

# Efficacy of Ammonium Sulfate vs. New Granular Sulfur Fertilizers in Crop Production

Sulfur has become a major problem for crop production around the world due to the use of high-analysis nitrogen and phosphorus (NP) fertilizers that contain little or no sulfur (S). To compound that effect, environmental regulations have greatly reduced sulfur emissions into the air from industry. While that has alleviated problems in other aspects of the environment, such as “acid rain,” it has had the effect of reducing sulfur deposited from the atmosphere into the soil. Today’s modern high-yield crops demand more of all nutrients than ever, including sulfur.

In response to demand, several new fertilizers containing micronized elemental sulfur (ES) with or without ammonium sulfate (AS) have been brought into the market. Monoammonium phosphate (MAP), diammonium phosphate (DAP), and triple superphosphate (TSP) products with micronized ES added have been introduced. Additionally, granulated bentonite-ES products have also been marketed.

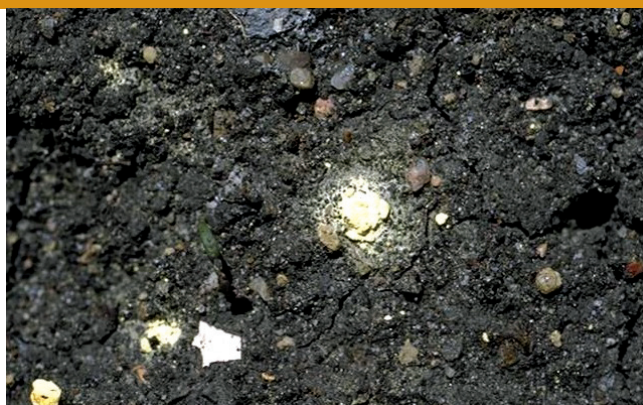
## How Effective Are They?

In the webinar, “Effectiveness of Ammonium Sulfate vs. New Granular Sulfur Fertilizers in Crop Production,” world-renowned crop nutrition expert Dr. S.H. (Norman) Chien examined the efficacy of granular bentonite and phosphate fertilizers containing ES with or without AS.

He explained that the oxidation of ES is dependent on particle size: the smaller the particle, the faster the oxidation rate of the ES. Based on this, several producers are incorporating very fine ES particles into granular phosphate fertilizers or granulating it with bentonite.

“The idea assumes that once the fertilizer granules dissolve, these fine ES particles will rapidly oxidize in the soil,” Chien says. “In an effort to make up for potentially slow ES oxidation early in the season, products containing various ratios of ES to AS have been developed. The assumption is that the S from the oxidized ES particles will become available to plants later in the season. In the case of bentonite-ES products, the assumption is that ES oxidation will provide available S through the season of crop growth to maturity.”

Chien reports that, while numerous field trials on granular S-bentonite and on phosphate S-enriched products have taken place, no results have ever been published in peer-



Disintegrated but clustered ES particles from bentonite-ES show the locality effect. Photo: Courtesy of Norm Flore, Western Cooperative Fertilizer

reviewed scientific journals. Chien conducted a review of the limited available literature, including greenhouse and field trials, and published the results in *Agronomy Journal* in 2016. The following conclusions were reached:

1. In most cases, the granular form of ES may not benefit crops planted within the season of application. A major factor affecting the ES oxidation is the negative locality effect. This means that when the fertilizer granule disintegrates and releases micronized ES particles into the soil, the very fine ES particles still cluster around the granule site, resulting in decreased contact between the particles and the soil, and ultimately, reduced oxidation of the ES into available sulfate-S. ES is also hydrophobic (repelled by water), further increasing the tendency of the ES particles to form large aggregate. Since the effectiveness of these products greatly depends on the rate of ES oxidation, this reduces the availability of ES to the plant.
2. “In addition, the sulfate component in new granular ES products, or any sulfate-S derived from ES oxidation, would be as susceptible to leaching as sulfate-S from straight AS,” Chien says.
3. In general, granular ES fertilizers, whether phosphate or bentonite products, were often found to be much less effective than AS to support crop growth within the season of S product application, despite claims by the producers of these new products.

## Split Application of Granular AS More Effective

“Recent research has shown that top-dress of N and S in late season may further increase crop yield of modern high-yielding corn hybrids and soybean varieties,” Chien says. “High-clearance, high-capacity spreaders have made it possible to top-dress granular AS, straight or in blends, as an effective way to split apply some of the N and S for late-season crop needs.”