Fields in Math and Farming

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Synopsis

A young woman's search for a a contemplative, insightful experience leads her from farming to mathematics.

I first conceived of studying mathematics while laboring on a small fruit, vegetable, and dairy farm in New York's Hudson River Valley. There, I logged long hours next to Paul, a sixty-three-year-old herdsman with a surprising ability to spot a good milking vein from across a crowded barn. He taught me that a square udder, one where the teats came down straight, was a sign of a good producer. Others claimed that a black Holstein was better on butterfat than a white one but Paul thought that idea was rubbish. He did believe, however, that a thin hide was a good sign. And the hooves, he said, should not point outward like snowshoes. It is a sign of bad feet.

After work, Paul liked to linger in the barn to say goodnight to each individual cow while I often sought out a forgotten bale of hay on which to meditate. The prayer I chose most often for my meditation was *The Central Truth* by Ramdas. Paul once asked me what meditation was but I suspected that he knew more about it than I did. Paul had worked full-time on a farm since he had been ten. He worked six days each week and fourteen hours each day. On those days that the barn flooded or the entire herd was sick, he worked around the clock until the crisis had been averted. He proceeded quietly and with great humility as he tended to the most mundane tasks. The fifty-seven cows, in turn, rewarded him with their affection and more than fifteen-hundred pounds of milk each day. The herdsman who filled in for him on his day off did not see work as a meditative exercise. On a good day, that herdsman was grateful to coax thirteen-hundred pounds of milk from the herd. So I told Paul that meditation was two-hundred extra pounds of milk and content cows. He nodded to indicate that he understood.

In addition to the bucolic setting, the farm offered droughts, hailstones, and the odd infestation of seventeen-year locusts. Paul birthed calves, planted seeds, tended to young sprouts and heifers, toiled when necessary, fed off of the bounty, and was changed by the abundant beauty of it all when everything went as planned. When everything did not go as planned, he showed his mettle by working even harder and never giving up. Still, Paul lost money on every cow he milked. While the rest of the farm struggled to subsidize the dairy, it did not always succeed. No doubt I wanted to farm. However, I needed to consider a more metaphorical approach to farming.

I had read somewhere about mathematical patterns on pineapples and one-sided topological objects. Perhaps I might spend hours, days, and years, proceeding quietly and with great humility—I was no math whiz after all—with mundane mathematical exercises, in pursuit of deep insight. That was how, as time passed, I began reciting statements like The Central Limit Theorem—a statement in statistics concerning the bell curve—rather than Ramdas' *The Central Truth.* Fields, no longer only land on which cows might graze, soon conjured thoughts of the real and complex numbers. Generators produced mathematical objects known as groups, rather than simply electricity during a power outage. Polynomials, as well as plants, had roots. Kernels, in addition to the bread-and-butter varieties of late summer, included sets of elements that mapped to the identity under homomorphisms. Symmetry groups, as well as crops, were rotated.

The metaphors helped. The mathematical definition of a tree may be technical but is aided by imagining a squat apple tree in winter. Rows of a matrix are exceptionally orderly, just like rows of corn or beans on a farm. Mathematical groups may be cyclic, just like the seasons. One may eat local by walking to a farmers' market to pick up produce and walking it back home again, a notion that evokes the notion of local connectivity on a manifold. A critical point in one's life may be a drought, hailstorm, or locust infestation. Or it may be the interior point of the domain of a function where the derivative is zero or undefined.

Logging long hours with textbooks, paper and pencils, I developed a surprising ability to see the golden rectangle in both natural and man-made objects. I also formed strong mathematical opinions that rivaled Paul's opinions of his cows. With all due respect to German mathematician Leopold Kronecker's significant contributions to number theory, his quote—God created the natural numbers and all the rest is the work of man—is rubbish.

That is, I am quite certain that the real numbers existed long before any person ever started thinking about them. I am confident, however, about the truth in Einstein's statement that pure mathematics is the poetry of logical ideas. In time, I discovered abundant mathematical beauty, made accessible by focusing my mind much in the same way that my meditations on bales of hay did so long ago.

That explains the change in location and consolidation of the blisters on my hands; four small bumps on the inside palm of my right hand from shoveling too much hay morphed into one large bump on the left side of my right index finger from pressing too hard and long on a pencil as I worked on math problems. Soon, the number of days I logged in the library surpassed the number I had spent in the barn. Then, one day, a long while after I left Paul and the cows, my graduate school—an institution I selected as much for its math program as for its proximity to farms—handed me a piece of paper certifying that I had satisfied the requirements for a doctor of philosophy in mathematics.

It was an odd day to say the least as I had never quite envisioned the possibility of achieving my goal of becoming a mathematician. On that day, I realized that meditation is not just two-hundred extra pounds of milk and content cows but also mathematics. That is, both farming and mathematics foster discipline, emphasize beauty, and thrive in the presence of an at-times bothersome tendency to obsess about the details.