

Making Elemental Sulphur Work

ES can be broadcast in the fall, through snow (up to 15cm), in the spring or even after planting. Leave it undisturbed on the soil surface and allow a couple of rainfalls to disperse the fine ES particles found in the bentonitic granules. Leaving the ES spread on the soil increases surface contact, allowing microorganisms in the soil to find the ES faster and easier. This increases the speed of oxidation, converting the ES to SO_4S that is useable by plants. As long as there is enough rain to sustain an average crop, there will be enough rain to convert an adequate amount of SO_4S . With bentonitic ES, you can expect at least 30% conversion to SO_4S in the first year (up to 60% is possible, depending on conditions). Subsequent applications will convert faster after a population of microorganisms have built up, awaiting more ES to convert.

During the first year of use, apply a larger rate of ES and/or use a small amount of AS to help bridge from an AS system to an ES system. If you are worried that ES may not supply enough S initially, use some AS (ATS or other sulphate) with the applied ES. If you're applying some ES every year (recommended for smaller rates), then there shouldn't be any concerns.

The release rate, whether it's 20% or 80% per year, or somewhere in between, is more dependent on the field than the product. Release rates vary by soil temperature, moisture level, physical degradation, residual population of Thiobacillus (one of the many soil organisms that oxidize ES), soil buffering capacity, etc. Alternately, AS may get there sooner in the spring, but may not hang around for the later season, reducing yield and protein synthesis. Coarse textured soils, irrigated soils or high precipitation areas are ideal situations to choose long lasting ES over leachable AS.

Apply large amounts of ES once every three to four years. The greater the variation in product particle size, the larger the application rate should be. Doing so will optimize conversion of the smaller particles of ES, while allowing for sustained release from the larger particles over time. The acid added by agronomic rates of ES application will not increase soil pH by significant amounts. Because the conversion to SO_4S is a biological process of the soil microorganisms, soil acidity is not immediately changed.

If more rapid conversion from ES to SO_4S is required, surface broadcast ES in the fall, winter or very early Spring. Frost and rain will help to disperse the fine particles, while seeding will help to incorporate some of the larger particles, increasing soil contact to a greater degree. Conversion rates in the first year can potentially increase with the increased soil disturbance provided by seeding equipment.



Elston Solberg

Elston grew up on a dairy farm near the Village of Ryley where he was Mayor for 9 years later in life. Elston knew very early in life that he would be a scientist and attended Camrose Lutheran College and the University of Alberta. At Camrose he played hockey with the Camrose Vikings who were crowned National Champions.

Elston has 37+ years of research and extension under his belt. It all started with M. Sc. research at the U of A with his mentor Dr. Marvin Nyborg where worked for 13 years (7 full time, 6 part time) and another 17 years with Alberta Agriculture. In 2002 he left his position as Head of the Field Crop Development Centre in Lacombe, Alberta and started Sun Mountain Inc. He has been affiliated with Agri-Trend ever since in several capacities, now strictly as a Senior Agri-Coach. Recently Elston has been assisting Bio-Cycle in the R&D of Bio-Sul Premium Plus.

Elston is passionate about agriculture and the people within. He has worked closely with a wide range of growers and industry partners over most of his career. Elston is excited about the future of Bio-Sul and believes that the concept is a game changing disrupter technology.



Elemental Sulphur

by Elston Solberg

Many producers are losing 10-40% of their potential canola yields in certain areas of their fields because they do not recognize mild to moderate sulphur (S) deficiency symptoms. If S levels are low enough to reduce canola yields, they are low enough to reduce the yield and quality of other crops in rotation. Further, mistakenly applying more nitrogen (N) will reduce yields more!



Need for Sulphur

Sulphur is an essential mineral nutrient that often ends up overshadowed by nitrogen, phosphorus and potassium. Sulphur is integral to numerous protein enzymes that regulate photosynthesis and nitrogen fixation. Plants can only absorb sulphur in sulphate (SO_4S) form. 70-90% of soil sulphur is present in soil organic matter and must be converted to sulfate by soil bacteria. Warm, moist soils and cultivation increase the conversion rate.

Plant tissues can accumulate S when it is available in excess of needs, but cannot mobilize extra sulphate to younger tissue if there is a shortage of supply. The optimal ratio of N to S in plant tissue is crop dependent, with canola having a tighter ratio than legumes. A plant contains both SO_4S and organic S compounds and analysis of S content will reflect all forms found within the plant.

Crops with large S requirements are often those with the highest protein contents, especially when the proteins contain high levels of cysteine and methionine. Of the crops commonly found in Western Canada, canola requires the largest amounts of S. Many other crops such as oats and malt barley benefit from proper S fertilization as well.

Choosing a Sulphur Source

There are many S fertilizer options on the market, some of which are very different from each other and must be managed in different ways. There are several versions of straight ammonium-sulphate (AS) or elemental sulphur (ES). There are other products that contain gypsum (calcium sulphate) that help to slow the release of sulphur into the soil. Recently, composted ES products have appeared on the Western Canadian market. All of these forms of sulphur vary greatly when it comes to placement, application rate, timing and tillage practices.

Pros & Cons: Two Main Sulphur Sources



SULFATE SULFUR	ELEMENTAL SULFUR
+ Immediate release	+ Sustained release
+ Water soluble	+ Not lost through leaching
+ Quick acting	+ More available at maximum plant growth
+ Leachable	+ Builds a sulphur "bank" in the soil
+ Suitable to correct a visual deficiency	- Slower to break down to plant-available form
- Can be lost in heavy rainfall	- Not suitable to correct a visual deficiency

Why Elemental Sulphur?

ES and gypsum have long been used in environments prone to leaching. One of the advantages of ES is that only the portion of sulphur that has converted to SO_4S can be lost. Any ES remaining is still available to plants once some of it converts to useable sulphate again. Consistently wet conditions, where ammonium sulphate would be lost to leaching or runoff, cause the bacteria that convert ES to useable sulphate go dormant, keeping ES in the ground.

In high soil pH regions, ES can be used in large amounts to drive down soil pH. The amount that is required to affect soil pH is dependent on soil buffering capacity (texture, pH, free lime). Typically it will fall in the range of 200-800lbs/ac every three or four years to amend the whole A-horizon. The P, Ca and micronutrients all become highly available and protected from tie-up in close proximity to a particle of S, allowing the roots of crops to access the nutrients.

In the case of land with high sodium (Na) levels where there are hardpan areas, surface puddling, large soil lumps or surface crusting that seedlings cannot grow through, S will work to convert the immobile Na^{++} into water soluble NaSO_4 . This encourages the Na to move more freely through the soil, moving it away from the surface. This works well in irrigated fields where the irrigation water is bringing in excess Na.



FERTILIZER MANAGEMENT STRATEGIES

1. Adopting an annual maintenance approach to S in a fertility program will increase ES success
2. Applying S during the canola year of a rotation will likely not provide desired results
3. Converting to an ES program requires managing the initial year of slow conversion to SO_4S by:
 - Applying 1.5 to 2 times as much ES as compared to an SO_4S fertilizer in the first or second year of conversion
 - Applying a physical blend of ES and SO_4S fertilizers
 - Applying ES in the fall prior to a growing season or as early in spring as possible
 - Surface applying the ES fertilizer whenever possible to speed conversion to SO_4S
4. In areas prone to S deficiency, apply ES every year, as responses will likely be seen in all crops
5. Save money, maximize production and optimize logistics by surface broadcasting large amounts of ES every three to five years