

Nutrient Management in Organic Cropping Systems

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Soil fertility amendments used in organic cropping systems are typically complex, whole nutrient source materials (e.g., compost, animal manure) making balanced nutrient management challenging. Nitrogen is typically the most limiting nutrient in organic cropping systems, but when compost or animal manures are applied at rates high enough to meet crop nitrogen needs, phosphorus (and often other nutrients) is generally over applied. Repeated nitrogen-based application of animal manure or compost results in excessive soil phosphorus levels which can lead to crop nutritional problems and threaten surface water quality. For this reason, sole reliance on compost or animal manures to meet crop nitrogen needs should be avoided.

Sustainable soil fertility management on organic farms requires routine soil testing and diligent monitoring of nutrient inputs. Monitoring nutrient inputs and soil test levels over time enables growers to adapt their nutrient management strategies to optimize crop yield and quality and minimize environmental impact. The goal should be to maintain soil nutrients within the *optimum* soil test range. Therefore, when soil test phosphorus levels are above optimum the application of compost or animal manures should be limited to rates no greater than that required to replace phosphorus removal by the crop. Where soil test phosphorus levels are excessive due to previous over application of organic amendments, no phosphorus should be applied.

In order to avoid building soil phosphorus levels to above optimum or excessive levels, organic growers need to develop creative nutrient management strategies to meet crop nitrogen needs. Growers can reduce the need for organic amendments by including legumes (either perennial forage or winter annuals) in the rotation. For example, if hairy vetch is planted early enough in the fall and allowed to grow late enough into the spring it can satisfy a large portion of the nitrogen needs of even the most demanding vegetable crops. Then, only a small amount of nitrogen will need to be provided by an organic amendment allowing a grower to apply it a rate low enough that phosphorus is not over applied.

It is also important to recognize that soil organic matter can be a significant source of available nitrogen. Where organic amendments have been applied for several years and soil organic matter levels have been increased, lower rates of organic amendments are often required to satisfy crop nitrogen needs. One way growers can determine a soil's capacity to supply nitrogen is to withhold pre-plant amendments from a small portion of the field and observe the relative crop growth and vigor compared adjacent areas that received pre-plant amendments.

Growers may also consider alternative organic amendments with higher nitrogen to phosphorus ratios than compost and animal manures. These include materials such as feathermeal and bloodmeal as well as pelletized blended organic fertilizers containing these materials. An added benefit of these materials is that they are easier to handle and tend to release nitrogen much more rapidly than manure and compost making them useful as sidedress amendments. Postponing the application of these nitrogen sources until sidedress time gives growers the opportunity to use in-season observation and soil testing (e.g., the pre-sidedress soil nitrate test, PSNT) to determine if and how much additional nitrogen might be needed.

Sustainable nutrient management is a critical component of organic cropping systems. Good record keeping and routine soil testing will enable growers to adapt their nutrient management strategies to meet crop nutrient needs and minimize environmental impact. Growers must use an integrated nutrient management strategy for organic systems that maximizes nitrogen inputs from legumes and supplements legume nitrogen with animal-based products at rates close to phosphorus removal rates by the crop.