Reducing manure application rate to prevent build-up of soil phosphorus (P) is a common nutrient management practice where P levels are very high. This overall reduction in nutrient application presents a challenge to meet most or all of corn crop nitrogen (N) needs with manure. Immediate incorporation of spring applied manure to conserve the ammonia-N that’s lost with surface applications can help. Over time, how do reduced rates of manure, with or without tillage incorporation, affect soil fertility and health, especially soil nitrogen and organic matter?

To address this, a five year study set up in 2001 in Aurora, NY used high and low rates of spring applied liquid dairy manure and composted dairy manure solids on a Lima silt loam field with 3.5% organic matter. The crop history was long-term corn harvested for grain with no manure. During the five years of the study, corn silage was the sole crop. Changes in soil nitrate and organic matter were evaluated for each manure source and application rate, in control plots with no inputs, and in plots with no manure where inorganic fertilizer was applied to meet crop needs.

Field study treatments: The study had six treatments and five replications: (1) low rate of composted dairy solids (P-based; 20 tons/acre), (2) high rate of composted dairy solids (N-based; 32 tons/acre), (3) low rate of liquid dairy manure with immediate (within one hour) tillage incorporation (P-based; 7,000 gals/acre), (4) high rate of liquid dairy manure application (N-based; about 20,000 gals/acre), (5) zero N as a control (0 lbs N/acre) and (6) side-dress inorganic N (urea ammonium nitrate) at the recommended rate of 100 lbs N/acre. For field preparation, each plot was chisel-plowed, disked, and rolled with a cultimulcher. The low rate manure plots were chisel-plowed twice. The first pass was to incorporate manure directly after application. Corn for silage was planted and harvested in the crop years 2001 through 2005.

What did we find? Soil Organic Matter (SOM, Figure1): After five years, only one treatment yielded an increase from the original 3.5% SOM. In the plots with high rates of composted manure SOM increased to 3.9%. The low rate of composted manure did not impact SOM, nor did the high rate of liquid dairy manure. However, the low rate of liquid manure with tillage-incorporation resulted in an 11% decrease in SOM to 3.1%. The inorganic N plots (no manure or compost applied) showed an 18% decrease in SOM, dropping from 3.5 to 2.87%.

Soil Nitrate (Figure 2): Soil cores from 0 - 8 inch depth were collected at three different time periods to evaluate end-of-season changes. The figure compares SOM in April 2006 with SOM in April 2001 for each fertility treatment.

Fig. 1. Soil organic matter. Treatments were HC: high rate of compost; LC: low rate of compost; HM: high rate of manure; LM: low rate of manure; N0: zero N control; and N100: 100 lbs sidedressed N/acre. This figure compares SOM in April 2006 with SOM in April 2001 for each fertility treatment.

Fig. 2. Soil nitrate (0 - 8 inches) levels as influenced by fertility treatments from September to April (averaged over 2003 - 2005). Treatments were HC: high rate of compost; LC: low rate of compost; HM: high rate of manure; LM: low rate of manure; N0: a zero N control; and N100: 100 lbs sidedressed N/acre.
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...are less consistent. It is generally accepted that a hybrid with good starch digestibility before fermentation will remain incrementally better after fermentation when compared to a hybrid that starts with lower digestibility before fermentation. Inquiring with a company about their data is quite beneficial, especially if they have wet chemistry data on fermented samples. It is always best to compare results from the same laboratory. However, if the results available are from different labs, ask for data from multiple hybrids to establish the relative differences in like datasets.

Starch Content & Digestibility: Starch content is a popular number to look at and justifiably so. At the risk of excessive repetition, this is another case where it is critical to look at these values in the context of the location mean, rather than absolute values as growing conditions and stage of harvest (whole plant dry matter) can affect this value.

Starch digestibility is more challenging. We know this value changes as the silage ferments, and laboratories continue to refine their ability to accurately predict starch digestibility using NIR methods, compared to the more intensive wet chemistry laboratory testing methods. It is also recognized that results from green (unfermented) samples, as are often used in Hybrid Testing Programs, are less consistent. It is generally accepted that a hybrid with good starch digestibility before fermentation will remain incrementally better after fermentation when compared to a hybrid that starts with lower digestibility before fermentation. Inquiring with a company about their data is quite beneficial, especially if they have wet chemistry data on fermented samples. It is always best to compare results from the same laboratory. However, if the results available are from different labs, ask for data from multiple hybrids to establish the relative differences in like datasets.

Yield and Agronomic Characteristics: While yield often receives too much attention in silage hybrid selection, you do want strong hybrids that have a competitive yield and are able to handle potential stressors. Some of these stressors may be more broadly driven by weather, while others may be typical of the micro-climate you farm, such as soil drainage, air drainage (disease prevalence) or elevation-driven temperature trends.

This is another instance where rather than focusing on actual yield numbers, pooling data from multiple locations and sources and matching this with weather data from those locations will help you understand if a hybrid’s performance is consistent across conditions or if it excels and falters in certain situations that may be applicable to your area.

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