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"It is the crops that feed the cows that make the milk which creates the money."

Advanced Ag Systems
Research, Education, Consulting

Manure Nitrogen and Sulfur for Winter Forage

Manure Nitrogen and Sulfur for Intensive Perennial Grass

Optimize Manure Nutrients for Corn Production

Manure Nitrogen and Sulfur for Winter Forage

This is my yearly letter on fertilizing winter forage with a twist that can save you money while simultaneously maximizing yield and quality. In early 2000 we did a number of trials on the nitrogen needs for winter forage and found that 80-100 lbs. of N/A were the optimum economic returns for spring nitrogen. Yields were 1.5 to 2.5 t/dm/acre for a majority of the sites. Since that work was completed, we learned how to **double our yields**. By planting earlier (10 days to 2 weeks before wheat for grain) it **increased yields 35%**. We also learned that up to 60 lbs. of nitrogen/acre in the fall **increased spring yields 43%** on a field without prior spring manure. The early planting and fall nitrogen available significantly increased the number of tillers that set the spring yield potential. Thus, it is common for yields to be 3.5 ton DM/A (10 ton silage) to 4.5 ton DM/A (14 tons silage). Farms have reported over 5 tons DM/A on better soils in areas south of New York. If we want to harvest 20% crude protein to offset the very expensive soymeal prices, the crop needs to be fed (see table at right). Most well managed winter forage is shorted on nitrogen and sulfur.

Tons 35% DM silage	Tons DM/A	Nitrogen removed at harvest @ 20% CP
2.9	1	64
5.7	2	128
8.6	3	192
11.4	4	256
14.3	5	320

Based on soymeal and nitrogen prices, if you are putting on 120 lbs. of nitrogen and sulfur it will cost about \$60/acre. You are getting at 2 tons of dry matter/acre, the protein is worth \$208/acre as soybean meal. A 3.5X return is not a bad deal. If you are getting 3 tons/acre and did not apply any fall nitrogen, you would have shorted the crop on yield and protein if you had only put on 120 lbs. of N/A. Because of the short growing season, we see no need to split apply spring nitrogen for winter forage.



Winter forage with the latest research backed management steps of planting on time and fall nitrogen boost, are resulting in farm yields of 3.5 to 4.5 tons of dry matter/acre. This requires higher spring nitrogen and sulfur fertilization to support the yield.

You have manure to get rid of and fertilizer to apply. Why not solve both issues at one time. Note: **top-dressing unseparated manure on tall winter forage is a prescription for potential disaster**. The manure will stay lodged in the forage crowns making **unfeedable silage** the next spring. The added factor and one I consider very important for any broadcast manure, is that you **waste most of the nitrogen** in the manure through volatilization. 120 lbs. of N/a, or about **\$56/acre of fertilizer** for every 8,000 gallons/acre of manure applied, **is lost to the air**. Injecting instead, for 150 acres, means you are more than halfway to paying for a 10 ft wide injector in one year through fertilizer savings.

The [September 2018](#) (Click to download) newsletter went into detail on utilizing a wavy coulter manure injection system to meet all the fertilizer needs of winter forage by applying the nitrogen directly into an 8 – 10 inch tall winter grain sod. We are looking forward to testing another company with a rolling coulter, [Zoskes](#), this spring on a neighboring farm. Applying manure by injection after the soil temperature has fallen below 50 degrees can store the nitrogen in the manure as ammonia attached to the soil until spring. Then it is converted to nitrate to be used by the winter forage for spring growth. In addition, Penn State research found a 38% reduction in the loss of soluble phosphate with injection. That means the fertilizer is staying on your field/farm to grow crops rather than polluting waterways. The other big advantage is that you can apply on fields close to houses with **no odor issues**. When we were testing injection on the winter forage, a consultant drove up downwind and said if he hadn't known it was a manure spreader, he would never have known we were spreading as there was no odor. As a bonus, injecting in November or December, the neighbors have all their windows closed tight to keep out the cold. Injection application to the winter forage after corn silage is finished is environmentally sound but balances the work load for field staff.

The only downside we experienced is that for winter forage which matures early, the manure nitrogen **may not release normally due to the very cold late spring** as we experienced in 2018. I have little worry about leftover manure nitrogen after winter forage harvest as most farms are strip tilling corn into the stubble immediately after. In fact, where we shorted the winter forage crop on nitrogen, the crop scours the soil and so there is insufficient leftover nitrogen for the corn to start well. In those cases, pop up nitrogen sources were needed for rapid early corn growth. Using the same rolling coulter unit to inject manure into winter forage stubble where the corn row will be planted eliminates that problem. As for cool season intensively managed grass fields, any nitrogen not available to the first cutting (typically the organic fraction of the injected manure), will be available for the second. Thus, injection is environmentally and economically sound.

Manure Nitrogen and Sulfur for Intensive Perennial Grass

The newest wrinkle on this, developed by Dale Dewing and Paul Cerosaletti of Delaware County Extension, is to do the exact same thing we described above for winter forage, but apply it to **intensively managed cool season grass** fields. Applying to the living sod in late fall-early winter; keeps it in the ammonia form. As soon as the grass starts to grow in the spring, the ammonia converts to nitrate and is released to support the crop yield and protein. You can **meet all the nitrogen and sulfur needs for top yield and quality with the manure**. Even with daily spread if you uniformly inject liquid manure you can apply all through November and most of December to both grass and winter forage. When spreading, where you run out you stop, lift the rig, and then start there again with the next load. You are not spreading manure-you are fertilizing the field and crop. The bonus is that manure also has the sulfur critically needed for crude protein. For smooth mowing, the **field should be rolled** before it freezes solid to push down any lifted sod and stones.



Manure, rolling coulter injected into perennial grass in November, captures and holds all the volatile nitrogen until the grass is ready to use it in spring. Rolling a day after injection (to allow liquid to soak in) will assure smooth mowing surface. The surface spread to the right of the injector is losing \$42/acre of nitrogen fertilizer and could lose more due to washing off of frozen ground during snow melt.

My observation is that for our trials on winter forage, the injector was on 18 inch centers. Moving closer to 15 inch centers will give much more uniform application (that said, we did NOT see any streaking from lack of N in spring) and allow you to come back with alternate units closed for 30 inch center injected manure to match the rows of the following corn crop. The other issue Paul and Dale found with injecting in grass sod, is that “We had the coulter at a 6.5% angle, and we are thinking that at our typical rates we might like the 4 degree better.” The reasoning is that the shallower angle will lift the sod less and less likely to bring up ledge rock that underlies most of their fields while still capturing all the injected manure. While applying into sod on a rainy day, they found less lifting because the sod was slipperier from the water.

Optimize Manure Nutrients for Corn Production

If you are not growing winter forage, late fall manure can still be injected with a nitrification inhibitor for spring corn production. By injecting like you were banding fertilizer under where the corn row will be planted (in other words, matching row width passes like you were planting corn); you can come back early the next spring and no-till plant your corn directly over the manure bands which can supply most, if not all your fertilizer needs.

10,000 gal/Acre injected in a recent trial applied **210 lbs. N/Acre** (70% as volatile captured ammonia); **114 lbs of P2O5/Acre**; and **225 lbs. of K2O/acre**. This is a lot of fertilizer directly under the plant. As you have already spread (injected) the manure, it can be some of the earliest corn you plant. **Note: this strip till/no till system is not for fields that have been beat to death with tillage and trucks, that results in soil structure the consistency of a county road.** For fields that have winter forage harvested, on

days that you can't make haylage, you can be injecting manure into the winter forage stubble for corn planting again on 30 inch rows – the same row area as what you will subsequently plant your corn. Research by Dr. Ketterings at Cornell found injecting up to 15,000 gal/a in line with 30 inch corn silage planting, you could meet all or nearly all the nutrient needs of the corn crop without burning and without additional fertilizer for those specific fields (maximum economic return in her trial was at 9,000 gal/a). By **adding a nitrification inhibitor** to the manure before injecting, it can help hold the nitrogen in a form that will neither leach or denitrify for 6 – 8 weeks after the soil warms in the spring or after injection following winter forage harvest. Corn plants use as a rule of thumb, 6 lbs. of nitrogen for the first 6 weeks and then 6 lbs. of nitrogen/day after that. The nitrification inhibitor will assure the nitrogen will be there and available when the corn starts its rapid growth phase. Do not add an inhibitor to manure fall injected into winter forage or perennial grasses as we want it to be available as soon as the grass/winter forage greens in the spring. Savings on fertilizer will **pay for the soil tests** you haven't taken, **top dressing** for your legume hay fields, and the **lime that has been forgotten** for the past 5 years of poor dairy economics.



Injecting manure directly under where the corn rows will be planted, eliminates any drag on early corn growth from the prior winter forage depleting the soil nitrogen reserve.

Sincerely,

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Hand
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