Understanding Manure's Environmental Benefits

For centuries, animal manure has been recognized as an excellent source of plant nutrients and as a soil "builder" because of its contributions to improving soil quality. When compared to more conventional fertilizer, manure properly applied to land has the potential to provide environmental benefits, including

- Reduced nitrate leaching
- Reduced soil erosion and runoff
- Increased soil carbon and reduced atmospheric carbon levels (potentially benefiting global warming)
- Reduced energy demands for natural gas intensive N fertilizers
- Reduced demand for commercial P fertilizer, which is a limited resource
- Improved productivity of cropping systems

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Manure contains most elements required for plant growth including N, P, potassium, and micronutrients. However, it is manure's unique combination of these nutrients with organic carbon that provides its value to crop production and the environment. First, manure N is more stable than N applied as commercial fertilizer. A significant fraction of manure N is stored in an organic form that is slowly released as soils warm. Commercial fertilizer N is applied in either a nitrate or an ammonium (easily converted to nitrate) form. Nitrate-N is very soluble and mobile, and early in the growing season, it contributes to leaching during excess precipitation or irrigation. Manure N's slow transformation to crop-available forms is better timed to crop N needs, resulting in less leaching potential. In addition, some manure N is released very slowly, often not becoming available until the second or third year after application, thus providing long-term benefits.

Soil organic matter is considered nature's signature of a productive soil. Most nutrients that enter the plant root zone are involved in a range of microbial processes during their conversion to plant-available forms. Manure's organic carbon provides the energy source for the active, healthy soil microbial environment that both stabilize nutrient sources and make those nutrients available to crops.

Tilling the soil and harvesting grain and other crops has reduced the organic carbon content of soils. It is estimated that soil organic content has declined by 50% to 70% in the Midwest during the past 150 years. Several long-term manure application studies have illustrated manure's ability to reverse the trend or return soil organic levels back to their original level prior to cultivation.

In addition to the value of soil organic carbon from a nutrient perspective, manure contributes to improved soil structure, which contributes to improved water infiltration and greater water-holding capacity, benefiting crop water stress, soil erosion, and nutrient retention. An extensive review of the literature and historical soil conservation experiment station data (Risse and Gilley 2000) at selected locations around the United States suggested that manure produced substantial reductions in soil erosion (13%-77%) and runoff (1%-68%). Increased manure application rates produced greater reductions in soil erosion and runoff. During years when manure was not applied, a residual benefit of past manure application was noted.