Cation Ratios and Soil Testing Methods for Sand-based Golf Course Greens

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Objectives:

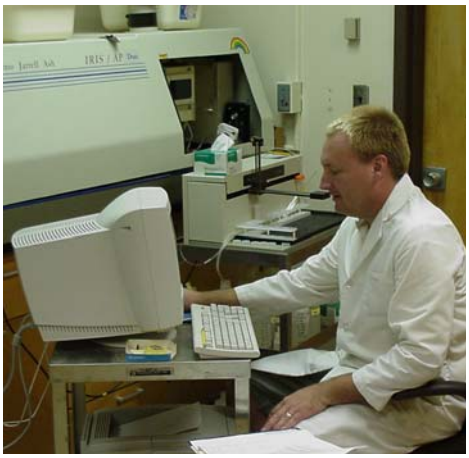
1. To evaluate and correlate several existing soil extraction methods with tissue analysis.
2. To modify, if necessary, existing extraction methods to better suit turfgrass soil types.
3. To better understand how the Basic Cation Saturation Ratio (BCSR) theory applies to turfgrass sytems.
4. Improve current soil testing recommendations for fertilization of turfgrass.

Start Date: 2003
Project Duration: three years
Total Funding: $74,895

While research has been done applying the Basic Cation Saturation Ratio (BCSR) theory to agronomic crops, little research has been done applying the BCSR method to sandy, low-CEC media, and even less research has been done applying this theory to turfgrass growth. With a large majority of commercial soil testing facilities using the BCSR concepts for fertilizer recommendations, more work needs to be done to determine its effectiveness on sand-based systems.

This research project, which began this summer, encompasses two main parts, 1) to better understand basic cation saturation ratios and how they apply to creeping bentgrass, and 2) to determine the best soil testing techniques to be used for sand-based greens.

We are still in the initial information gathering stages of this project. Furthermore, we are reviewing the literature and talking to other soil scientists and chemists to sort out the details of the different soil testing techniques that are available. We are also looking at different methods and procedures others have used to vary the basic cation ratios of different crops established on many different soil types.



Mehlich III extractant and an ICAP were used to measure exchangeable cations.

We have established 100 eight-inch pots of 'Penncross' creeping bentgrass grown either on calcareous or silica sand. We will be establishing different ratios of calcium (Ca), magnesium (Mg), and potassium (K) within the soil and measuring turf response and quality, as well as tissue nutrient concentrations.

We have also done some preliminary cation ratio studies. We mixed varying amounts of either calcareous or silica sand and peat with nutrient solutions containing varying Ca:Mg ratios. The soil was then placed in Ziploc bags and incubated at room temperature for 20 days. We used a Mehlich III extractant and an ICAP to measure exchangeable cations. The measured exchangeable cations of the silica sand relatively matched that of the applied nutrient solution. However, the exchangeable cations measured in the extracts from the calcareous sand did not follow the same trend. The solutions extracted from the calcareous sand had a much greater proportion of Ca than Mg despite the applied fertilizer solution. This could be due to the great abundance of Ca in the soil solution from the $CaCO_3$ particles within the calcareous sand, and due to some dissolution of the $CaCO_3$ particles by the Mehlich III extraction procedures.

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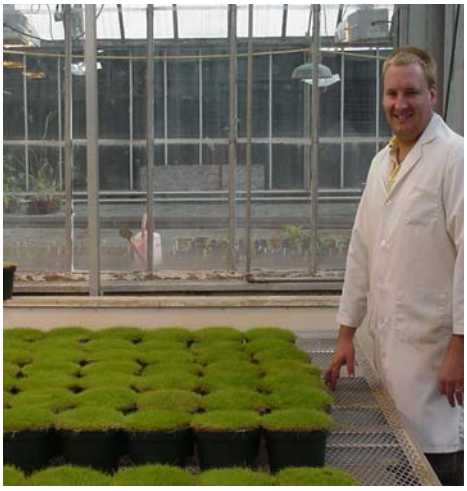

One-hundred eight-inch pots of 'Penncross' were established on calcareous or silica sand.

We are also interviewing different soil testing firms to learn about their methods and techniques. In May, Harris Laboratories in Lincoln, NE, was visited as well as Brookside Laboratories.

With the outdoor field season winding down, we are quickly gearing up our laboratory to begin processing many soil samples using different extraction techniques and running several greenhouse experiments to try to modify the exchangeable cation ratios of different sands.

Summary Points

- Current soil test methods may not be appropriate for sand-based systems.
- More work is needed on the Basic Cation Exchange Ratio (BCSR) soil test method for turfgrass areas.
- The impact of calcium to magnesium (Ca/Mg) ratios on turfgrass performance needs further study.