Monitor potassium levels for healthy turfgrass

A healthy grass leaf contains 2.5 to 3.5 percent of potassium. The growing medium and cation exchange capacity are keys to potassium content.

■ Most soils contain relatively large amounts of potassium (K^+)the essential element for plant growth, often in quantities as much as two percent of the weight of the mineral portion.

At the same time, the concentration of potassium in the soil solution from which the grass draws its needs may be only 50 to 100 parts per million.

This relationship illustrates the reason why the total chemical analysis of a soil has little correlation with its ability to supply grass with a nutrient and why soil testing procedures were developed which were more closely related to plant growth.

The potassium in the leaf is not associated with the structure of any specific compound such as protein or carbohydrate in the leaf. It appears as a free ion in the cell sap and helps maintain the ionic and pH balance within the cell as well as with some enzyme functions.

In fact, when a leaf dies, most of the potassium contained in the leaf will be leached out by the rain and returned to the soil.

The major portion of the potassium in the soil is found as an element in the structure of clay minerals and sand grains originating from the mica and feldspars in igneous rock.

Over many years, the potassium-containing minerals mica and feldspars break down. The potassium released due to this breakdown may become part of the structure of secondary minerals known as clay minerals or become exchangeable ions in the soil solution.

The potassium which is part of the clay structure is considered slowly available to the soil solution and can slowly recharge the potassium in the soil solution over a period of weeks or months. The rate at which the restructuring or breakdown of clay minerals releases potassium is known as the potassium supplying power, and can vary significantly between soils.

Potassium taken up by the plant is composed of potassium in the soil solution and the exchangeable potassium.

Cation exchange—Cation exchange occurs when compounds or minerals are surrounded by a sphere of negative electrical influence.

This gives them the ability to attract positively charged ions. Ions such as potassium, calcium and magnesium carry a positive charge, and are attracted by the negative charge the same way the north pole of a magnet attracts the south pole.

Cation exchange is also a property of large organic matter molecules, particularly when present as humus, because they also have a negative "sphere of influence" Since clay minerals and humus have a negative sphere of influence and therefore attract cations, the cations are held from leaching in the percolating ground water.

Cation exchange capacity—The ability of a soi lto retain all cations by the exchange system is called its cation exchange capacity (C.E.C.). The CEC of a soil depends on the amount of organic matter, the amount of clay and the type of clay found in the soil. The silt and sand fractions do not have a negative charge, so they have no effect on the CEC.

The type of clay mineral which makes up the clay fraction has a large influence. Clays found in the tropics tend to be the kaolinitic types with a low CEC. Clays found in the temperate regions such as Canada have illite to montmorillonite type clays and thus are more fertile due to a higher CEC.

There is little the turf manager can do to alter th eamount or type of clay in his soil. He can, however, increase the humus content by returning clippings, top dressing with composted organic materials and use management practices which favor a dense, deep root system.

Don't look for immediate results; this is a slow process.

Sports field CEC—Sports fields builts on an all sand rooting medium will have a very low CEC as evident from the above discussion. The lack of any CEC in sand is one of the reasons many designers will advocate the inclusion of a small amount (three to 10 percent) of natural top soil in the mix.

Attention to the potassium nutrition of turf growing on a sand system is critical. More frequent applications will be required. A soil testing system will give a reading on the potassium primarily in the soil solution, potassium which may be quickly lost by excessive rain or irrigation. There will be little reserve in the cation exchange system.

The turf manager must decide the economics of frequent light applications of soluble forms of potassium versus the cost of the coated materials. There is little research available to guide him regarding the application timing of slow-release potassium.

All potassium fertilizers, with the exception of controlled release forms, are water soluble. As a result, they can cause foliar burn when applied at high rates or where there has been an over application due to equipment failure or operator error.

—by R.W. Sheard, P.Ag., writing in the Sports Turf Newsletter.

HUMUS/CLAY MINERAL POTASSIUM RETENTION THROUGH CATION EXCHANGE

	(grams potassium/kg. material)
Humus	78
Montmorillonite clay mineral	39
Illite clay mineral	15.60
Kaolinite clay mineral	3.12
Sandy loam low in organic matter	0.76
Sandy loam high in organic matter	3.90
Clay loam with kaolinitic clay mineral	1.56
Clay loam having illite clay minerals	21.45