TechLink Research Summary #3322

Phosphorous Reduction Using Compost

Phosphorus (P) is an essential nutrient to plants in land based ecosystems. While P is essential to terrestrial plant growth it is often a pollutant in fresh water ecosystems. As this nutrient is typically the 'limiting nutrient' to plant growth in fresh water systems (such as nitrogen is to plants on land based ecosystems) a small amount of P loading to a water body can elicit a rapid growth response by algae. Although P is not toxic to humans or aquatic organisms, once algae blooms occur in an aquatic ecosystem, the microbial decomposition of the algae causes aquatic microbes to utilize a higher percentage of the dissolved oxygen in water, thereby causing fish and other aquatic organisms to suffocate and ultimately die, often in large numbers. This process is called eutrophication.

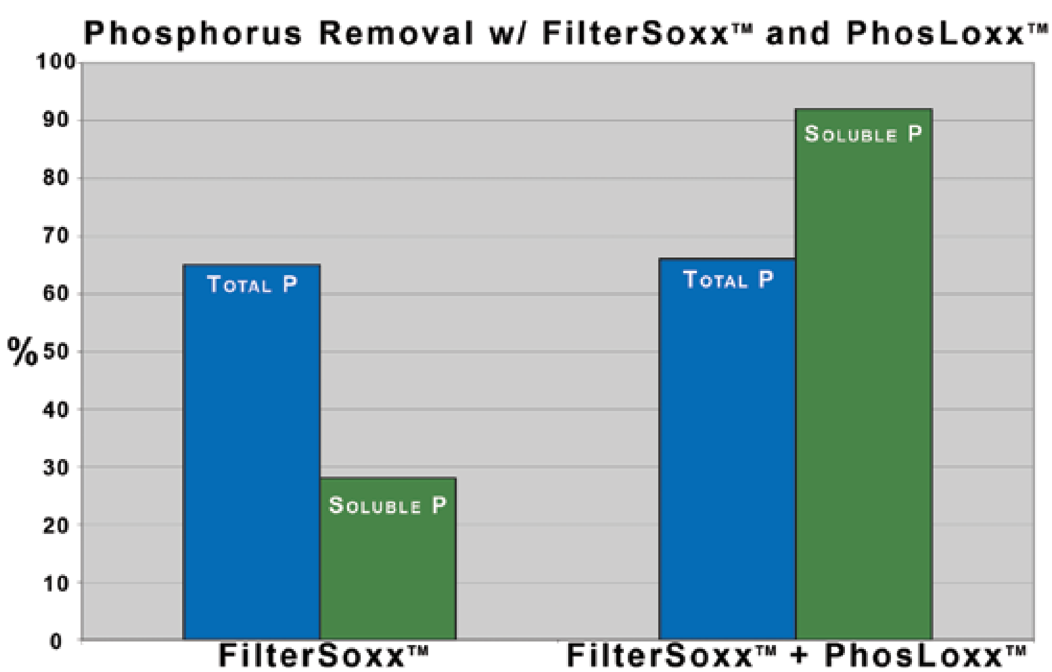
Additionally, algae growth can blanket the surface of a water body, thereby reducing sunlight penetration through the water, resulting in reduction of photosynthesis to aquatic plants under the surface. These aquatic plants are often habitat and/or food source for other aquatic organisms in the food web and without them can lead to mortality of certain aquatic organisms or even whole trophic levels.

Phosphorus enters surface waters typically through non-point source storm water runoff. It is either attached to sediment particles (particulate or sediment-P) or free-floating in the runoff water solution (dissolved or soluble-P). Sediment-P runoff is typically higher where soils are disturbed, such as construction sites, while soluble-P is higher where land surfaces have been recently fertilized or where storm water volumes are high due to prevalent impervious surfaces in the watershed - such as parking lots, highways, and roof tops.

Reducing P loads from runoff can be done by source reduction, reducing runoff volume (through infiltration or containment practices such as bioretention, engineered soils, and green roofs), or filtration (by physical means for sediment-P and chemical means for soluble-P).

Total phosphorus concentration limits generally applied to wastewater treatment plant discharges are 5 mg L-1 (5 ppm) and typical storm water runoff concentration is approximately 0.4 mg L-1 (0.4 ppm). The critical concentration of total P (sediment-P + soluble P) in streams at which eutrophication is triggered is 0.10 mg L-1 (0.10 ppm), and 0.03 mg L-1 (0.03 ppm) for soluble P (Brady and Weil, 1996). Soluble P entering surface water is of particular concern because it is often bio-available to aquatic plants for immediate uptake, leading to increased risk of eutrophication, while sediment-P is not readily available for plant uptake (but can become available over time). Total annual loss of nitrogen, phosphorus and potassium due to soil erosion in the US is estimated to be over 38 million Mg (42 million tons). It is estimated that the annual cost to society for on-site loss of soil and nutrients due to soil erosion is over $27 billion per year (Brady and Weil, 1996).

Total maximum daily load (TMDL) - Section 303(d) of the US Clean Water Act, 'listed streams' for phosphorus have become increasingly common in recent years as over 5600 water bodies have been labeled as nutrient impaired and over 3500 have been approved as TMDL listed water bodies for nutrients since 1995 (US EPA, 2007). While erosion and sediment control BMPs may reduce sediment-P, they do little to reduce soluble-P in storm runoff. Additionally, when soil becomes detached and in contact with water, sediment-P can quickly



become desorbed, thereby transforming into soluble-P (Westermann et al. 2001). In order to improve receiving water quality, and in particular to meet TMDL requirements for phosphorus, BMPs should be developed to reduce soluble-P loading to streams. Soluble-P is more reactive, or bioavailable, relative to sediment-P to aquatic plants; therefore, it is more likely to cause algae blooms and eutrophic conditions contributing to the degradation of our nation's surface waters.

Filtrexx Phosphorus Solutions

FilterSoxx™:

Filtrexx® FilterSoxx™ provide a physical means to filter P from storm water, while Filtrexx® Nutrient agent adds a chemical binding component by flocculating soluble P ions in water. According to the USDA Agricultural Research Service (USDA ARS), standard Filtrexx® FilterSoxx™ remove 65% of total P and 27% of soluble P from storm water runoff on disturbed or bare soils. By adding Filtrexx® Nutrient agent, the removal efficiency of soluble P increases to 92%. Experimental conditions included runoff-sediment concentrations of 60,000 mg/L, runoff total P concentration of 82 mg/L, soluble P concentration of 37 mg/L, a 10% slope, exposed to 30 minutes of simulated rainfall at 3.4 in/hr (8.5 cm/hr) (Sadeghi, 2006). Filtrexx® FilterSoxx™ utilizing Filtrexx® FilterMedia™ include: Filtrexx® Sediment control, Inlet protection, Check dams, Concrete washouts, Filtration systems, Sediment traps, and Slope interruption.

Filtrexx® Slope protection & Storm Water Blankets:

Filtrexx® Slope protection and Storm water blankets reduce P loading through runoff volume reduction and because plant nutrients are in organic form - a form less mobile under storm runoff conditions relative to fertilizers typically used in traditional seeding and hydromulching applications. According to the University of Georgia (UGA) Filtrexx® Slope protection and Storm water blankets can reduce total P and soluble P loading in runoff by over 80% relative to hydroseed and hydromulch applications used in seeding and vegetation establishment (Faucette et al, 2005). See Filtrexx TechLink #3321 for more information on how these technologies reduce nutrient loading in storm water runoff.

References

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