# *Effects of Organic Fertilizers on the Saturated Hydraulic Conductivity of a USGA Rootzone*

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**Objectives:**

1. To determine if heavy use of natural organic nitrogen sources affects the saturated hydraulic conductivity of a USGA recommended rootzone mix

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**Project Duration:** one year
**Total Funding**: $6,000

Problems associated with organic matter accumulation in golf green sand rootzones have been widely reported. Questions have been raised about the contribution of organic matter and other material to these rootzones through the application of commercial fertilizers that contain high levels of organic matter.

The contribution of these high organic matter content fertilizers to the overall organic accumulation of a golf green seems limited considering the amount of organic matter produced by the turfgrass stand each year. The amount of organic material a turfgrass stand produces in a year varies depending on species, growing conditions, fertility, etc. but the addition of 5,000 lbs of oven dry organic matter per acre per year is a conservative estimate. Researchers have reported amounts higher than 7,000 lbs per year.

If a superintendent applied a high organic matter content fertilizer source such as Ringer 10-2-6 to their greens to deliver 5 lbs. of actual nitrogen per thousand square feet per year, the amount of organic matter added would be about 1,500 lbs per acre. While a significant amount, the amount produced from the turfgrass stand is a magnitude higher.

The non-organic matter content or the ash that remains could potentially be of greater concern. The ash that remains after a loss on ignition test is typically referred to as mineral matter. The concern is that there may be high amounts of "fines" in these products. When applied at a rate to deliver 5 lbs. of nitrogen per thousand square feet, a fertilizer conceivably would be adding as much as 50 lbs of fines per thousand square feet. This experiment examined the effect of applications of a few commonly available organic fertilizers on the saturated hydraulic conductivity of a USGA rootzone.

*Ash was applied to the surface of the rootzone in the cylinder prior to compaction as well as treatments of applying ash to the surface and worked it into the top 4 mm.*

Five organic and four nonorganic fertilizer products were selected for evaluation. Each fertilizer was dried, weighed, and exposed to temperature of 440$^{o}$ C until a constant weight was achieved. The remaining ash was weighed and a loss-on-ignition value was calculated . Enough ash was produced from the fertilizers to apply the equivalent amount of ash to cylinders containing a USGA specified rootzone mix at rates equal to the amount of material that would be applied when using that product to deliver 5, 10, and 20 lbs of N per thousand square feet per year.

Ash was applied to the surface of the rootzone in the cylinder prior to compaction as well as treatments of applying ash to the surface and working it into the top 4 mm. Non-combusted fertilizer was also applied at a rate to deliver 5 lbs of N per thousand square feet to treatment cylinders and worked into the surface 4 mm. Saturated hydraulic conductivity was determined on each treatment cylinder using.

None of the treatments tested had a saturated hydraulic conductivity lower than the control. Neither the non-combusted fertilizer nor the ash treatments negatively affected the saturated hydraulic conductivity of this rootzone mix.

The amount of ash applied was very high. We questioned how the application of such a large amount of material had no negative affect on the hydraulic conductivity of the sand rootzone. Solubility tests were conducted on the ash and fertilizer using both water and sulfuric acid as solvents. The total silica content of the ash and fertilizers was also determined.

*Questions have been raised about the contribution of organic matter and other material to these rootzones through the application of high organic matter commercial fertilizers*

The amount of silica present had a high correlation with the percent solubility of both the ash and fertilizer. The solubility of the Milorganite and Sustane ash was lower than the other products. However, 86.5% of the Milorganite ash and 50.7% of the Sustane ash was sand-sized particles and thus had no negative affect on the hydraulic conductivity of the rootzone.

## Summary Points

- The application of large quantities of the fertilizers used in this study or the ash produced from these fertilizers had no affect on the saturated hydraulic conductivity of a USGA specified rootzone.
- A significant portion of the ash produced from these organic fertilizers was water soluble or, in the case of Milorganite and Sustane, sand-sized particles.
- The traditional method to determine particle size distribution through sedimentation is not an appropriate method to determine the particle size of organic fertilizers or the ash produced from these fertilizers because much of the material is soluble in water.