Hauling manure to fields for application is an expensive task, but there is a silver lining—nitrogen, phosphorus, potassium, and micro-nutrients all come along for the ride.

Nitrogen can be lost just as quickly as it can be retained. However, retaining it for the coming crop can save $40, $50 or even $60 per acre at today’s nitrogen prices. Add in the other nutrients and manure quickly commands the respect of purchased fertilizer.

From a management standpoint, nitrogen and phosphorus are the critical nutrients demanding attention. Begin managing them by having soil tests conducted and apply manure nutrients to the fields testing lowest in phosphorus.

Second, apply manure on fields that will be planted with high nitrogen demand crops such as corn and sugar beets.

Third, apply manure as if it were fertilizer. You should know the nutrient content (fertilizer analysis), spread evenly, calibrate for desired nutrient values, and keep records.

There are some other principles that relate to manure nitrogen. If left on the surface of dry soil during warm temperatures, the ammonia portion of manure will volatilize into the air and be lost for crop production. If applied on wet soils, some may denitrify and be lost into the air.

The goal is to spread manure such that it is placed and retained in the root zone for crop uptake.

Some people assume all the nitrogen from surface-applied manure volatilizes to the air and is lost. This is not the case. The ammonia fraction of nitrogen in manure can volatilize, but manure also has an organic fraction of nitrogen that does not volatilize. A portion of that will become available for plant use.

Under hot and dry summer conditions, when manure is applied with no incorporation, virtually all of the ammonia fraction is lost. When moved into the soil by rain or incorporation, volatilization will be reduced. When injected, loss of ammonia nitrogen will be negligible, but it is hard to estimate how much will still be there the following spring when the crop is planted.

When manure is surface applied in the winter during cold temperatures, not all of the ammonia is lost into the air. In the spring, if manure is surface applied when cool
and the soils are damp, potentially little ammonia is lost into the air. The same surface application in the spring on dry soil and with temperatures greater than 50 degrees Fahrenheit can result in significant ammonia loss.

In all of the above scenarios, only the ammonia fraction of nitrogen in the manure is being considered. As previously stated, manure also contains organic nitrogen, which is slowly broken down over several years with 25 to 35% becoming available the first year.

**A Practical Example**

A typical dairy manure from the lactating herd, applied at 6,000 gallons per acre, may contain about 150 pounds of plant-available nitrogen when injected or incorporated within 1 day of application. The same manure could be broadcast under warming conditions and within 1 week lose up to 75% of the potential nitrogen just by lack of incorporation. That brings down the plant-available nitrogen credit to only 35 pounds per acre. At 40 cents per pound of nitrogen, the difference between 150 and 35 pounds of nitrogen results in $46 per acre of lost nitrogen. The manure had to be hauled anyway—a little more time spent on effective incorporation can be well worth it with today’s nitrogen costs.

The nitrogen in swine manure tends to be higher in the ammonia form than dairy manure, making injection or immediate incorporation even more cost-effective.

All manures have a different nitrogen test and percentage in the ammonia fraction, so go by the actual analysis of manure samples, not the examples listed above. Be sure to have the manure analyzed for ammonia content, not just the total nitrogen content.

Because soil moisture, temperature, manure type, and application method impact plant-available nitrogen greatly, how can a farmer be sure there is sufficient nitrogen available for the coming season?

One answer is pre-side dress nitrate soil testing. PSNT can provide an accurate method of measuring the plant-available nitrogen in the soil at side dress time, thereby quantifying the impact of all the factors mentioned above. This soil test is different than traditional soil tests, so there are unique guidelines to be followed.

- The PSNT measures the nitrate form of nitrogen readily available to plants.
- Collect PSNT samples 5 to 14 days before you plan to side dress so results can be received from the soil laboratory in time to adjust the side dress rate. Taking samples earlier in the season will not provide adequate credit for nitrogen that becomes available from the manure.
- If more than 40 pounds of actual nitrogen already has been applied as fertilizer, the PSNT may not be accurate for measuring manure nitrogen. If the nitrogen has been applied in a starter band, avoid this area when soil sampling.
- Soil samples should represent no more than 20 acres. The sampled area should be consistent for past crop, soil types, and manure applications.
- Probe soil 12 inches deep if possible, indicating the depth of the soil sample on the laboratory submission form. Take 15 to 20 probes per composite sample.
- Air dry samples as soon as they are taken. Do not put damp soil samples in plastic bags. If the soil samples cannot be dried right away, keep them cool, less than 45 degrees Fahrenheit.
- Deliver soil samples directly to a laboratory or express mail the air-dried samples. The Michigan State University Soil Testing Laboratory or other commercial laboratories are set up to conduct the PSNT and return results in 24 to 48 hours. Visit <http://www.rootzone.msu.edu> for more information.