

# Transitioning to Natural Organic Fertilizers: Turfgrass Response and Potential Impacts on Soil Properties

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## Objectives:

1. To evaluate fertilization programs for transitioning from the use of synthetic fertilizers to natural organic fertilizers, taking into consideration that natural organic products have slower initial nutrient release, extended response, and potentially significant amounts of recalcitrant nitrogen that may take several years to become available.
2. To evaluate the potential impacts of repeated applications of natural organic fertilizers on soil physical properties, including hydraulic conductivity (infiltration) and soil organic matter content.

**Start Date:** July 1, 2008

**Project Duration:** 3 years

**Total Funding:** \$32,517 (\$15,000 from NTA, \$17,517 from Washington State Department of Agriculture).

Natural organic (NO) fertilizers are becoming more widely used on golf courses and in other turf settings. The benefits of these materials include slow-release nitrogen and phosphorus, low burn potential, and low leaching potential compared to soluble inorganic sources. The popularity of natural organics is due in part to the concept of resource reuse and recycling, as well as the desire of both the public and professional managers to increase the level of environmental stewardship.

Current research we are conducting indicates that N availability from natural organic sources ranges from 30% to 80% of N availability from a coated urea. The remaining N may become available in subsequent years, but this partial release during the first year means that the effective N rate will be relatively low. This project addresses fertilization programs during transition into a natural organic based management system, investigating ways to compensate for reduced N availability during the first year or two of natural organic fertilizer use.

Natural organic fertilizers have relatively low nutrient content, resulting in 85% or more of the material not being used nutritionally by the plant. Significant amounts of organic material might remain on the soil surface following application, with additional accumulations following repeated applications. It is known that organic amendments used in sand-based construction and organic inputs due to root turnover can affect soil physical properties. Could additions of natural organic fertilizers have a similar effect? Our research will measure water infiltration rates and surface soil organic matter content in order to quantify impacts on these soil physical properties.

Three sets of plots were established for this project. One is in perennial ryegrass golf course fairway turf at The Home Course in DuPont, WA, in a sandy gravelly soil. The other two sets are at the WSU Puyallup R.L. Goss Research Farm: one on Puyallup fine sandy loam soil managed as lawn/rough; the other on a sand based *Poa annua* turf maintained as fairway. Treatments include seven fertilization programs:

1. Synthetic organic (SO) product: (Proforma 20-5-10, 60% of N as polymer coated sulfur coated urea).
2. Natural organic (NO) product 1: (SoundGro 5-4-0, biosolids, 75% insoluble N).
3. Combination program 1 – NO1 + SO (portion of N from each source, see explanation below).
4. NO product 1, 1.5X rate.
5. NO product 2: (NatureSafe 8-3-5, feather, meat, blood, fish, poultry, and bone meals, 90% insoluble N).
6. Combination program 2 – NO 2 + SO (portion of N from each source, see explanation below).
7. NO product 2, 1.5X rate.

Three more NO fertilizer treatments were added at The Home Course based on the golf course Superintendent's interest: Sanctuary 8-3-6, NatureSafe 10-2-8, and NatureSafe 15-2-8. The last fertilizer is a "bridge" product, containing methylene urea mixed with the NO fertilizer. Each of these products is applied at a 1X rate.

Annual N application rate at The Home Course and Puyallup native soil sites is 3 lb N per 1000 sq ft per year for the 1X rate and 4.5 lb for the 1.5X rate (applied in equal amounts in July, October, and April). The annual rate at the Puyallup sandy soil site is 5 lb N per 1000 sq ft per year for 1X, 7.5 lb for 1.5X (applied in July, September, November, April, and June). Programs 3, 4, 6, and 7 are designed to compensate for the expected lag in N release from the NO sources. Programs 3 and 6 address this by gradually transitioning to NO fertilizers. During the first year, 1/3 of the total N will come from NO fertilizer, and the remainder from SO fertilizer. In year 2, 2/3 of the N will come from NO, and in year 3 100% will come from NO. Programs 4 and 7 compensate by using a 1.5X rate of the NO fertilizers compared to programs 2 and 5.

Infiltration rates were measured at both Goss Farm sites prior to fertilizer application in July 2008 to serve as baseline data. These will be repeated annually, but have not been conducted yet for 2009. The gravelly soil at the Home Course made it impossible to install the infiltration rings. Similarly, soil organic matter content is measured each year, but 2008 base line data only has been collected, so there is no basis for comparison yet.

Visual color and quality assessments are conducted monthly for all plots, as well as chlorophyll index ratings using a FieldScout CM1000 chlorophyll meter. Summaries of color and quality ratings are presented, averaged for all ratings collected between fertilizer application dates. Chlorophyll meter readings are more complex than can be presented in this summary format.

Color and quality ratings for the native soil plots have been similar for all fertilizer treatments, and all are of acceptable color and quality for lawn/rough turf. This soil is high in organic matter and well-suited for turf growth, resulting in few visual differences. Visual differences were more apparent in the sand-based and Home Course plots.

For the Home Course plots, average ratings collected through Oct 2008 indicated better color from Nature Safe than from SoundGro or PCSCU. Turf quality was similar for all fertilization programs. For ratings collected from Nov through Apr, both 1X rate NO programs resulted in lower color and quality than all other programs. Therefore, either increasing the rate of NO fertilizer or applying PCSCU in the fall resulted in

enhanced turf color and quality.

For the sand-based Goss Farm plots, ratings for the Aug – Sep period indicated higher color and quality from both 1.5X rate NO programs compared to all others. For the periods Sep – Nov and Dec – Apr, the both 1X NO programs resulted in lower color and quality ratings than all other programs, similar to what was observed at the Home Course.

Soil organic matter and infiltration measurements will be repeated in June 2009 and compared to baseline measurements collected prior to fertilizer treatment initiation in 2008.

**Summary Points:**

- Following July or August fertilizer application, all fertilizer programs produced good turf color and quality. The 1.5X rate of natural organic fertilizers enhance the responses on sand-based turf at the Goss Farm, but not at the other locations.
- During cooler months when mineralization rates of organic N were likely lower, either applying a 1.5X rate of natural organic fertilizer or applying PCSCU resulted in improved color and quality compared to a 1X rate of the natural organic fertilizers. It is probable that reduced soil temperatures limited the release of N from the natural organic products during this period.