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The Value of an Acre

As fertilizer and input costs get more expensive, there can be a lot of questions about new types of production and new methods of farming. When profit margins get tighter, farmers must get creative to ever tow that thin line of profitability. Now is the perfect time to meet our new K-State Extension Forage and Crop Systems Specialist, Dr. Bruno Pedreira for some creative conversation on how you might maximize profit on your farm or ranch. An upcoming series "Pizza with Pedreira" invites any Ag producer to a free lunch and conversation in the Girard Extension office on May 11th, Old Iron Club in Fredonia on May 12th, Independence Extension office on May 25th, and Altamont Extension office on May 26th. Held from 12:00 to 1:00 pm each day. There will be no lecture, just an opportunity to meet Bruno and our agents, ask questions, and eat pizza.

What's in an acre? Practically it's 43,560 square feet of soil (though technically, that is only the top foot of that acre). The value of that acre to a farmer, however, depends on what's in that 43,560 square feet of soil. During my few years as an extension agent, I've had several soil samples come in that were from farmers looking at land they hadn't yet bought, and that is honestly a great idea. The discrepancy in fertility between field crop acres can be great, but it's the fertility of pasture acres that can be huge and mostly hidden. Now with the current cost of fertilizer, the value between high and low fertility has never been greater. For fun though, let's first look at what is purchased, physically, in one acre of soil.

Removing all water and organic matter, the weight will be around 3.6 million pounds in an acre-foot of dry soil. There is a lot of variation but it's around 45 percent oxygen, 30 percent silicon, 8 percent aluminum, 6 percent iron, 5 percent calcium, 2 percent potassium, 2 percent magnesium, 1 percent sodium, and 1percent everything else. Odd to think that when we add 3 tons of agricultural lime to the soil, we are only adding 2,000 lbs of calcium to the 100,000 lbs already there. When we add 100 lbs potassium, we are just throwing that into 30,000 lbs potassium already within the soil. There are around 3,000 lbs of phosphorus too. This is also why adding non-chelated iron to high pH soil is pointless, because there is already a lot of iron, but it's all complex and unavailable to plants. This is all to show that every soil test is merely an attempt to quantify nutrients in the most plant-available pool. It is not, in any way, a total nutrient test.

Cost of P and K -

Of all the nutrients and adjustments, building phosphorus and potassium from the soil test category of “very low” to the ideal “agronomically optimum,” will be by far the biggest direct and measurable cost. Extremely low soil test P can be in the ‘not detectable’ range, effectually 0 ppm, while agronomically optimum is around 20 ppm. To move the soil test P from 0 to 5 ppm will take 30 lbs P per 1 ppm, and it takes 10 lbs per 1 ppm from 15 to 20 ppm. However, the average over the range comes to around 20 lbs of P per 1 ppm moved, or 400 lbs P to move from 0 to 20 ppm. At the current cost of $1.25 per lb of P, that’s $500 per acre. This is similar to potassium. A very low soil test can be around 50 ppm K while the agronomic optimum is 130 ppm K. If it takes on average 8 lbs K to move the soil test 1 ppm, and the current cost of K is $0.73 per lb, it would come to $470 per acre. This is all ignoring spreading cost too.

Cost of lime -
The cost of lime is actually fairly cheap by comparison to fertilizer nutrients. While highly variable from acre to acre, a fairly acidic soil can take up to 4 tons of ag lime to move it to the target of 6.8 pH. Costing around $70 per acre, it is well worth it. Nearly every nutrient becomes more plant available (or less toxic, as with iron) in a well pH balance soil and gets the biggest yield benefit for that fertilizer cost.

Cost of organic matter -
Organic matter (O.M.) is much harder to calculate due to a number of intrinsic values. It is hard to determine the money value of microbes, water infiltration, less compaction, and increased nutrient and water retention. Some direct value can be made with nutrient turnover though. 1 percent O.M. mineralizes 20 lbs N, 6 lbs P, and 2.5 lbs S, plus a handful of micronutrients. This means the difference of 2 percent O.M. is the difference of around $70 in direct fertilizer cost every year. The storage of 20,000 gallons of water per 1 percent O.M. per acre and the prevention of nitrogen losses is easily more than the $50 from 2 percent O.M. difference given for the concept of this column. Keep in mind that low O.M. value is not a cost like fertilizer and lime but a loss in benefit that occurs continuously and every year. Considering 1% O.M. in an acre contain 1,000 lbs N and 100 lbs of P, the overall value adds up to far more over time.

All together, the value difference between the low fertility, acidic, and over-tilled low O.M, and the prime optimal fertility, well-balanced, and high O.M. came to a difference of $1,160 just in direct input value. The actual value when productivity benefits are included will be far more. However, the numbers in this column are my own calculations based upon researched assumptions, and I’m not an economist. Still it shows that the difference in intrinsic input cost from one acre to another can be great and increasing larger with higher fertilizer prices. The same is true with rented ground as well. The value of knowledge of an acre’s fertility can come before the acre is even purchased or rented.

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