Sulf-N® Ammonium Sulfate

ADVANCING SOYBEAN YIELDS

AdvanSix

Maximize Profit Opportunities in Soybeans

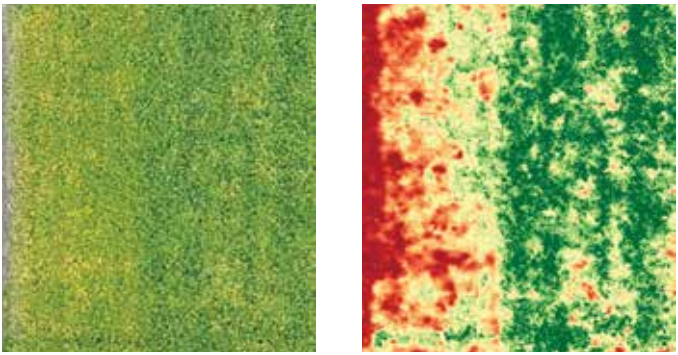
Soybeans are more than just a crop to rotate with corn. Well-managed, high-yielding varieties also provide opportunities to increase your profits. To achieve the full genetic potential of these varieties, good fertility is critical.

Sulfur is particularly important for legumes, given its role in nodulation and the symbiotic relationship between nodules and nitrogen-fixing bacteria. Sulf-N® ammonium sulfate is an excellent fertilizer for providing readily available sulfur as well as nitrogen to boost plant growth while nodulation establishes.

Recent studies at Purdue University showed sulfur responses of up to 13 bushels per acre (bu/A) with the application of Sulf-N® fertilizer versus a nitrogen-only fertilizer application. See the following images for side-by-side comparisons.

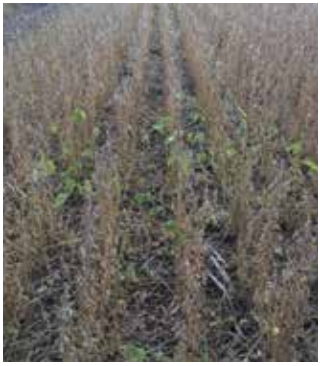
Soybeans with no sulfur fertilization (left), and with 20 pounds of sulfur per acre (lb S/acre) using Sulf-N® fertilizer (right). Note the differences in size, color and canopy closure.

Source: Casteel, Purdue University, July 2016



Aerial photo and corresponding Normalized Difference Vegetation Index (NDVI) map of the soybean plots with no sulfur fertilization (left), versus receiving 20 lb S/acre as Sulf-N® fertilizer (right), confirming 2016 observations.

Source: Casteel, Purdue University, September 2017



Soybeans with no sulfur fertilization (left), and with 20 lb S/acre using Sulf-N® fertilizer (right). Note the differences in weed intrusion, pod retention and branching.

Source: Casteel, Purdue University, 2017

Soybean plants with no sulfur fertilization showing 31 pods, 17 nodes and 1 branch (left), and with 20 lb S/acre using Sulf-N® fertilizer showing 45 pods, 18 nodes and 2 branches (right).

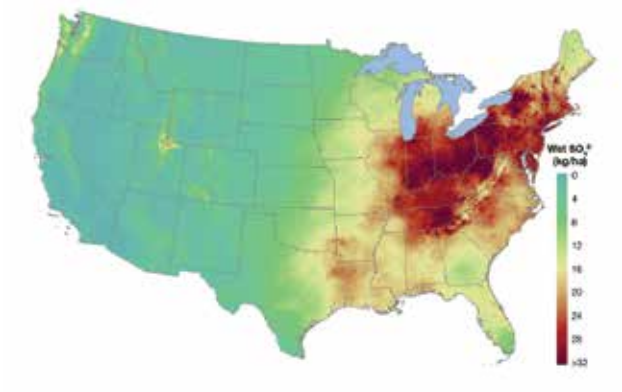
Source: Casteel, Purdue University, 2017

Less Atmospheric Sulfur Drives Need for Sulfur Fertilization

Environmental regulations have significantly reduced the amount of "free" sulfur available in the soil from industrial emissions. Atmospheric sulfur deposits were close to two pounds per acre in 2017, down from more than 18 pounds per acre in 1989 (see deposition maps). This deficiency is a major reason why more sites and soil types are reporting soybean responses to sulfur fertilization.

Sulfate Ion Wet Depositions, 1989 versus 2017

1989



2017

Source: United States Environmental Protection Agency

Higher-Yielding Varieties Need More Sulfur

Higher-yielding soybean varieties have greater nutritional needs. This, combined with decreases in atmospheric sulfur, make it even more essential to be deliberate about providing enough sulfur so it does not become a yield-limiting factor. The table below shows major nutrient requirements for different soybean yield levels.

Soybean Nutrient Requirements

Grain	Lb/bu*	50 Bu	75 Bu	100 Bu
N	3.30	165	248	330
P_2O_5	0.73	37	55	73
K_2O	1.20	60	90	120
S	0.18	9	14	18
Total S	**0.35**	**18**	**26**	**35**

Source: International Plant Nutrition Institute, 2014
**Pounds per bushel*

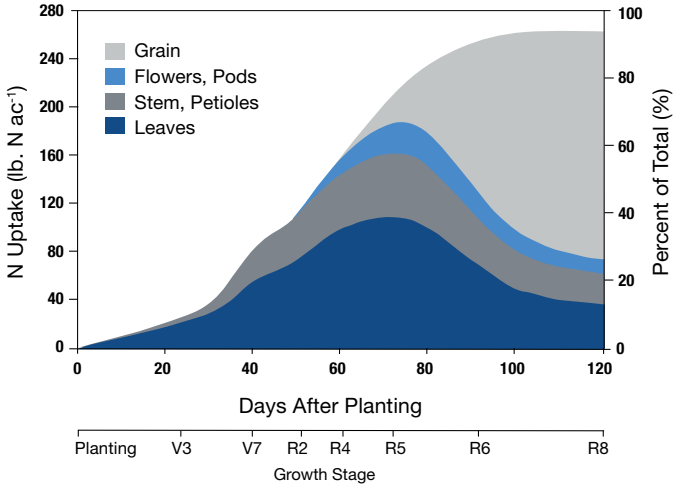
Modern Varieties Take Up More Sulfur and Nitrogen

Traditional soybean fertilizer recommendations were based on research conducted over 50 years ago. Recent work shows that modern soybean varieties take up more sulfur and nitrogen than traditional varieties, with higher nutrient concentrations in the leaves and higher total biomass produced.

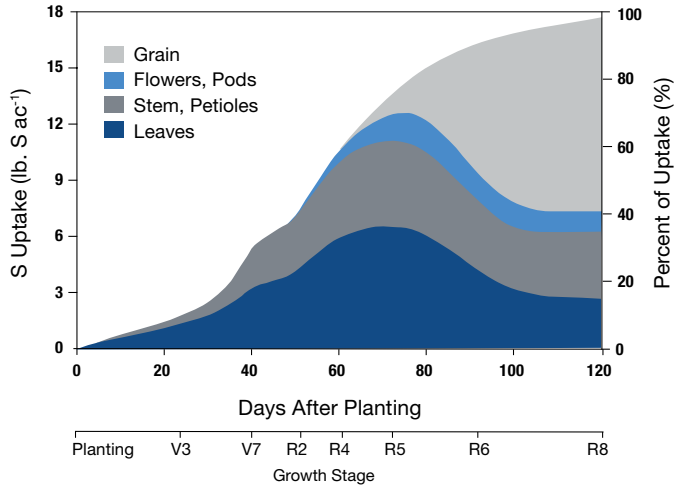
Data from the University of Illinois show that the post-flowering uptake of nitrogen and sulfur – two essential protein-building blocks – is crucial for seed-filling in modern varieties. About one-half of the total uptake of each of these nutrients takes place after flowering, when no new nodules are formed.

For this reason, a second application of these nutrients around flowering can be beneficial when the crop shows the potential for yields above 70 bushels per acre. As a non-volatile fertilizer, Sulf-N® ammonium sulfate is an excellent choice for top-dressing nitrogen and sulfur. See Partitioning graphs on the next page.

Partitioning* of Nitrogen Uptake by Modern Soybean Varieties



Partitioning* of Sulfur Uptake by Modern Soybean Varieties



**Data averaged across two varieties, two fertility regimes and three site-years during 2012 and 2013 - Agron. J. 107: 563-573 (2015)*

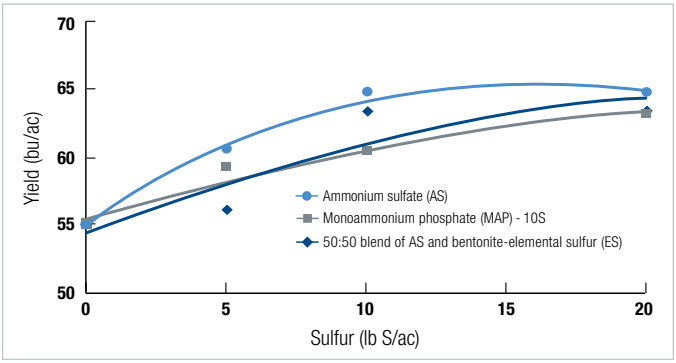
Choose the Right Sulfur Source

Sulfate is the only form of sulfur that is readily available for root uptake. Elemental sulfur (S) is not plant-available until it converts to sulfate, which can take months in natural settings.

In a Purdue University study, the higher nodulation and root development observed with Sulf-N® ammonium sulfate translated into significantly higher nutrient use efficiency than the alternative granular sources containing elemental S. This occurred despite the elemental-S particles being micronized within each granule. This is likely due to a low surface area of localized particles on the soil surface, even after granule disintegration.

With 100% of its sulfur in the sulfate form, Sulf-N® fertilizer was able to reach maximum yields with one-half the sulfur rate than sources containing elemental S. See graph and image below.

Soybean Yield Response to Different Sulfur Sources



Source: Casteel, Purdue University, two-year data (2016-17)

Whole plants from the same study, clearly showing more root development and nodulation with Sulf-N® ammonium sulfate fertilization.

Source: Casteel, Purdue University, 2018

Try a Systems Approach to High Yield Soybeans*

Taking a systems approach to soybean farming can also help increase yields. Below are five key tenets for success.

1. A Firm Foundation

Achieving high yields begins with a deliberate approach to fertilization. Sulf-N® ammonium sulfate is an excellent way to provide readily available sulfur and supplemental nitrogen to help meet those needs.

2. Timely Planting

Soybeans need to be planted early in the season when the soil is warming, as they respond to both heat units and photoperiod. Timely planting ensures the opportunity to accumulate adequate thermal energy for pod and seed development.

3. Stand Establishment

Ensuring plants have a uniform stand with good root development will give soybeans the opportunity to access water late in the season and promote nodule development.

4. Proactive Scouting

Continued monitoring of plants allows for the efficient control of nutritional deficiencies, weeds, pests and diseases.

5. Timely Harvest

Harvesting below 13% moisture will cause yield loss. Don't delay harvesting even if green stems are still on the plants.

**Adapted from the webinar, High-Yielding Soybeans: More Sulfur (and Nitrogen) Acquired or Required? Casteel, Purdue University, 2018.*

PARTNER

Contact AdvanSix

To learn more about the benefits of Sulf-N® Ammonium Sulfate, visit **AdvanSix.com** or **SulfN.com** or call:
1-844-890-8949 (toll free, U.S./Can.)
+1-973-526-1800 (international)

November 2019-4, Printed in U.S.A.

300 Kimball Drive, Suite 101, Parsippany, NJ 07054

AdvanSix