IPNI Stewardship SPECIFICS

Organic or Inorganic: Which Nutrient Source Is Better for Plants?

No. 2

A quick answer to the question asked in the title is that neither organic nor inorganic (manufactured or mineral) nutrient sources are better for plants. Both have their places and should be used wherever appropriate. Each has its advantages and disadvantages. Using both sources in appropriate ways is called integrated nutrient management. The relative merits of the two sources need to be explored further.

Organic materials such as animal manures, composts and biosolids should be viewed as important nutrient sources that can be used along with mineral fertilizers in the production of crops. They contain varying amounts of plant nutrients and provide organic carbon (C). They can improve the biological, chemical and physical properties of soils. However all nutrient sources need to be properly used.

In the case of animal manures produced in confined geographic areas, nutrient loading can occur in crop fields near production facilities. This can pose a threat of excessive nitrate (NO_3^-) leaching to groundwater and phosphorus (P) moving into surface waters through runoff and erosion. Because their nutrient ratios usually differ from the ratio needed by crops, long-term use can result in excessive P loading in heavily manured soils because crops usually require much less P compared to nitrogen (N) than that contained in the manure. Significant amounts of ammonia (NH_3) can also be lost to the atmosphere.

- Indiscriminate use of animal manure and human waste in some countries (biosolids) can create human health hazards through the accumulation of heavy metals and pathogens in the soil.

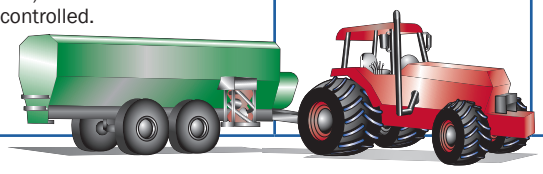
There are other disadvantages associated with the use of organic sources. They are usually low in nutrient content, making it uneconomical to transport them far. It is also challenging to time the release of the nutrients they contain to match the needs of the growing crop and minimize residual amounts that can impact the environment.

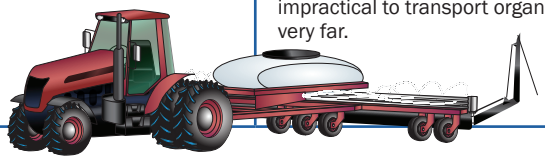
On the other hand, mineral fertilizers contain precise—guaranteed—levels of nutrients, in forms that are readily available for plant uptake and use. Their application can be timed to meet crop requirements, assuring efficient nutrient use and minimizing any potential impact on the environment. Because of their high nutrient content, mineral fertilizers are easy and economical to ship to great distances from their point of production.

It should also be understood that crop plants take up nutrients primarily in the inorganic form—as is found in mineral fertilizers. Although some plants may take up small amounts of some organic N molecules, these organic forms contribute negligibly to agronomic plant nutrition. It is overwhelmingly clear that nutrients in organic materials are not used in any significant amounts until the materials decompose to an inorganic form. When adding organic materials to soil, careful management is required to balance the complex dynamics of nutrient release with the short and long-term demands of growing crops.

What's the N-P_2O_5-K_2O Analysis?

Livestock manure		Commercial fertilizer	
Storage, handling, weather, and other factors result in big differences in nutrient content of organic materials, while the nutrient content of inorganic (mineral) fertilizers can be carefully controlled.	4-3-2 ? 2-4-2 ? 2-3-4 ?	16-16-16 (or whatever ratio is specifically needed)	Nutrient content of livestock manures and other organic material varies considerably. Inorganic commercial fertilizers contain guaranteed ratios of nutrients and can be easily adjusted to crop and soil needs. Relatively low analyses usually make it impractical to transport organic sources very far.





FOR FURTHER READING:

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This *Stewardship Specifics* is one of a series of condensed summaries of issues impacted by nutrient stewardship written by scientific staff of the International Plant Nutrition Institute (IPNI). This series is available as PDF files at www.ipni.net/publications.

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