ATHLETIC TURF

Phosphorus bans ignore problem's real causes (Part II)

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Athletic Turf News

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Phosphorus in turfgrass fertilizers comes in two chemical forms, and both are 100% water-soluble. That means after one or two irrigations or comparable rainfalls no fertilizer phosphorus remains on the soil surface. Instead, the phosphorus has washed into the soil, where it becomes strongly attached to soil particle surfaces while remaining available to plants.

At that point, less than 1% of the fertilizer phosphorus is capable of making its way into bodies of water or the water table.

Fertilizer bonding

Transfer of fertilizer phosphorous (P) to surface water is therefore predominantly through erosion of phosphorus-bearing soil particles. These soil particles constitute what is commonly referred to as the sediment in runoff water.

This is where turfgrass has a unique feature when compared to agricultural row crops. Sediment losses from agricultural lands are measured in tons per acre, while sediment in turfgrass runoff water ranges from zero up to 100 pounds per acre.

This superior ability of grasses to trap and hold sediment is why grass has long been used as a buffer strip between agricultural lands and surface waters.

Thick Lawns Deter Runoff

Since sediment transport is the primary means for transfer of fertilizer phosphorus from turfgrass to surface water, the quantity of phosphorus transferred should depend on two things: the amount of sediment lost, and the concentration of fertilizer phosphorus on the sediment particle surfaces.

The amount of sediment lost from turfgrass is almost totally dependent on the density of the grass. Research has shown as turfgrass cover approaches 70%, sediment losses approach zero.

Another factor in sediment loss is a visual quality rating of the grass. Turfgrass researchers employ a rating scale of 1 to 9, with 1 being bare soil and 9 being a dense, uniform cover. Research shows as the quality rating approaches 7, sediment loss goes to zero.

The second thing determining the quantity of fertilizer phosphorus in sediment is the concentration of phosphorus on soil sediment particles. This is readily determined by soil tests. Soil tests are good indicators of the amount of fertilizer phosphorus applied, and presumably the phosphorus concentration bears a direct relationship to the amount of phosphorus in turfgrass runoff water.

This assumption is what leads to the use of soil test phosphorus level as the criterion for deciding when fertilizer phosphorus application on turfgrass is to be banned.

Soil tests not valid

But is this a valid assumption? Not according to research conducted to date in Minnesota and New York. That research has shown there is no direct relationship between turfgrass soil test phosphorus levels and the quantities of phosphorus in runoff water.

Similarly, Wisconsin research has shown there is no relationship between the amount of fertilizer phosphorus applied and the amount of phosphorus in turfgrass runoff water.

In other words, there is no scientific validation of the use of soil tests as the criterion for regulating or banning fertilizer phosphorus application to turfgrass.

A study conducted in Madison, WI, showed the amount of tree canopy over streets accounted for all of the P in runoff from the streets. It has long been known that P loads from urban areas have two peaks—one at the time of leaf fall and the other during spring snow melt.

Recycling phosphorus

One impetus for banning the fertilizer phosphorus on turfgrass has been surveys showing many home lawns have excessive levels of soil-test phosphorus with respect to actual turfgrass requirements.

When soil-test levels of phosphorus exceed what the grass actually requires, there is no additional uptake of phosphorus. Phosphorous bans assume fertilization is responsible for high soil-test levels. However, the science does not support this seemingly logical assumption.

Turfgrass researchers know the ratios in which nutrients are taken up by grasses are remarkably constant. For the cool-season grasses grown in northern climates, the ratio in which nitrogen (N) and phosphorus (P) are taken up is close to 9:1.

Leaving the clippings on lawns, now a widespread practice, results in recycling of phosphorus. Wisconsin research has shown when clippings are left on lawns, it takes only 0.1 pound of fertilizer P per pound of N to replace what has been removed from the soil. This equates to a ratio of 10:1. Any survey of fertilizers commonly sold for lawn application quickly reveals a similar ratio of 10:1.

This leads to the inescapable conclusion that these fertilizers are supplying only the quantity of phosphorous that is being removed by the grass.

Stockpiling topsoil

An alternative source of the P in lawn soils was recently explored in Madison, WI.

Researchers noted new housing developments often strip topsoil and stockpile it for eventual spreading on lawns prior to turfgrass establishment. They also note much of the development is on agricultural land that likely has a history of heavy fertilization. The stockpiled topsoil averaged more than three times the phosphorous levels researchers consider optimum for home lawns.

That means the common practice of spreading these topsoils around newly constructed buildings prior to lawn establishment can result in high to excessive levels of soil test P without any fertilizer actually being applied.

Editor's note: This is the second in a four-part series on the science behind phosphorous bans increasingly being proposed in state legislatures. The series is appearing in the online site The Heartland Institute.