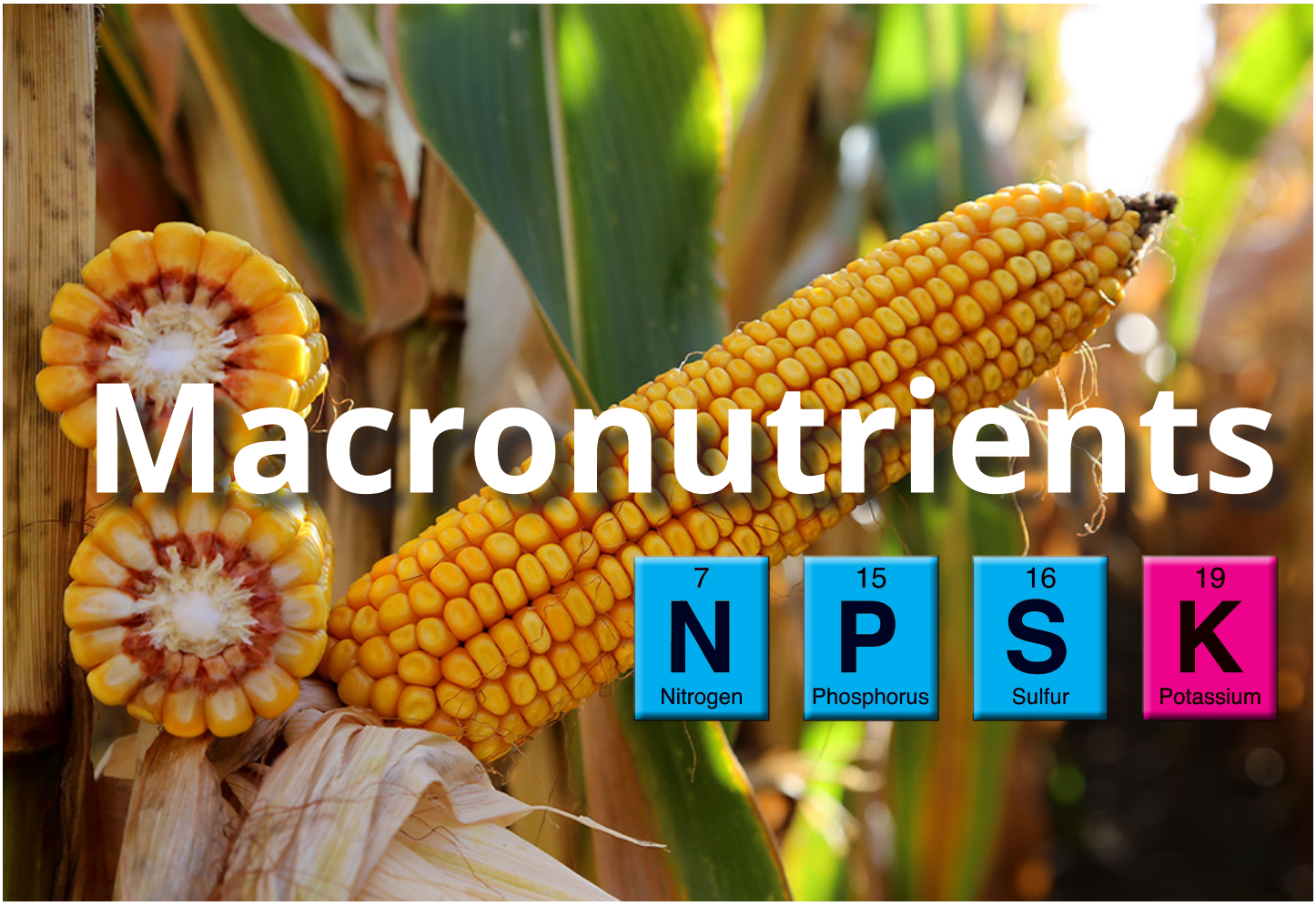

"Quantity and timing are crucial when it comes to nutrient management."

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Feeding today's high-yielding hybrids

Today's high yielding hybrids and increasing population densities have researchers once again looking at the quantity and timing of nutrient uptake throughout the growing season.

Each macro and micronutrient has a unique role and individual characteristics within the growing plant. Having the right rate at the right time can definitely influence the performance of high yielding hybrids.

Researchers from Purdue University and University of Illinois are focusing on this topic to determine if new fertility guidelines are required.

The results of these studies have exemplified the need for greater fertility to maximize yields. Their findings provide an interesting insight as to when, where and how nutrients are taken up and ultimately partitioned.

Table 1. Macronutrient uptake of high yielding hybrids (230 bushel avg). Table was reproduced from Bender et al. 2013 Agron Journal Vol 105:1 161-170

Nutrient	Total Nutrient Uptake	Removed with Grain	Harvest Index, %	Nutrient Removal coeffecient, lb/bu
N	256	148	58	0.64
P_2O_5	101	80	79	0.35
K_2O	180	59	33	0.26
S	23	13	57	0.06

* Harvest index represent the percent removed with the grain as compared to the total quantity taken up.

Macronutrients

For the interest of this paper we will look at Nitrogen (N), Phosphorus (P), Potassium (K) and Sulfur (S) as macronutrients. Most producers and agronomists are well aware of their importance and fertilize accordingly (Table 1).

Nitrogen has the greatest uptake of all the macronutrients. Bender et al. 2013, found that a 230 bushel corn crop requires 256 lb/ac with 58% (148 lb/ac) of this being removed with the grain. A majority of this nitrogen (70-75%) is acquired during the vegetative to early reproductive (R2) stages (Figure 1).

Timing of nitrogen can be very problematic or risky as it is highly influenced by the environment. The greatest rate of nitrogen uptake occurs during the V10-VT growth stages. Nitrogen application and composition are very important at this crucial stage of growth.

The use of slow release forms of nitrogen (ie. ESN) or side dressing/top dressing can alleviate losses associated with springtime leaching or denitrification.

Timing nitrogen applications to the demand of the plant significantly increases nutrient use efficiency, economic return and reduces the environmental impacts associated with nitrogen losses.

Phosphorus uptake is almost linear with approximately 45% taken up by the R1 growth stage (Bender et al. 2013 and Ciampitti et al. 2013). A very large portion of phosphorus is partitioned/remobilized to the grain (Table 1 and Figure 1).

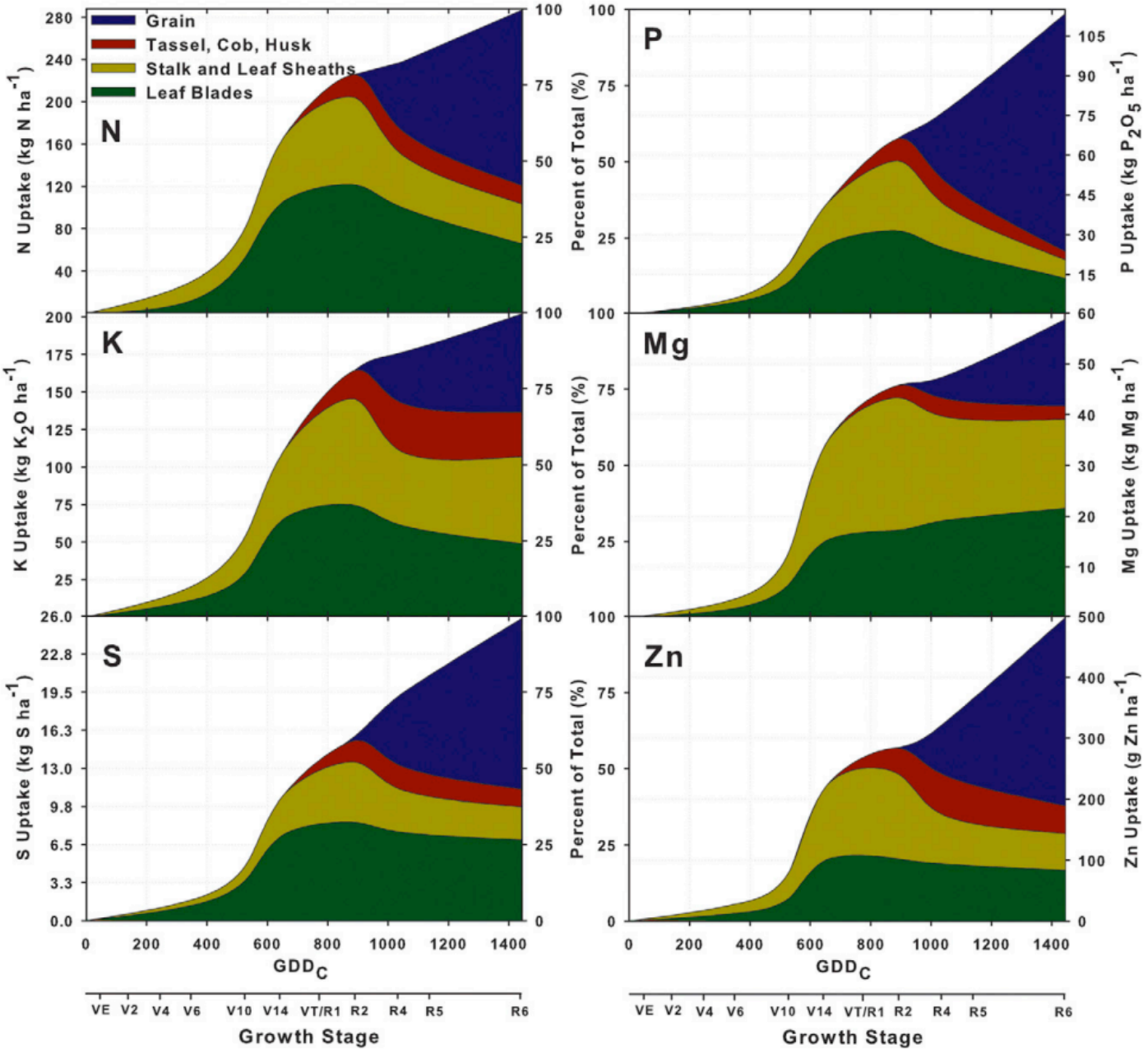
It was found that approximately 79% of the phosphorus taken up by the plant is removed at grain harvest. The linear relationship of phosphorus indicates that it is required through most of the growing season.

It is very important to provide a phosphorus source early in the growing season as either a 2x2 band or in-furrow liquid application. Re-

search has proven numerous times the importance of phosphorus for early vigor, particularly with early planting in cool soil.

As an aside, Dr. Fred Below has emphasized the importance of accounting for the high removal rates of phosphorus by corn on the next crop. It is important to remember that for every bushel of corn you are removing, approximately 0.35 lb/bus of phosphorus (Table 1). Depending on the fertility program one must budget accordingly to ensure sufficient phosphorus will be available to meet the demand of the following soybean crop.

Figure 1



Potassium and nitrogen uptake follow a very similar pattern with a majority (75%) acquired by R2 (Bender et al. 2013 and Ciampitti et al. 2013). Unlike nitrogen, only 33% of the total potassium taken up is partitioned to the grain. If the entire plant is harvested either as silage or grain/stover one must remember how much

potassium is present in the stover component.

The same 230 bushel crop that was referred to earlier, would remove 180 lbs of K compared to only 59 lbs with the grain. This would have a major influence on the subsequent crops. Work by Greg Stewart of OMAFRA has demonstrated that soil K is very important for corn production.

He recommends that if your soil test is below 90 ppm, the addition of K is essential. His latest fertility research exemplifies the importance of having sufficient K to meet the demand of the growing corn crop.

If levels are too low it will become a major limiting factor regardless of the other nutrients applied (Greg Stewart, 2014).

Sulfur, in recent years, has garnished a new appreciation among growers and consultants. Sulfur depositions in the air have been reduced with new environmental guidelines for the manufacturing emissions.

This lack of sulfur, coupled with the increases in crop yields has resulted in noticeable sulfur deficiency. Sulfur uptake, like phosphorus, is a linear relationship and similar to phosphorus only 48% is acquired prior to R2 (Figure 1).

Total sulfur requirements are much lower than the three aforementioned nutrients (Table 1).

Referring to the same 230 bushel crop, 23 lbs of sulfur was required with 57% (13 lbs) being removed by the grain.

There are numerous forms of sulfur available and most are formulated with another macronutrient. It can either be broadcasted or banded with 2x2 starter in order to provide sufficient fertility.

The importance of these findings will be crucial as we move forward with precision agriculture. Increased interest in variable rate seeding will necessitate proper fertility (variable rate fertility) to match the varying population densities.

As management zones are estiblished, proper soil testing will be necessary to accurately produce the proper prescriptions. Look for my next Field Talk - Removal rates and uptake of micronutrients in high yielding environments.

References:

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