Mosaic®
AgriSight®
TRUSTED CROP NUTRITION EXPERTISE℠
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Looking Beyond the Big Three in Soybeans

Research Provides Needed Soybean Nutritional Information

The objective of a recently published study conducted by University of Illinois plant physiologist Dr. Fred Below and recent doctoral graduates Dr. Ross Bender and Dr. Jason Haegele was to identify which secondary macronutrients and micronutrients demand attention in a new era of soybean production. Genetic and agronomic advancements have helped soybeans achieve record yields, with record nutrient requirements and removal (Table 1). The research team cites significant gaps in the understanding of secondary macronutrients and micronutrients at current soybean yield levels. Findings from this study were used to help address common misconceptions regarding nutrient management for maximum soybean profit.

Misconception 1:
I applied sulfur to my corn last year; I'll be fine.
While it is true that soybeans are frequently grown in rotation with corn, residual effects of sulfur (S) are often diminished due to its activity in the soil. Like nitrate (NO_3^-), sulfur exists as the negatively charged anion sulfate (SO_4^{2-}), and is prone to leaching in soils with low cation exchange capacities or environments with high rainfall. Data published from the University of Illinois highlight the need for season-long S availability in soybeans (Fig. 1). In fact, the greatest demand for S occurs in the weeks around seed filling, with uptake rates over 0.25 lb S/ac/day.

What does this mean for producers?
If sulfur is needed in your soybean crop, identify nutrient sources that ensure season-long availability. Mosaic's MicroEssentials® SZ™ contains two forms of sulfur: 1) sulfate, designed to maximize early-season vegetative growth, and 2) elemental sulfur, which continues to oxidize and become plant-available during seed filling.

Misconception 2:
I've heard boron can be toxic; I'm staying away.
While the range between deficiency and toxicity can be narrow, boron (B) use at recommended rates leads to healthy plant development and function. Inadequate B fertility can interfere with proper flower initiation and pollen development. New research from the University of Illinois shows that the proportion of total B needed to carry out reproductive development is greater than almost any other nutrient. Moreover, this research discovered that B did not translocate from leaf tissues to other plant organs (Fig. 2). In simple terms, foliar B may not be considered an ideal nutrient source for soybeans because of its inability to translocate to developing grain.

What does this mean for producers?
Farmers with fields necessitating B should consider sources that encourage uptake through root tissues. To help meet plant B needs, Mosaic developed Aspire,® which provides B and K in every granule. Consider using Aspire in your operation to experience more uniform nutrient distribution, root assimilation of boron, and improved soybean profit.

Misconception 3:
Zinc was never used on our farm, so why start now?
New research from the University of Illinois highlights the need for zinc (Zn) in developing soybean seeds. A plant-essential complex known as phytin is formed when zinc binds with phosphorus in the grain, leading to increased Zn demand during seed filling. In fact, nearly 40 percent of total Zn accumulation occurs during a three-week period from R5 to R6 (Fig. 3). This naturally leads to elevated Zn concentrations in soybean seeds, and therefore, the potential for rapid Zn removal.

What does this mean for producers?
To ensure adequate Zn during seed filling, consider nutrient sources that provide uniform nutrient

Improvements in nutrient management are necessary to maximize efficiency and return on fertilizer investments.

distribution. Developed using the patented Fusion® technology, Mosaic's MicroEssentials SZ contains nitrogen, phosphorus, sulfur and zinc in each granule. Extensive research suggests a threefold increase in Zn efficiency relative to conventional zinc sulfate applications.

Misconception 4:
Magnesium is not important for soybean development.

Magnesium (Mg) can be naturally abundant in many soils or in areas receiving dolomitic limestone, which contains magnesium and calcium carbonates. Magnesium is essential for plant photosynthesis and in activating hundreds of plant enzymes. University of Illinois research documented the need for early-season Mg availability to support adequate stem development and leaf photosynthesis. (Fig. 4.) Nearly 65 percent of total Mg uptake occurs in the final six to eight weeks of the soybean growing season, which may increase the need for Mg applications in certain environments.

What does this mean for producers?

Farmers pursuing high-yielding soybeans, or having soils with a low cation exchange capacity, low exchangeable Mg levels or with no recent Mg applications, may need supplemental Mg. K-Mag® is a premium magnesium, sulfur and potassium nutrient source with an analysis of 0-0-21.5–10.5 Mg-21 S.

Tips for Fine-tuning Your Soybean Fertility Program

University of Illinois results emphasize that nutrients are not accumulated at the same rate, at the same time, or used in the same way — specific nutrients require individualized management. The demand for season-long macro- and micronutrient availability is greater today than ever before, and new fertilizer technologies exist to deliver those needs. Rethink the aforementioned misconceptions as strategies to maximize profit for your business.

Table 1.
Secondary macronutrient (lbs/ac) and micronutrient (oz/ac) uptake and removal for a soybean crop yielding 60 bu/ac. Data were adapted from Bender, et al. (2015)[1] and are reported on a dry-weight basis.

Nutrient	Maximum Uptake	Removal with Grain	Harvest Index	Nutrient Removal Coefficient*
	lbs or oz/ac		%	lbs or oz/bu
Sulfur, lbs (Fig 1.)	17	10	59	0.17
Magnesium, lbs (Fig. 4)	45	8	18	0.13
Boron, oz (Fig. 2)	4.64	1.58	34	0.026
Zinc, oz (Fig. 3)	4.78	2.00	42	0.033

*Multiple grain yield by nutrient removal coefficient for estimate of nutrient removal.

Uptake and partitioning for soybeans yielding 60 bu/ac.

Fig. 1. Sulfur (S)

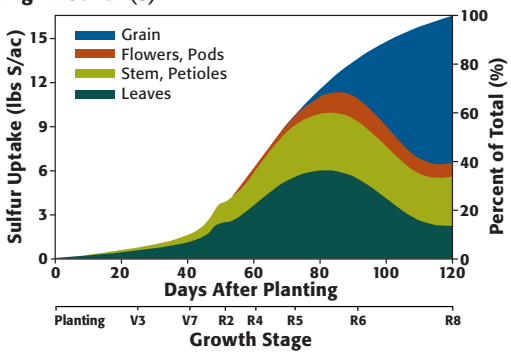


Fig. 2. Boron (B)

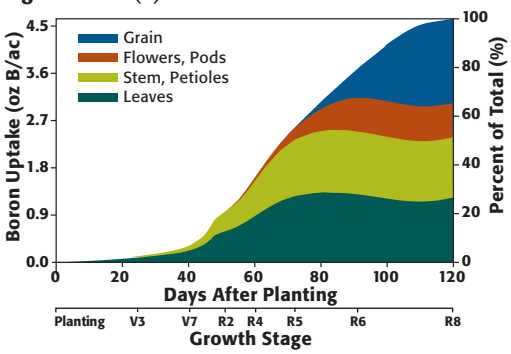


Fig. 3. Zinc (Zn)

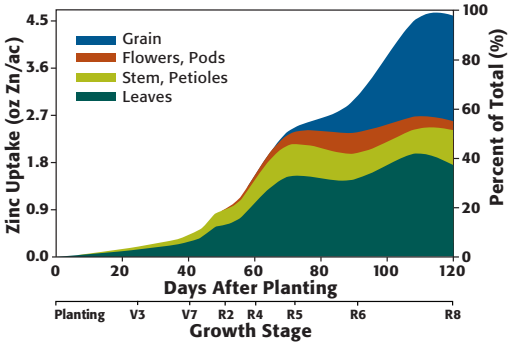
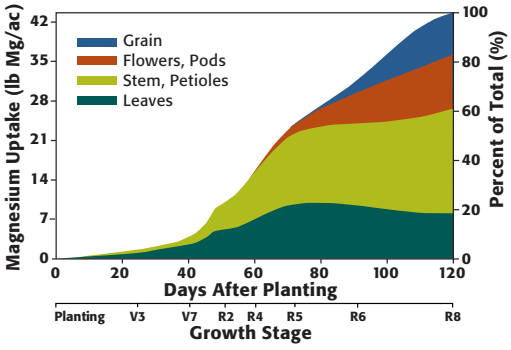


Fig. 4. Magnesium (Mg)



>FACT

Nearly 40 percent of total Zn accumulation occurs during a three-week period from R5 to R6.

[1]Bender, R.R., J.W. Haegele and F.E. Below. Modern soybean varieties' nutrient uptake patterns. ***Better Crops with Plant Food*** 2015;99(2):7–10.

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