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SWAPPING ORGANIC AND INORGANIC FERTILIZERS

The bickering over the superiority of one source of plant nutrients over another gets tiresome. There are excellent arguments about why organic nutrient sources make valuable contributions to plant and soil health. However, remember that the inorganic fertilizer industry first developed to satisfy farmer's irreplaceable need for affordable plant nutrients. Yes, both sources of nutrients play essential roles for food production sustainability.

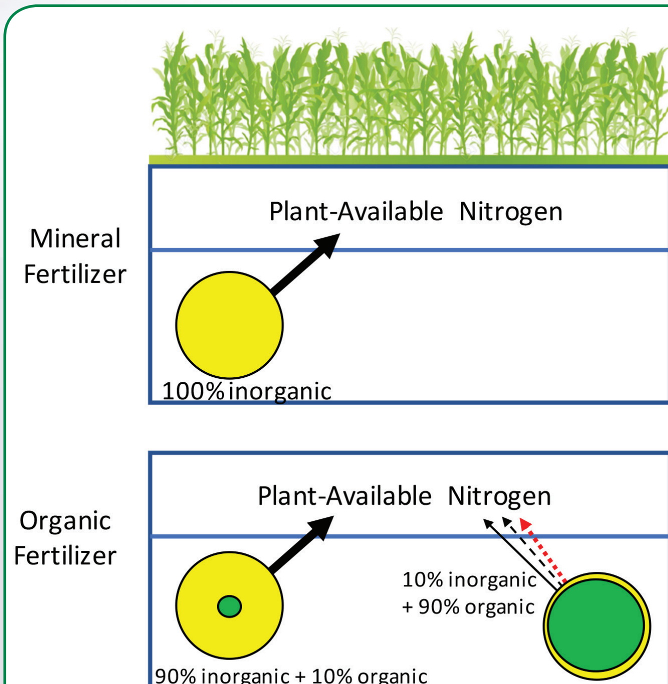
The fundamentals of 4R Nutrient Stewardship remind us to always use the Right Source of nutrient regardless of their origin. Applying 4R principles will always assist in achieving the desired goals of each unique situation.

Predicting N release from mineral fertilizers is relatively simple (see diagram provided). The N release from organic fertilizers depends on the proportion of rapid and extended-release materials. The environmental conditions and field management practices influence the behavior of all nutrient sources applied.

One difference between many organic and inorganic fertilizers is the presence of organic carbon. Addition of organic matter is almost always beneficial for soil health. However, there are at least two ways of adding organic matter to soil: 1) harvest crops from one field, feed them to animals and humans, and then return the manure to another field, or 2) grow plant-based organic matter directly on the field (such as cover crops or by returning crop plant residue). Both approaches are effective in increasing organic carbon inputs to the soil.

The decision of using organic or inorganic nutrient sources is often based on the availability of local resources, the economics of hauling and application, and the need to supply balanced crop nutrition. Here are a few considerations to keep in mind:

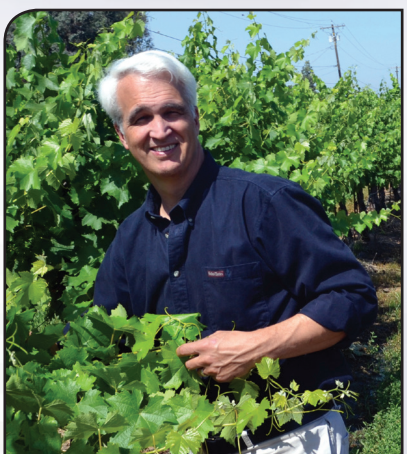
Potassium (K): The fertilizer equivalence of K in most organic nutrient sources is quite similar to inorganic sources. Since K is not a structural component of plant cells, it remains soluble in animal manure, urine, and crop



Mineral Fertilizer: Most soluble N fertilizers are based on urea, ammonium, nitrate, or a combination of these materials. After application, all three of these sources dissolve quickly in the soil and become available for plant uptake.

Rapid N release materials: The presence of high concentrations of ammonium and urea usually results in high availability of N for growing crops. They behave most similar to inorganic N fertilizers that contain exactly the same urea, ammonium, and nitrate compounds.

Extended N release materials: The presence of carbon in organic materials impacts N availability due to microbial immobilization reactions in the soil. When the ratio of C:N is higher than ~15:1, the materials may have limited or no N release during the year of application, but N release may continue for several years.



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residues. The nutrient value of K in animal manures is generally equivalent to soluble K fertilizers.

Phosphate (P): Phosphorus availability from organic materials for plant nutrition is extremely variable. In animal manure, 45 to 70% of the P is present as inorganic phosphate, the form found in most fertilizers. Most reports indicate that there is no difference in crop growth between P supplied by animal manures and composts or fertilizer P (Prasad, 2009, Zhang, 2002). Phosphorus availability in manure and compost will often range from 60 to 100% of the inorganic P fertilizer equivalent. Conditions controlling mineralization and the presence of additional organic matter can also play a role in P availability.

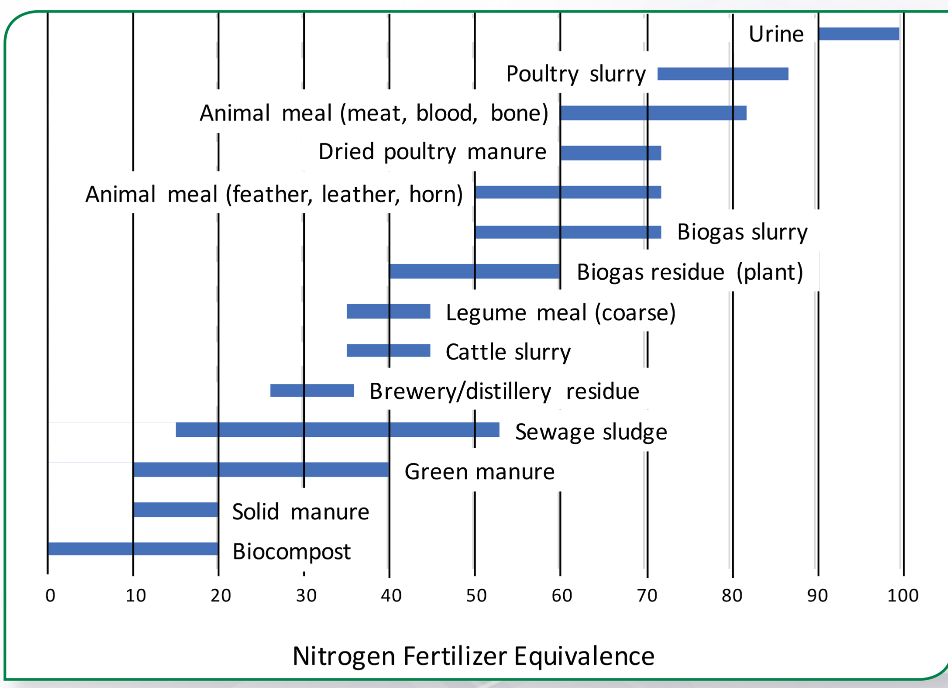
Some commercially available organic fertilizers have been shown to be unsatisfactory at supplying the immediate P needs of plants. However, with a multi-year perspective, even these slowly available P sources may eventually supply P for crop growth if applied in large quantities.

Nitrogen (N): Predicting the fertilizer-replacement value of N in organic materials is the most challenging of the primary nutrients. The availability of N from an organic material is partially controlled by its chemical and physical characteristics. The N-release rate from organic materials is also impacted by factors such as the site (e.g., soil, climate), soil fertility (existing C and N, turnover rate), crop type (length of growing season, rooting patterns), and multi-year field management practices (placement, tillage).

Some organic materials, such as urine, are equivalent to a solution of urea and N will rapidly become available for plant uptake. Other materials, such as aged beef-lot compost will be stable for several years and only begin to release N after many years.

Many organic fertilizers provide both short-term and long-term N release, which consequently requires considerable skill and knowledge to accurately predict the nutrient value. To aid in this prediction, Gutseri et al. (2005) developed a chart for comparing the N fertilizer equivalence for a variety of organic materials during the first year of application.

The selection of any nutrient source should be made so that it simultaneously accomplishes the 4R goals of economic sustainability, environmental protection, and societal acceptance. Whether a farmer primarily uses organic nutrient sources, inorganic fertilizers, or a combination of the two, they must all be managed properly. ***Let's not argue about it.***



The nitrogen fertilizer equivalence of a variety of organic materials during their first year of application, compared with soluble inorganic N fertilizer (adapted from Gutser et al., 2005).

References and Further Reading

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