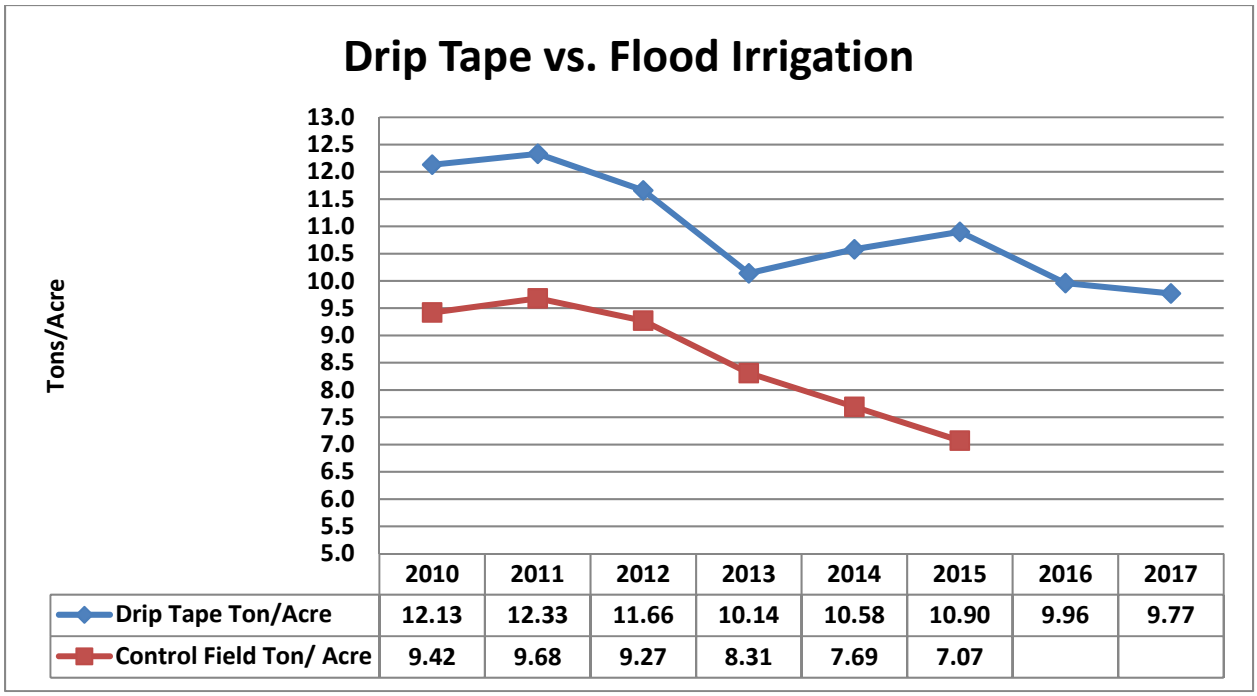
our water applications for the season. On average we apply about 41.3" of water to our drip irrigated fields, whereas our flood fields generally get an average of 57" applied. With an effective rainfall of about 6.5" for our area annually, that puts us right at 47.8" of water applied to the crop for the season, which is our target.



	2010	2011	2012	2013	2014	2015	2016	2017
Drip Tape Ac/In Applied	40.92	37.56	42.84	45.00	41.76	40.80	42.72	38.68
Control Field Ac/ In Applied	60.00	57.00	60.00	57.00	57.00	50.40		

CUTTING SCHEDULES AND YIELD

In general, we try to cut for as much high test, dairy quality hay as possible. Seven to eight cuttings per year, starting in late March and running through mid-November is pretty standard for our operation. 50% - 60% of our production is our target for our higher quality hay and we like to give the hay a bit of a rest in the summer months and focus more on tonnage for those cuttings rather than quality. Since implementing SDI on our ranch, stand longevity has become almost as much of a concern as the quality of the hay itself. Our goal is to get 8 – 10 years on the life of our SDI alfalfa stand, so sometimes quality is sacrificed to maintain a healthy and vigorous stand. When stand counts for stand evaluations have been done compared to flood irrigated fields, what we have seen, is not a dramatic increase in plants or crowns per square foot, but a greater amount of stems per crown in that particular square foot. After 4 years of comparing our first SDI alfalfa field to our control flood field we saw a 26.0% increase in yield. After 6 years of comparison, that number grew to a 32% increase due to the fact of the SDI field maintaining production and the control field continually declining at a more rapid rate. So far after 8 years of production our first SDI field has yielded 87.47 ton/acre of hay on 59 total cuttings. That comes out to a 10.93 ton/acre/years over the course of eight years.



	2010	2011	2012	2013	2014	2015	2016	2017
Drip Tape Ton/Acre	12.13	12.33	11.66	10.14	10.58	10.90	9.96	9.77
Control Field Ton/ Acre	9.42	9.68	9.27	8.31	7.69	7.07		