ECONOMIC & POLICY UPDATE
VOLUME 22, ISSUE 2
Editors: Will Snell & Nicole Atherton

Reducing Your Dependency on Commercial Fertilizers Strategies for Cattle Farms in 2022 and Beyond

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Published: February 28th, 2022

Fertilizer prices have risen to all-time high levels in the last few months. Table 1 shows these increases over the last year for the most common commercial fertilizer sources used by cattle farmers. Nitrogen and potassium fertilizers have both more than doubled over the last year.

Table 1: Fertilizer Price Increases 2022

	Spring 2021		Winter 2022	
Fertilizer	**$/ton**	**$/unit**	**$/ton**	**$/unit**
Urea (N)	$370	$0.40	$920	$1.00
DAP (P_2O_5)	$515	$0.40	$860	$0.54
Potash (K_2O)	$370	$0.31	$815	$0.68

For an acre of hay fertilized at 60 units N, 30 units Phosphorous (P2O5), and 100 units Potassium (K2O), this would increase the overall cost from $67 to $144 per acre, an increase of $77 per acre. For an acre of pasture fertilized at 60 units N, 10 units Phosphorous (P2O5), and 33 units Potassium (K2O), this would increase the overall cost from $38 to $87 per acre, an increase of $49 per acre. If we assume one acre of hay and two acres of pasture needed per cow, this would amount to a $175 increase in cost for every cow in the herd. For a 50 cow herd, that would be an increased

fertilizer bill of nearly $9000, or roughly $16,000 total. This total fertilizer bill would represent over 40% of the calf crop at expected prices this fall for a typical spring calving farm.

The most common advice I have heard about managing these prices increases have been to increase soil testing, and to not fertilize when you are in the medium level for P and K. These recommendations may help reduce fertilizer expenditures, but they are not going to make a significant dent in that $9000 increased cost. This article focuses on three practical methods that can significantly cut fertilizer costs on cattle farms, and to possibly eliminate the dependency on commercial fertilizer entirely.

1) Use Legumes Instead of Commercial N

I have been amazed by the amount of commercial nitrogen that is used on cattle farms in Kentucky. Decades ago when it was cheap it may have made more sense. However, at $.40/unit it is an expensive way to boost production, and at $1.00/unit it is economic suicide. Table 2 shows the cost to obtain an extra ton of forage production using commercial nitrogen at two prices (spring 2021 and winter 2022), and compares this to getting similar production increases with clover or annual lespedeza.

In a good year, 50 units of nitrogen applied in early spring would likely get around one ton of extra forage production (40 lbs of dry matter production per unit N) on a conventionally managed farm in Kentucky. At $.40/unit and with a $6 per acre application cost, that would translate to $26 per extra ton of forage produced. At $1.00/unit N cost, it would translate to $56 per ton forage produced. If hay is selling for $60/ton (roughly $30 for a 5x5 bale), you would have a $4 per ton margin to pay for everything else in making that hay – good luck! Now compare this to getting this same increased production from seeding clover or annual lespedeza. The clover seeding would be every three years, the lespedeza every year. With a $24 clover seeding cost plus the $6/acre application cost once every three years, it would cost $10 per ton forage produced if we averaged one extra ton of forage per year. If we got 1.5 extra tons of forage per year from the clover seeding, the cost per ton would decrease to $7. Both of those figures are well below the $26 per ton cost for $.40/unit nitrogen, and a small fraction of the $56 per ton cost at $1.00/unit nitrogen. Seeding annual lespedeza at $16 per acre cost every year doesn't look quite as good as the clover ($20 per ton vs. $10 per ton at the 1.0 ton increase level), but almost all of that production will come in July and August when pasture forage is needed the most. Pasture forage produced during this time is more valuable than forage produced in late April and May when you are generally swamped with too much pasture growth.

Table 2: Cost per Ton Extra Forage Produced Various Methods

Extra Forage Production (tons)	50 units N $.40/unit	50 units N $1.00/unit	Clover $24 Seeding	Lespedeza $16 Seeding
0.5	$52	$112	$20	$40
1.0	$26	$56	$10	$20
1.5	$17	$37	$7	$13
Note: All have $6/acre spreading charge; Clover seeding lasts 3 years				

Moreover, with both the clover and lespedeza, the quality of the increased forage will be much higher than typical fescue pasture or hay. It seems like a slam dunk for using legumes. So why do so many cattle farmers continue to rely on commercial nitrogen? From my experience, the first and most important reason is tradition. Many of these cattle farms have been applying fertilizer for multiple generations, in many cases back to an era when nitrogen was relatively cheap. Another important reason is that the management skills for getting good growth with nitrogen is much lower than getting good growth with legumes. In many cases all that is necessary is one phone call in March to get it done. It takes better management skills to establish and keep a good stand of clover. A final reason is obsolete soil test recommendations. For example, the University of Kentucky soil lab recommendations for grass-based pasture is to apply up to 100 units of N Feb. 15 – March 15, and up to 50 units of N May 1–15. While this might make sense on hay ground with cheap nitrogen, it won't pencil out with anything close to current prices. Moreover, applying high amounts of nitrogen on spring pastures is like pouring gas on a fire: You will never be able to keep up with the added growth.

There will typically be a transition period going from a commercial N-reliant system to a legume-based system where forage production is poor. Soils that get regular doses of commercial nitrogen become dependent on it, just as people that get regular doses of drugs become dependent on those drugs. Removing that dependency will be painful in the short run and there will be a transition period before either can function well without them. Do not attempt to establish legumes and continue to apply commercial fertilizer. Doing so is like driving with one foot on the accelerator and one foot on the brake: the increased grass production will choke out the legume seedlings. First-year production for clovers seeded into a grass sod will usually not have significant production in the first year. They are establishing and you will not get the full benefit from that clover until the second year. However, with annual lespedeza, you will get all of the benefits in that first year as it is an annual, and you will get the bulk of its growth when it is needed the most in July and August. It also does well with less-than-ideal fertility conditions and in pastures that have low biological activity. Thus I consider annual lespedeza to be a great "bridge" legume for the 1-2 year transition period. You can also seed clover with the annual lespedeza for the next year's production.

2) Feed Hay to Retain Nutrients

Most cattle farms in Kentucky will feed 2-3 tons of hay per cow in an average winter. This amounts to approximately 72-108 lbs N, 24-36 lbs P, and 104-156 lbs K cycling through the cows. In theory, around 90% of these nutrients could be retained on the farm to feed the next year's crop of hay and pasture. In practice, we have cattle farms that need constant applications for P and K, as well as N if they have not learned how keep good stands of legumes in their pastures and hayfields.

Confinement feeding is the primary reason for this loss of nutrients, whether in a sacrifice area, feeding pad, or conventional feeding barn. "How could this be?" many cattle farmers will ask? "We scrape up every last bit of manure from our feeding pads and spread it back on our pastures and hayground each spring. We must be getting the bulk of the benefits of those nutrients".

Or not. Approximately 90% of the potassium, and 67% of the nitrogen that comes out the back end of a cow is in the urine. Unless you have a deep, high-carbon source such as sawdust on that concrete pad to soak up and hold the urine, most of it will be lost. If you have your doubts, here is an on-farm experiment you can conduct: Fill a 100 gallon tank with water and dump it out on your concrete feeding pad, wait 30 seconds, and then see how much of the water you can scoop up with your front-end loader. If you capture more than 5 gallons you just set the Kentucky Olympic record.

Still don't believe it? A Saskatchewan analysis compared feeding directly on pasture where bales were fed in a checkerboard fashion to frozen drylot feeding which mimicked a feeding pad. Nutrient capture and subsequent forage growth were compared in the two systems where the manure from the same number of cows was spread back onto an equivalent amount of pasture for the drylot system. Soil inorganic N (easily available to plants) was 187 percent higher and extractable potassium was 185 percent higher in the direct-fed pasture system. Subsequent forage growth over the next two years was 127 percent higher and protein levels of this forage were 74 percent higher in the direct-fed pasture system. The results from this research indicated most of the nutrients from confinement feeding are being lost.

Unrolling hay or bale grazing are the two best ways to retain nutrients on your farm from winter hay feeding. The Saskatchewan direct-fed system used bale grazing, but unrolling hay would have had a similar effect. I prefer bale grazing due to the substantial reduction in equipment hours needed as well as keeping equipment off pastures when they are wet. But unrolling hay is exponentially preferred overfeeding in sacrifice lot, feeding pad, or feeding barn. I have been bale grazing on one of my farms for over a decade now and have never had to apply a pound of commercial fertilizer. Ed Rayburn, Extension Forage Specialist for West Virginia University has been bale grazing for two decades on his hayfields and has maintained soil test levels for P and K without adding one pound of commercial fertilizer. For the basics of bale grazing see the "**Feed Hay the Rotational Grazing Way**" article in Hay and Forage Grower or watch the **recorded presentation**.

3) Reduce Your Stocking Rate

There is a tradeoff between having a high stocking rate where you sell more calves on the farm, but incur a high amount of costs, versus a low stocking rate, where you sell fewer calves, but have a much lower cost structure. Not just overall costs, but a lower cost per cow. There are a lot of variables that go into the calculus of what the most profitable stocking rate will be on a particular farm, but the two biggest drivers will be the cost of hay for that farm, and the marginal profitability for that farm (the gross profit of adding or removing one more cow). Without going into details, I will summarize that the vast majority of commercial cow-calf farms in Kentucky are overstocked and feeding too much hay. The average cow-calf farm in Kentucky is likely feeding 120-140 days in a normal year, while in most situations the most profitable number of hay feeding hays will be around 60-90 days. In that analysis, I assumed a cost structure that used no nitrogen and had replacement rates for P and K with pre-2022 fertilizer prices. By reducing your stocking rate and feeding less hay, you will substantially reduce your dependency on commercial fertilizer. For details of the analysis see the "**Find the Hay-Feeding Days Sweet Spot**" article in Hay and Forage Grower.

Summary

Calling your farm supply store each spring to buy your fertility may be a convenient and easy way to maintain good yields. It is also expensive. Even at 2020 prices, cattle farms that relied heavily on commercial fertilizer effectively traded away most of their potential profits for that convenience. At 2022 fertilizer prices, they will trade away a lot more than that. It is also wasteful. Well-managed cattle farms should have a closed nutrient cycle. On farms that are constantly bringing in commercial fertilizer, that effectively means nutrients are leaking out of that system. At some point in the future, if we don't collectively close the nutrient cycles on our farms someone else will offer to do that for us. One silver lining of high fertilizer prices will be that it provides an incentive to figure out how to get that done on our own. In the long run, that will be a winning approach for everyone. You can

complain about high fertilizer prices or you can do something to reduce your dependency on them. What will be your strategy for 2022 and beyond?

Recommended Citation Format:

Halich, G. "**Reducing Your Dependency on Commercial Fertilizers Strategies for Cattle Farms in 2022 and Beyond**." *Economic and Policy Update* (22):2, Department of Agricultural Economics, University of Kentucky, February 28th, 2022.

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