

# RED ROCK RANCH

Five Points, CA



INTEGRATED ON-FARM DRAINAGE MANAGEMENT SYSTEM  
LOW-PRESSURE CENTER PIVOT SPRINKLERS  
MINIMUM TILLAGE

**John Diener**  
with his Forever Water Machine

John Diener's family started farming in the Central Valley in 1929. After pursuing a degree in Agricultural Economics at UC Davis, John decided to follow his passion and returned to the Valley to farm. In 1980, John started Red Rock Ranch in Five Points, CA, located southeast of Fresno. He currently farms 7,000 acres of fruit and vegetable crops including almonds, grapes, wheat, alfalfa, sugar beets, tomatoes, and spinach.

Many factors threaten the future of farming on the west side of the San Joaquin Valley, where John farms. The soils are naturally rich in selenium and the combination of continuous irrigation and poor drainage has resulted in concentrated levels of salinity and selenium in the soil and drainage water. Drainage issues also plague this area. An impermeable layer of clay prevents the irrigation water from filtering deep into the ground and the trapped irrigation water forms a shallow, or perched, water table. With nowhere to go, the salty water rises closer to the surface and affects the productivity of the land. The selenium levels in the drainage water are toxic to wildlife and impede safe off-farm drainage and disposal of the water. The result is a zero-discharge parameter and the need for innovative strategies to deal with the build-up of nutrient-rich drainage water and land that is no longer productive.

John has been working on a solution to this dilemma. As he explains, "Ultimately, the goal is not exposing the drain water to the community at large, whatever that is – the ducks, people or whatever – and be able to have total utilization of the water resource that has been dedicated to the long-term sustainability of the farmer. This whole project – whether it is water, whether it is human, whether it is soil – is a matter of how we treat resources that we all have at our disposal and how we manage those things for the best benefit of everybody."

Driven by a passion for learning, John has developed a number of innovative projects that he hopes will help the farm move forward, stay in business and allow John to pass it on to the next generation. He is in the last phase of completing the design for an Integrated On-Farm Drainage Management (IFDM) system that addresses drainage problems, rehabilitates the land back into high-value production, and creates resources from the wastewater. (See IFDM text box.)

## WATER-SAVING PRACTICES

- The Integrated On-farm Drainage Management System (IFDM) reduces irrigation water use by about 20%. With this system, John is able to rehabilitate the saline and selenium saturated land while creating an economic resource from drainage water traditionally considered waste.
- John uses new-generation center pivot sprinklers equipped with smart controllers for precise irrigation scheduling. These low-pressure sprinklers apply large diameter droplets that reduce evaporative losses.
- John's irrigation management team checks soil moisture levels with an inductance probe to ensure that their CIMIS based irrigation scheduling system is accurately set.
- Through minimum tillage techniques, John has cut tractor work by approximately 80 percent, while improving water infiltration.
- John irrigates his permanent almond and grape crops with drip tape.

## BENEFITS

- The Integrated On-Farm Drainage Management system returns land into productivity, improves water quality and protects wildlife.
- The selenium and salt harvested through the land reclamation system provide value-added products.
- The solid set center pivot sprinklers “eliminate quite a bit of labor, the type of labor that you have a hard time finding – the hand-moved sprinkler labor.”
- The center pivots are low pressure, reducing the amount of energy needed to irrigate.
- Minimum tillage reduces tractor use and related energy and labor costs. Employing minimum tillage also reduces Nitrogen Oxides (NOx) and particulate matter air pollution.

## COSTS

- “The center pivot system is considerably less - an installed drip systems cost about \$1,200 to \$1,400 an acre, whereas the center pivot systems cost about \$500 an acre to put in. At the end of the day, it is a lot cheaper not only from a capital cost, but from an operational cost than a traditional stand. Pivots give you much broader latitude as far as what crops you grow, so you have much more diversity in responding to the economics of the day,” explains John.
- The drain tiles for the integrated on-farm drainage management system cost about \$600 per acre. John is still trying to get exact figures on the capital costs for the water distillation machine, the brine shrimp processor, and salt harvesting equipment. (See text box.) However, these expenses are offset by the increase in value of the reclaimed land by approximately \$1,600 per acre and a net return on higher-value crops of \$150 - \$375 per acre per year.

## LESSONS LEARNED

- **Create resources out of waste.** John explains that “another part of the puzzle for sustainability is getting the item to produce some revenue so that it isn’t just all subsidies at the back end to take care of the waste products. We are taking the products that people want to treat as toxic substances, creating, and making them into resources.”

- **Keep changing.** “I am of the opinion that you have to move with the times. I always keep moving – you might turn into a pillar of salt if you stand still.”
- **Become energy independent.** John’s goal is to farm with passive energy – solar, wind, and concentrating solar and avoid buying energy from the grid. He explains, “My goal in life is to be self-sufficient in power. I think we will be in ten years.”

### Integrated On-Farm Drainage Management System

With a subsurface drain tile system, salt is leached out of the soil and perched water table and the land is returned to production for high-value crops. The drainage water is then sequentially re-used several times to irrigate blocks of increasingly salt-tolerant plants (halophytes), including pasture grasses that are used as winter feed for rangeland cows. The canola and mustard seed that John grows as one of the salt tolerant crops help remove selenium from the soil. These seeds contain oil that John extracts with pressing equipment to produce biodiesel to fuel farm vehicles. After the oil is removed, what remains is a selenium-enriched seed meal that John intends to market as a feed supplement for dairy cows. Finally, the salt-saturated water enters a solar evaporator or a salt-water pond filled with brine shrimp, which remove selenium from the water. John is currently designing a second-generation Integrated On-Farm Drainage Management system with a water distillation machine that will harvest available water by mining the salt out of the tiled drainage water. This new machine, the “Forever Water Machine,” will effectively replace the solar evaporator and the system of recycling the water through successive lesser value crops. The final system will include a three-stage process that produces distilled water, brine shrimp and salt while reclaiming the land for higher value crops. Ultimately, John plans to market the brine shrimp as fish food or as selenium supplements for animal feed. He hopes to market the harvested salt as a product for dust suppression.



Low-pressure center pivot sprinklers