Pay Dirt

High-Nutrient Soil for High-Yield, High-Profit Farming

by KATHERINE BELL

Paul and Elizabeth Kaiser’s Singing Frogs Farm is an amazing example of what attention to soil health can yield in produce and profit on a small-scale farm. From careful observation of plant life coupled with years of trial and error in search of ways of farming in harmony with nature, the Kaisers now produce three to five times the amount of vegetables as other area farms and gross $85,000 to $100,000 per acre of land in crop production. Their story is not only remarkable in terms of their unconventional way of farming but their farm also serves as an inspiration to other farmers.

The Kaisers bought Singing Frogs Farm in 2007 with the idea of being back in the states to raise a family and having a place to grow their own food. They came to farming via a circuitous route.

“Farming wasn’t what I was trained in or did,” said Paul. “I had dealt with human and ecological systems and how they support or hinder each other.”

As Elizabeth tells it, “We met while working in the Peace Corps. Paul was utilizing agroforestry – bringing trees into agriculture – in the Gambia near the Sahara Desert.”

The trees were for windbreaks and provision of mulch from sticks and leaves and to hold water and soil nutrients with the goal of reviving the fertility of sun-baked lands. With soil cover in place, farm water usage decreased.

“Really agroforestry is environmental health, and I was dealing with human health,” said Elizabeth. “I went on to finish master’s degrees in nursing and public health, and Paul completed master’s degrees in natural resource management and sustainable development. For part of those studies we were in the Washington-Baltimore area and then in Costa Rica at the UN University for Peace. Our broad back-grounds helped us … Paul learned to think in terms of ecological systems and how they work with agricultural systems; I thought in terms of health holistically.”

In Costa Rica, Paul puzzled over how to rehabilitate deforested land. Through scientific study, his colleague found that an orchard planted near a forest lush with trees, bushes and undergrowth had 90 percent fewer pests than a second orchard on an open plain a mile away. The conclusion: beneficial bees, bugs and insects living in the adjacent forest were controlling the pests. The need to support beneficials was underscored.

GOING NO-TILL

At Singing Frogs, the Kaisers secured an 8-acre piece of land in need of reworking near downtown Sebastopol, California.
“We immediately began building up our own ecology. We put in hedge-rows and trees, bushes, water catchment — we wanted the full bounty of Mother Nature at work,” said Paul. “Once we did all that, we realized we had to ramp up food production. We had to go from being a garden to a farm to pay for the landscape we now had. Growing vegetables was a new venture for us.”

The Kaisers eventually embraced no-till farming as a major key to preserving soil life.

“As we tilled the acreage, we saw the land that had been inactive become degraded very, very rapidly. A point of juxtaposition was upon us. Here we everyone farmed, we started out tilling. As we tilled the acreage, we saw the land that had been inactive become degraded very, very rapidly. A point of juxtaposition was upon us. Here we were trying to increase life and build up our ecology and habitat with a wonderful amount of trees and hedges while at the same time causing our soil to become more friable and have more weeds and less life.”

Both Paul and Elizabeth noticed the way dogs, cats and crows would “dive in for a feast” on the chopped up worms, upturned bug colonies, dead snakes and gophers left in the wake of plowing with a tractor. Then one spring day, while driving his tractor, Paul came close to running over a mother killdeer and her nest.

“This mother killdeer had been signaling me away from her nest for half an hour, but operating a 5,000-pound machine, I didn’t see her. She was shaking and in trauma, yet fearless in her instinct to protect her nest. After that, tillage just wasn’t right to me.”

OPERATING YEAR-ROUND

Several issues led the Kaisers to seek year-round production. They didn’t want to lose an exceptionally bright and able employee, a UC Santa Cruz Ph.D. candidate in nutrition history and organic agriculture, so they asked themselves, “How can we farm in the winter months to keep Marty working?” Also there was the energy it took to “put the farm to sleep” with cover crops and the inordinate amount of energy it took to “wake up the farm” in February and March. Then because maneuvering the rototiller with the winter rains and wet soil was such a beast of a task and even the rototiller destroyed worms and organisms, the question became how to farm without any machinery at all. Thus, out of practical need, the Kaisers found their way to farming year-round with zero tillage. Not only were they able to retain four highly skilled employees, but they also took their soil organic matter to dense and high levels — from 2.4 percent eight years ago to 6.5 to 9 percent today when tested to a depth of 12 inches.

The science behind no-till farming involves the burgeoning discoveries related to soil life. High nutrient soil leads to high crop yields.

“In photosynthesis, what the plants exude through their roots feeds the soil microorganisms,” said Paul. “Having green plants in the ground year-round feeds the microbial and fungal life. The plants take CO₂, sunlight and water and then make glucose; they resynthesize glucose into a myriad of products for the biota. Soil microorganisms get nutrients back into the soil. Tillage makes bare ground and wipes out all the green plants. With no plants and no photosynthesis, you have no food source for the soil – the soil microorganisms are dying. With the soil bare and exposed for up to 12 weeks, nitrogen and carbon and other nutrients volatilize. And yet as a farmer, you must have nitrogen for plant growth and carbon for soil structure. Tillage contradicts every property of good soil management whether it’s sandy loam like we have or hard packed clay with rock in it, laterite or in-between soils.”

Also, the factor of SOM levels and the soil’s ability to hold moisture come into play. Every 1 percent increase in SOM allows an acre of soil to hold 16,500 gallons in the top 12 inches of dirt. Heavy tillage farming has reduced SOM to 1 to 2 percent. No-till with other techniques can help bring it back.

“In our California drought, when we do get rain it comes in a deluge followed by long, dry periods,” said Paul. “Without the soil capacity to hold the rainwater, it runs off. Our farm water usage is now down from two or three hours of drip irrigation two to three times weekly to 20 minutes of drip every five days. We wait until the first signs of crop stress in order to practice minimum irrigation.”

The Kaisers have scaled infrastructure to meet the small farm’s year-round growing needs.
Kaiser declares, “Bringing SOM levels back up is good for pest management, nutrient density of crops, crop virus and disease protection, maintaining moisture in the soil – receiving and holding it, making soil moisture available to plants for structure and for carbon sequestration.”

**COMPOST**

In looking for ways to radically build up their soil profile, one effort was adding compost. Currently Paul and Elizabeth apply 40 to 50 tons per crop acre per year, which is just a little more than the California allowance for certified organic operations. However, with three to seven economic crops in production as opposed to only one or two, Singing Frogs’ compost-to-crop ratio is actually much lower. Also, as typical certified organic farms still till, the factors of soil degradation and low SOM can lead to loss of nutrients through leaching. Having nutrients in the soil is critical.

Kaiser defines a farmer accordingly: “Somebody who is in the business of exporting nutrients off a farm every day of the year.” He adds, “You cannot be sustainable unless you bring nutrients back on. Composting is essentially recycling nitrogen and carbon through bringing biological material back onto the farm to keep food production going forever.”

Regarding the concern that Singing Frogs might have excess nitrates in its soil and water due to intensive composting, the latest tests in March and May 2015 prove the health of the Kaisers’ system. Total microbial life at between 4000 and 6000 ppm is higher than an excellent rating. Also their system measured as totally balanced and unstressed. As for the farm’s water, tests showed the water becoming cleaner and cleaner by way of moving through soil rich in microbial life and high in SOM with runoff having zero detectable nitrates, meaning Singing Frogs soil is holding its nutrients.

**A GREENHOUSE & TRANSPLANTING**

Another key to the remarkable yield from the 3 acres in production at Singing Frogs Farm is the use of a greenhouse and nurseries to grow and then transplant stronger seedlings into the fields. In standard farming practice, a farmer sows seed straight into his fields. He might get 100 percent germination or 70 percent or only 30 percent. Based on this rate, he then decides whether to keep the crop even if it has holes with weeds here and there or plow it under and reseed. With the transplanting method, even if the germination in the greenhouse is low, the economic yield in the fields reaches nearly 100 percent because only the healthy, viable plants are put into the ground. Also, the hardy, month-old seedlings out-compete the weed seeds that must break through the compost layer, helping to control weed growth. For the crops, a shorter cycle of time in the field means a shorter time of susceptibility to damage and disease. Finally, the shorter term in the field per crop allows the Kaisers to grow from three to seven crops in sequence in a year. And Paul has engineered his greenhouse for temperature control.

**INTERCROPPING**

In observing bare space in rows of plantings, the Kaisers decided to combine crops in single beds. Within a bed yielding a 100 percent crop of cauliflower, for example, they also get a 70 percent crop of lettuce. The crops shade and shield each other.

Because Paul and Elizabeth continue to replenish the biological life and nutrient presence in their soil, it works to utilize their land year-round; they
see no need for fallow periods. Theirs is a management-intensive system as they cut one crop out in a morning harvest and transplant right back into the field that same afternoon. The cycle is compost, transplant, harvest, repeat. The result: 100 up to 140 different varieties of vegetables including multiple types of broccoli, cabbage, cauliflower, peppers, cucumber, winter and summer squash, lettuce, mustard greens and tomatoes. From Halloween to New Year’s, transplanting is limited to the smaller leafy greens. Thus, due to limited sunlight and freezing temperatures, dozens of the hundreds of beds on the farm go unused. Blankets cover them until transplanting time.

The Kaisers continue to experiment in search of collaboration with nature and greater efficiency.

“Just last winter we started covering the beds we couldn’t plant with black fabric covers,” Elizabeth said. “Things could compost a bit underneath, and the soil was protected. This saved a ton of labor. When we were ready to plant in January, we just pulled off the covers. Covering kept weeds down, too.”

FARMING WITHOUT SPRAYS

Paul and Elizabeth are part of a farming sector termed “beyond organic” or organic 2.0. In addition to the full attention they give to their soil, they also use no sprays of any kind. Organic farms use tillage and often spray with mixtures derived from organic substances. Instead the Kaisers rely on the proliferation of beneficial insects and pollinators in their adjacent hedgerows. The beneficials eat the pests; the snakes take care of the gophers.

“In our first years when we tilled, we did have major pest problems. But now with the undisturbed, healthy soil, our plants are healthier. We’ve broken that negative cycle of spraying and killing our beneficials,” said Elizabeth.

MARKETS

The beyond organic practices at Singing Frogs are truly paying off. With the amount of food produced, the Kaisers supply 120 to 130 CSA members year-round, sell to up to nine local restaurants in Sebastopol, and sell at two year-round farmers’ markets plus two or three seasonal markets. A wholesale distributor sells their vegetables in their home county, Sonoma, and in the Bay Area. The Kaisers advocate for the year-round relationships with their CSA members and their farmers’ market customers.

“It’s stressful trying to get CSA customers back again when you only farm in a season. It’s much easier to keep them all year,” says Paul, speaking from early CSA experience. And in winter, the competition at the markets is much less. The Kaisers have seen loyalty developed there in the off months carry over to the main season.

Elizabeth recognizes the fairness of the prices they get from selling direct to those who eat their produce as opposed to middlemen. And both see selling through their CSA and the local farmers’ markets as a way to get the message of high-nutrient soil, high-yield farming out to the public.

SHARING KNOWLEDGE

What the Kaisers have developed at Singing Frogs offers answers for other farmers. Particularly economic answers in that in grossing up to $100,000 per crop acre they are overcoming high land costs, escalating land taxes and the current costs of operating small-scale. Their farm has labor costs that approach 45 to 50 percent of gross yearly revenue, but they save quite a lot by having no machinery or machinery maintenance expenses. Paul notes that most of the other farmers he knows are grossing between $15,000 and $20,000 per crop acre. These farmers exist right above the threshold of making it. Ecological answers, too, are part of the farm DNA in terms of healing and sustaining the land. And also answers in terms of nutrition and the American food supply. Paul and Elizabeth know this and so they devote time to mentoring others.

Farm tours are part of the schedule at Singing Frogs. Audiences at the Quivira Coalition Conference, the EcoFarm Conference, the New Young Farmers Coalition Conference, Western Water Conference, the National Heirloom Conference, as well as the California Small Farmers Conference have heard their science straight from them. Isaac Bekalo of the International Institute of Rural Reconstruction believes Singing Frogs should be “a teaching lab – it so inspires.”

Young farmers are studying the Kaiser model. After visiting the Kaisers’ place, Michael and Shannon Whamond are now transitioning their less-than-2-acre Hillview Farms to 90 percent no-till.
“We have produced three times as much yield per square foot on no-till areas as compared to areas of tillage,” said Michael. “And we are on pace to gross $80,000 this year from an acre and a quarter.”

Caiti Hachmyer, founder of Red H Farm, was inspired to find a way to do no-till on a small-scale vegetable farm during graduate studies at Tufts. The Kaisers’ work only strengthened her in developing an “undisturbed soil ecosystem.” No-till and mulching with compost and wood chips brought about “a dramatic increase in yield” and thus 20 percent more in annual dollars.

Kate Greenberg of the National Young Farmers Coalition, Western Region, says, “Paul and Elizabeth definitely practice the triple bottom line. They are integrating productivity, economic return and ecological stewardship, and investment in their employees and community. Without compromise.”

However even with their example, Greenberg sees problems for young farmers in America. “The new wave in agriculture of selling direct to consumers is huge for allowing new farmers entry. The buy local movement is key. But we lack significant infrastructure for the next generation of farmers to scale and make money for themselves and their families. It’s very difficult for them to get wholesale accounts. The niche markets are not promoting scalability. We need to engage cities and the whole supply chain.” And not every farm has proximity to people willing to pay premium prices for food like in Sebastopol.

Regarding the heavy use of compost, Dan Kittredge, farmer and founder of the Bionutrient Food Association, says, “Such a level of composting is not realistic for agriculture at large. In Vermont, 50 tons of compost would cost thousands too much. In a lot of places, Illinois and Iowa and elsewhere, there just isn’t the compost supply for the acres of farmland.” For New Englanders like Kittredge, weather prohibits year-round farming for most. Ever the man with answers, Paul Kaiser points out that when revenue hits his levels, money is there to pay for compost. And Paul adds, “Four Seasons Farm in Maine manages to go year-round.”

VISION FOR THE FUTURE
The Kaisers believe small, intensive production farms should be established around urban centers everywhere.

“Paul and Elizabeth’s model of regenerative agriculture, food production that improves rather than impoverishes the land,” according to Kevin Boyer with the 11th Hour Project, “is pushing the envelope on what is possible. In the very near future, we are going to see expansion in the local food movement and the little innovative farmers coming in.”

And as Dan Kittredge surveys America, he feels, “Surrounding urban cores with small farms is very viable as a way for young farmers to get established. A lot of small cities provide untapped markets. As I go around the country, the more I am convinced of the potential for small-scale farmers to make a good, honest living on not much land.”

Katherine Bell enjoys writing on Apostolic-Prophetic Christianity, nutrition and food supply issues, functional medicine and nutrient-based psychiatry, real estate and matters urban. Contact her at katherinefbell@me.com.