

PLANT NUTRITION TODAY

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BALANCED NUTRITION FOR SUSTAINABLE CROP PRODUCTION

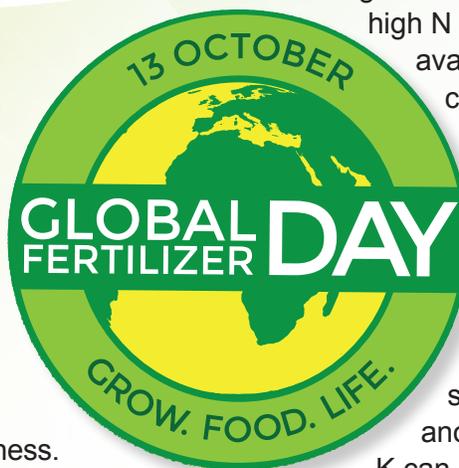
If you had to make a change in your farm's nutrient management to reduce annual fertilizer cost, would you skip the application of nitrogen (N), phosphorus (P), or potassium (K)? Which nutrient is more important to minimize the yield impact? This is a question that I have been hearing in recent nutrient management discussions.

What if you were asked to remove one nutrient from your diet? Would it be N, P, or K? If you choose K you will have more muscle aches and stiffness. Leaving out N may cause your hair to fall out, loss of muscle, or skin irritation. A P deficiency may cause bone softening and respiratory failure. Not an easy decision, but the concept is similar to the nutrient deficiencies observed in crops—an inadequate supply of one could impact overall crop health.

Nutrient interactions within the soil rhizosphere—the zone of interaction between plant roots and nutrient uptake—and the response of the plant roots to adapt to the environment can be very complex. The soil's fertility is critical to the efficiency of these processes; therefore, one nutrient should not be singled out as more important than another.

Can too much of a good thing be bad? Yes! Some nutrients in excess can result in an antagonistic relationship with another nutrient, interfering with its uptake and availability, and reducing use efficiency. For example, high N levels can reduce the availability of boron (B), copper (Cu), and K. High soil P can interfere with the uptake of iron (Fe), calcium (Ca), Cu, and zinc (Zn). Conversely, as a particular nutrient concentration increases, it may stimulate the need for another nutrient. Too much K can reduce the availability of magnesium (Mg), but stimulate the need for Fe and manganese (Mn). As P concentrations increase, the need for Mg increases—this positive relationship with P occurs when Mg concentrations increase as well!

A long-term field experiment conducted in Northern China captured the value of balanced nutrition for long-term productivity. In the absence of N or P fertilizer, wheat and corn yields in a double-cropped system, were significantly lower than those produced with N, P, and K. Long-term omission of K fertilizer decreased corn yields by 26%. For both crops the largest yield gap occurred when P was omitted. During the corn-growing season, long-

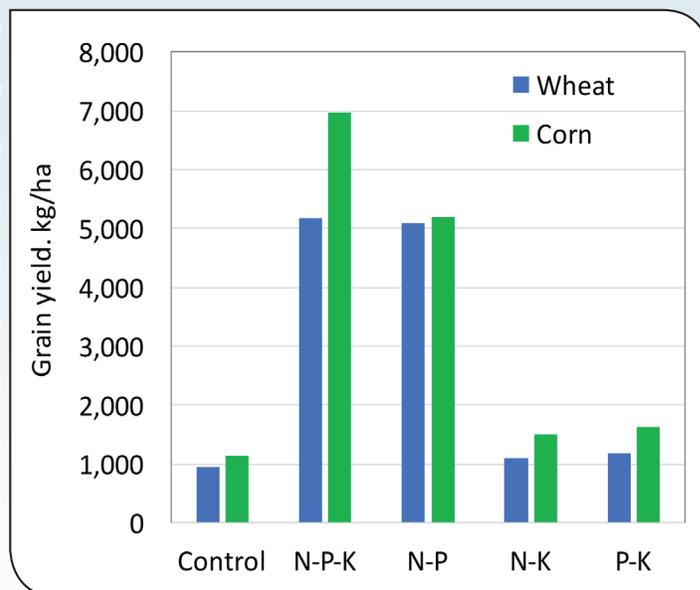


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term P omission also resulted in a deficit of both soil available N and extractable P. If it is an initial cost savings that is driving the decision to omit a nutrient application, there are management options that a producer can consider when looking to reduce the overall nutrient input expense while maintaining balanced nutrition. For example, adopting 4R Nutrient Stewardship practices can let you reduce application rates by focusing on using the right nutrient source, at the right time, and in the right place. Applying the right rate requires that all nutrient sources are properly credited to adequately reflect the crop needs. Applying nutrients based on crop-uptake patterns can improve management for maximum productivity and recovery. For improved efficiency the nutrients must be applied so that they can be extracted and utilized by the crop roots. If the timing and placement reduce substantial losses, then rates too might be reduced without a yield impact.



A 17-year fertilizer study with wheat and corn found that highest yields were sustained in the N-P-K treatment (Dai et al., 2013).



The 13th of October has been designated as Global Fertilizer Day.

It is a day set aside to highlight the range of contributions from fertilizers. As the above study from China shows, balanced fertilization is a fundamental practice that will be necessary to sustainably fulfill the increasing global demand for food, feed, and fiber. Living in a society where our resources are abundant, it can be hard to fathom a day without an adequate food supply. As the world’s population is projected to reach over 9 billion people by 2050, balanced crop

nutrition will be a critical piece to overcoming yield gaps and meeting global needs. A balanced supply of essential nutrients is one of the most important factors affecting crop yield. As a first step at the local level, soil sampling is one strategy to help maintain a balanced supply of nutrients for improved plant growth, increased yields, and reduced losses—creating an overall more efficient cropping system.

References

Dai, X. et al. 2013. PLoS ONE 8(12): e82147. doi:10.1371/journal.pone.0082147

