to N, which was largely obtained from remobilization (**Figure 2**). Plant Zn exhibited a unique mobility characteristic in which stalk tissue served as a major, but temporal Zn source. By R6, nearly 60% of stalk Zn was remobilized, presumably to corn grain. Similar to that of Karlen et al. (1988), leaf B content appeared to drop around VT/R1, indicative of its role in reproductive growth (**Figure 7**).

## Optimization of Nutrient Management

Although nutrient management is a complex process, improving our understanding of uptake timing and rates, partitioning, and remobilization of nutrients by corn plants provides opportunities to optimize fertilizer rates, sources, and application timings. Unlike the other nutrients, P, S, and Zn accumulation were greater during grain-fill than vegetative growth; therefore, season-long supply is critical for balanced crop nutrition. Micronutrients demonstrated more narrow periods of nutrient uptake than macronutrients, especially Zn and B. As a percentage of total uptake, P was removed more than any other nutrient. In a corn-soybean rotation, it is commonplace in Illinois to fertilize for both crops in the corn production year. While farmers fertilize, on average, 93 lbs $P_2O_5$ for corn production (Fertilizer and Chemical Usage, 2011), the 80% of soybean fields receiving no applied P would have only 13 lbs $P_2O_5$ remaining (Fertilizer, Chemical Usage, and Biotechnology Varieties, 2010). These data suggest a looming soil fertility crisis if adequate adjustments are not made in usage rates as productivity increases. This plant nutrition knowledge is critical in understanding our current nutrient management challenges.

## Summary

As a result of improved agronomic, breeding, and biotechnological advancements during the last 50 years, yields have reached levels never before achieved. However, greater yields have been accompanied by a significant drop in soil macronutrient and micronutrient levels. The latest summary on soil test levels in North America by IPNI reported that an increasing percentage of U.S. and Canadian soils have dropped to levels near or below critical P, K, S, and Zn thresholds during the last 5 years (Fixen et al., 2010). Soils with decreasing fertility levels coupled with higher yielding hybrids suggest that producers have not sufficiently matched nutrient uptake and removal with accurate maintenance fertilizer applications. Integration of new and updated findings in key crops, including corn, will better allow us to achieve the fundamental goal of nutrient management: match plant nutritional needs with the right source and right rate at the right time and right place. BC


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*Mr. Ross Bender is a Graduate Research Assistant, University of Illinois at Urbana-Champaign, located in Urbana, Illinois; e-mail: bender14@illinois.edu. Dr. Haegele is a Post-Doctoral Research Associate, University of Illinois at Urbana-Champaign, located in Urbana, Illinois; e-mail: haegele1@illinois.edu. Dr. Ruffo is the Worldwide Agronomy Manager, The Mosaic Company, located at Buenos Aires, Argentina; e-mail: matias.ruffo@mosaicco.com. Dr. Below is a Professor of Crop Sciences, University of Illinois at Urbana-Champaign, located in Urbana, Illinois; e-mail: fbelow@illinois.edu.*


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