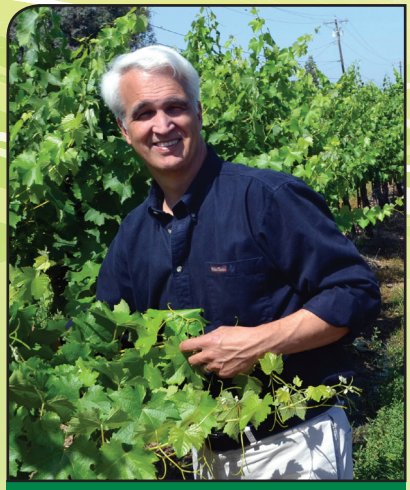
PLANT NUTRITION TODAY

2017 ISSUE 3, NO. 2



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AVOID GROWING PAINS FOR YOUR CROP

Preteen children sometimes wake up at night complaining of sore legs and an uncomfortable ache that is slow to go away. These growing pains will be different for every child, ranging from no pain to a lot of discomfort.

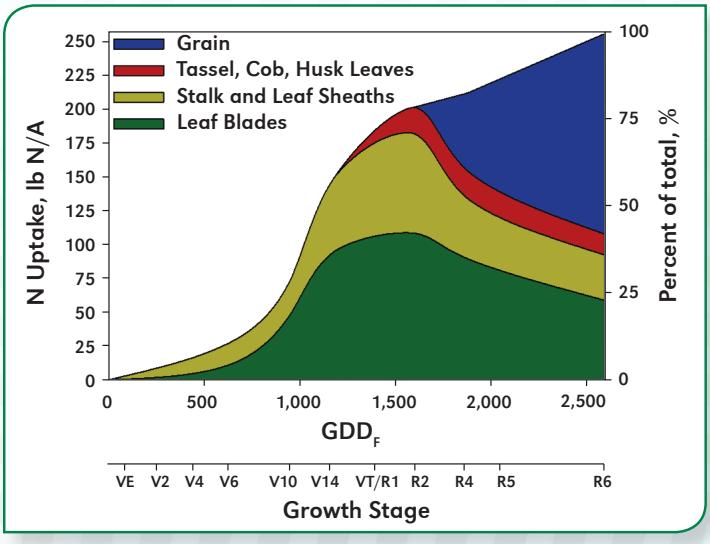
While you won't hear crops complain during their growth spurts, they still need the right supply of nutrients to match their demands for growth and development. Most grain or fruiting crops have distinct peak periods of nutrient uptake that correspond to their growth pattern. Crops such as grasses and forage have a more consistent pattern of nutrient uptake through the growing season.

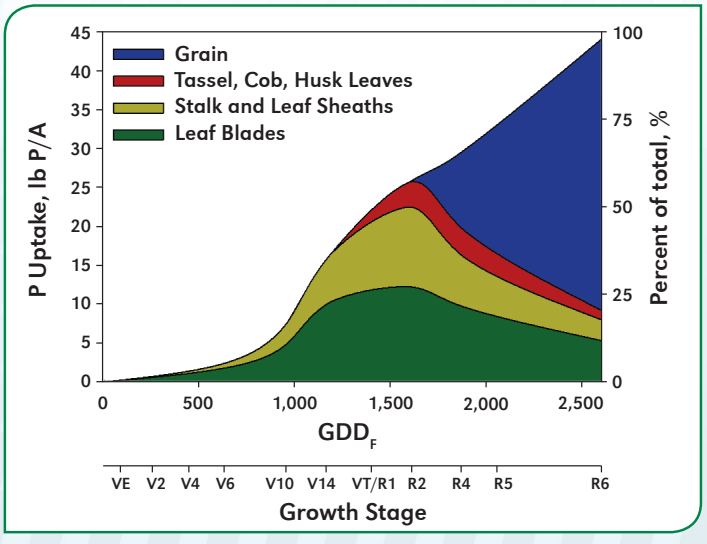
One of the fundamental principles of 4R Nutrient Stewardship is making certain that the proper nutrients are in the root zone at the time plants need them. This "Right Time" approach needs to be adjusted for different nutrients and individual crops.

In general, it is best to apply nutrients as close to the time of uptake as practical. Nutrients such as P, K, Ca, and Mg are slow to move in the soil and can be applied several months ahead of when the plants will need them. For nutrients that readily move in the soil (such as nitrate and sulfate), it is best to apply them as close to the time for uptake as possible. This reduces the potential for nutrient loss from leaching or denitrification.

When the nutrient supply in the soil cannot match the plant's demand, crop growth slows and a portion of the final yield is lost each day. Nutrient shortages often cause plant stress and yield loss far earlier than when deficiency symptoms become visible, a deficit known as "hidden hunger."

It is important to understand when the peak demand periods occur for the specific crops you work with. This allows the "Right Time" component of the 4R's to support crop yields to their full potential. A few examples of various crops are shown





Accumulation patterns of N and P in various maize plant parts during the growing season (Better Crops, 2013).

PLANT NUTRITION TODAY is a quarterly publication of compiled scientific information developed by the International Plant Nutrition Institute (IPNI).
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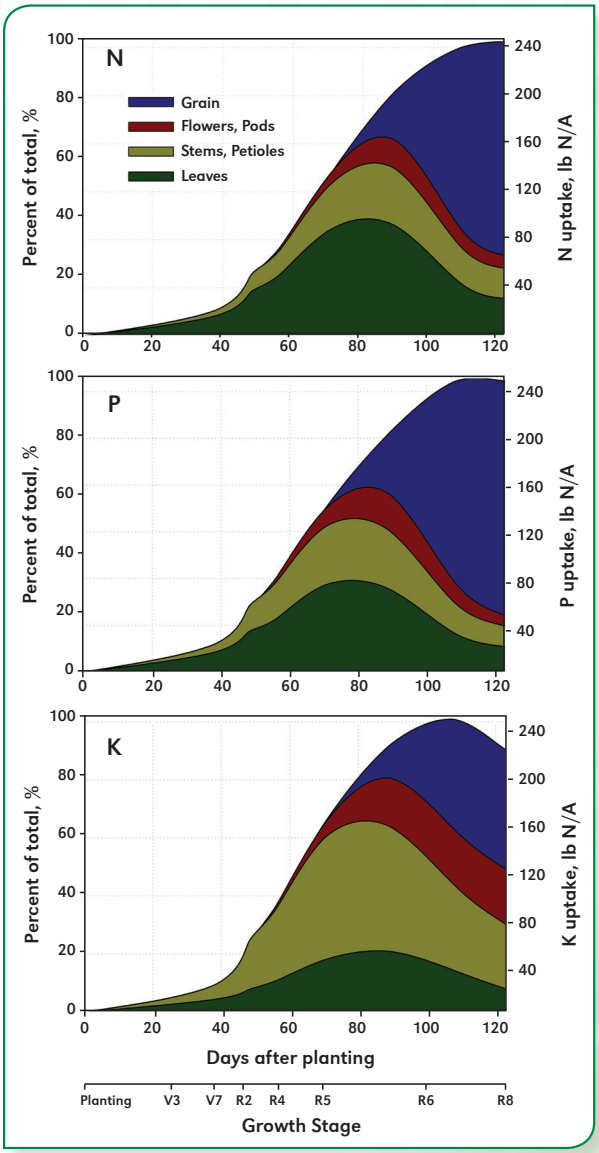
here to highlight some of the differences in total seasonal accumulation or daily nutrient uptake rate.

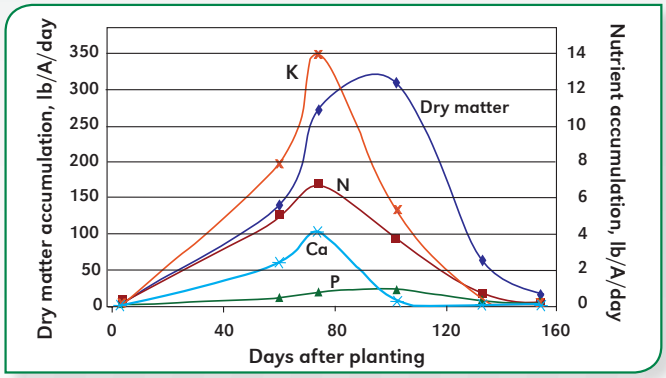
Maize: Nitrogen and K uptake follow a traditional S-shaped pattern during the growing season, with two-thirds of the total nutrient requirement acquired by the silking stage (VT/R1). However more than half of the total P uptake occurs after the VT/R1 stage, indicating the need for a continual supply of P from the soil throughout the season until crop maturity.

Soybean: For most of the crop nutrients, uptake continues during the entire growing season. The exception is K, where nearly 75% of the total K is taken up before the late vegetative and early reproductive growth stage. The season-long accumulation of most nutrients is a reminder of the importance of maintaining an adequate nutrient supply all the way to maturity.



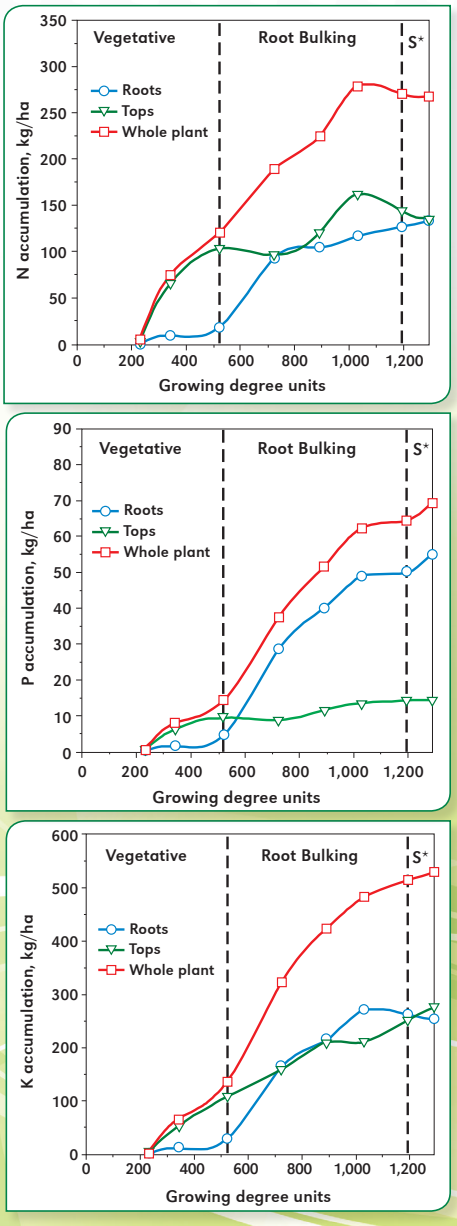
Accumulation patterns of N, P, and K in various soybean plant parts during the growing season (Better Crops, 2013).

Potatoes: Approximately two-thirds of the total N is accumulated in the first few months following planting. The rate of plant P uptake generally peaks during the middle of the growing season, with a daily demand of between 0.4 and 0.9 lb P/A/day depending on the variety and location. Potassium uptake reached a peak of 14 lb K/A/day during the midseason of this study from Oregon.



Daily nutrient accumulation rates during the potato growing season in Hermiston, Oregon (Better Crops, 2008).

Sugar beets: High-yielding sugar beets produce very large amount of biomass. During the growing season, the total nutrient accumulation in Idaho was approximately 240 lb N/A, 60 lb P/A, and 470 lb K/A. In addition to large amount of nutrients taken up, there were distinct peak periods where the daily N accumulation exceeded 4 lb N/A and the daily K accumulation reached 10 lb K/A.



Accumulation patterns of N, P, and K in various sugar beet plant parts during the growing season (Mriganka and Moore, 2017. Agron. J. In press).

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