# NONACID CATION BIOAVAILABILITY IN SAND ROOTZONES

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Soil nutrient analyses are used as indices of nutrient availability to plant roots. The 1 *M* $NH_4OAc$, Mehlich 3, Morgan, 1:5 $H_2O$, and 0.01 *M* $SrCl_2$ extracting solutions were evaluated for measurement of extractable nonacid cations in a calcareous sand rootzone. The 1:5 $H_2O$ and 0.01 *M* $SrCl_2$ tests adjusted to sample pH during the extraction process, but the 1 *M* $NH_4OAc$, Mehlich 3, and Morgan tests did not adjust to sample pH. When comparing the extraction methods for their ability to detect K-induced changes in extractable Ca or Mg from a calcareous sand, the methods that adjusted to sample pH were sensitive to the changes, but the non-adjusting methods were not. The 0.01 *M* $SrCl_2$ method also predicted cation exchange capacity (CEC). In a selection of 37 sands and 17 soils, CEC was estimated by summation of the nonacid cations extracted by soil nutrient analyses. These CEC estimates were compared to CEC measured by compulsive exchange of $Mg^{2+}$ for $Ba^{2+}$. In sand samples, the 0.01 *M* $SrCl_2$ estimates of CEC were very similar to measured CEC, but the 1 *M* $NH_4OAc$, Mehlich 3, and Morgan estimates of CEC were larger than the measured CEC. The nonacid cations extracted by 0.01 *M* $SrCl_2$ can be used to estimate CEC in calcareous and non-calcareous sands and soils. All extracting solutions were able to detect increased K availability to creeping bentgrass [*Agrostis stolonifera* var. *palustris* (Huds.) Farw.] in field and greenhouse experiments. Cation exchange membranes detected increased K supply rates in field plots to which K fertilizer had been applied. However, leaf K content varied between sampling dates, so although leaf K was related to soil K at individual dates, it was difficult to predict creeping bentgrass K content from soil nutrient analyses of sand rootzones. By

expressing leaf K as the concentration of K in tissue water ($K_w$), variability associated with changes in leaf water content between sampling dates was reduced. Performance of L-93 creeping bentgrass in a calcareous sand classified as low in K was not affected by K fertilizer application or by changes in soil K, Ca, and Mg. These results suggest that current interpretations of nonacid cation soil test sufficiency levels should be re-evaluated for sand rootzones. Under greenhouse conditions, A-1 creeping bentgrass grown in sands with pH ranging from 5.0 to 8.5 had leaf Ca, Mg, and K content within sufficiency levels, even in sands classified as low in Mehlich 3 extractable Ca, Mg, and K. Testing methods that adjust to sample pH were suitable for assessing nonacid cation availability in calcareous and non-calcareous sands. Future research should more clearly identify the relationship between extractable nonacid cations and turfgrass growth.

## BIOGRAPHICAL SKETCH

Micah Woods was born in 1976 at Forest Grove, Oregon. He grew up in Oregon's Willamette Valley and in the Allegheny Mountains of southwestern Pennsylvania. After graduating from Woodrow Wilson High School in Portland in 1993, Micah worked for a year on the maintenance crew at Waverley Country Club, and then he enrolled at Oregon State University to study horticulture. Over the next four years, Micah completed the requirements for his undergraduate degree and worked at golf courses in Arizona, Mississippi, and Georgia. In 1997, he worked on the maintenance crew for the Masters Tournament and on the Greenkeeping Support Team for the Open Championship at Royal Troon. Micah graduated from Oregon State in 1998, and he moved to Shanghai to work at Shanghai Links Golf and Country Club as the assistant superintendent. He worked as the golf course superintendent from November 1998, and remained in that position through August 2000. Micah then moved to Chiba prefecture in Japan, where he worked as an agronomist and golf course superintendent for Environmental Turfgrass Systems until August 2001. At that time, Micah began graduate studies at Cornell University in Ithaca, New York.

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