



Liquid Fertilizer

# THIO-SUL

Sulfur Nutrition | Nitrification Inhibitor  
12 - 0 - 0 - 26S

## Thio-Sul<sup>®</sup> – Ammonium Thiosulfate Solution

Total Nitrogen (N) as Ammoniacal Nitrogen	12%
Total Sulfur (S) derived from Ammonium Thiosulfate	26%
Density: pounds per gallon at 68°F	11.1
Volume: gallons per ton	180
Pounds of nitrogen per gallon at 68°F	1.3
Pounds of sulfur per gallon at 68°F	2.8



# THERE'S NO SUBSTITUTE FOR THE ORIGINAL

## GENERAL INFORMATION

Thio-Sul is the original liquid nitrogen and sulfur plant nutrient solution instrumental in unlocking the full potential of your fertility program. Thio-Sul is a clear liquid containing 12% nitrogen (N) and 26% sulfur (S) and is the most popular S-containing product used in the fluid fertilizer industry. Thio-Sul contains 1.3 pounds of N and 2.8 pounds of S per gallon, and weighs 11.1 pounds per gallon. Thio-Sul is compatible with N solutions and complete (N-P-K) liquid blends that are neutral to slightly acidic. In addition to its wide adaptability for use in clear liquid blends, it is also well suited for use in suspensions. Thio-Sul contains nitrogen in the ammoniacal form and sulfur as thiosulfate.

### Thio-Sul Delivers Results

- Is an excellent source of highly soluble sulfur.
- Blends easily with other liquid fertilizers, including UAN and 10-34-0 or 11-37-0 (Always check compatibility before blending fertilizers).
- Versatile – may be used as a 2" x 2" starter, broadcast, early top-dress and through irrigation water.
- Slows down nitrification, reducing risk of leaching nitrates.
- Helps reduce ammonia volatilization losses when surface applied with UAN or other urea-based fertilizers.

### Thiosulfate as a Sulfur Source

Nitrogen and sulfur are important components of proteins. Sulfur deficiency affects the plant's ability to utilize nitrogen for protein synthesis. For best management practices and utilization of nitrogen and sulfur, apply Thio-Sul with enough UAN or other liquid ammonium or urea fertilizer products to make an N: S ratio of 5:1. Most crops need between 20 and 50 pounds of sulfur (7 to 18 gallons of Thio-Sul) per acre per crop depending upon local growing conditions, soil type, fertilizer placement, crop and yield potential.

Plant tissue analysis is recommended to determine a crop's sulfur requirement. For best results, follow soil and plant tissue analysis guidelines on sulfur nutrition for crops in your area.

The advantage of thiosulfate is that it is a highly soluble source of sulfur, great for liquid blends. When applied to soils, Thio-Sul immediately begins to oxidize to sulfate-sulfur. Within 1 to 3 weeks, depending on soil temperature, soil type and rate of application, most of the thiosulfate sulfur converts to sulfate-sulfur, and in the process can increase the solubility of phosphorous and some micronutrients, including iron, zinc and manganese.

Thio-Sul is often applied in combination with UAN solutions and aqua ammonia in supplying the sulfur needs of crops.

### Thio-Sul as a Nitrogen Stabilizer

University research has shown that Thio-Sul acts as a nitrification inhibitor when blended with liquid urea and ammonium-based nitrogen fertilizers (including UAN solution). This slows the conversion of ammonium nitrogen to leachable nitrate nitrogen. Since ammonium does not leach as readily, the applied nitrogen remains available to the crop in the upper profile of the soil for a longer time. This can help the plant better utilize the applied nitrogen.

The amount of nitrification inhibition increases as the concentration of applied thiosulfate increases. The ideal concentrations can easily be achieved in banded applications when greater than 5 lbs/A of thiosulfate-sulfur is applied. For more information about using Thio-Sul as a nitrification inhibitor, contact a Crop Vitality Agronomist or Specialist. Thio-Sul also provides a degree of ammonia volatilization protection when included in urea-based blends and surface applied.

Thus, applications of Thio-Sul, when added to liquid urea and ammonium-based nitrogen fertilizers, help to improve nitrogen use efficiency in three ways: 1) Protecting applied nitrogen from losses due to nitrate leaching, 2) Limiting ammonia volatilization losses from urea-based fertilizers, and 3) Adding essential sulfur to the blend.

## SOIL APPLICATION

DO NOT apply Thio-Sul directly on or below germinating seeds such as in a “pop up” fertilizer program. Reduced germination may result when used in an in-furrow fertilizer application.

**Row and Vegetable Crops (starter fertilizer):** Apply Thio-Sul as a band application 2 inches to the side and 2 inches below the seed row at 1 to 3 gallons per acre by itself or in combination with other liquid fertilizers.

**Row and Vegetable Crops (sidedress):** Inject 6 to 12 gallons of Thio-Sul per acre to meet the crop’s sulfur requirement. If injection applications are made close to the row (less than 12 inches), reduce application rate by half (3 to 6 gallons per acre). Avoid root pruning. For preplant soil injection application, DO NOT apply Thio-Sul where it will be in direct contact with the seed.

**Trees and Vines (soil injection and surface banding):** Apply 5 to 10 gallons of Thio-Sul per acre early in the growing season for sulfur nutrition. Avoid pruning roots during injection application.

**Trees and Vines (broadcast):** Apply 10 to 12 gallons of Thio-Sul per acre in a broadcast spray by itself or mixed with water and/or other liquid fertilizers. For young trees and vines apply 5 to 8 gallons per acre.

### Topdressing

Use caution when applying Thio-Sul as a top-dress (by airplane or ground rig) when temperatures are above 70°F and relative humidity is below 30%. Some foliar burn may occur even under the best of conditions.

**Pastures and Small Grains Only:** Apply Thio-Sul along with nitrogen solutions (UAN) to provide adequate sulfur nutrition. For every 5 to 7 pounds of nitrogen, apply 1 pound of sulfur. Application on small grains should be done before jointing (Feekes Growth Stage 5). See the “Application Precautions” section on the following page for more information. Tissue testing is recommended.

**Alfalfa:** Apply 5 to 10 gallons of Thio-Sul with a ground sprayer immediately after a cutting or during dormancy before regrowth has occurred.

## FERTIGATION

Fertigation is the practice of injecting soluble fertilizer through irrigation systems using water as a nutrient delivery system to the crop.

Before injecting Thio-Sul into an irrigation system, make sure that the irrigation system is in good condition and provides uniform distribution to the field. When applying Thio-Sul through solid-set sprinkler and micro-irrigation systems, injection should occur in the middle third or second half of the irrigation set.

The injection of Thio-Sul should be done slowly, and should last at least as long as it takes irrigation water to travel from the point of injection to the last emitter or sprinkler in the field. The injection of Thio-Sul should be done with a fertilizer injection pump and should be done over a 1 to 4 hour time period. Rapid injections of Thio-Sul may lead to uneven distribution of fertilizer and may cause crop damage. For additional information about injection of nutrients into an irrigation system, consult with your local agronomist and review University of California publication 21620 “Fertigation with Microirrigation,” or University of Florida Bulletin #250 “Injection of Chemicals Into Irrigation Systems: Rates, Volumes, and Injection Periods.”

### Sprinkler and Center Pivot Irrigation

Application of Thio-Sul by sprinklers should be followed by 1 to 2 hours of additional irrigation to reduce the possibility of fertilizer injury to the crop. Always apply Thio-Sul in a full irrigation set and avoid application during the midday when temperatures are high.

When applying Thio-Sul at recommended rates through a center pivot, the product is diluted with enough water that foliar burn is not normally a problem.

**Row and Vegetable Crops:** Apply 1 to 5 gallons of Thio-Sul per acre with irrigation water. Apply at planting or wait until the crop is at the 3rd or 4th leaf stage. Repeat as needed every 7 to 14 days. Thio-Sul may be mixed with nitrogen solutions (UAN) and applied as needed during the season.

**Trees (under):** Apply 5 to 8 gallons of Thio-Sul per acre with irrigation water every 10 to 14 days as needed beginning at full leaf stage.



**Trees (over):** Apply 3 to 4 gallons of Thio-Sul per acre with irrigation water every 10 to 14 days as needed beginning at full leaf stage.

**Vines:** Apply 2 to 4 gallons of Thio-Sul per acre with irrigation water every 10 to 14 days as needed.

**Alfalfa:** Apply 5 to 10 gallons per acre of Thio-Sul with irrigation water after cutting.

### Flood and Furrow Irrigation

Thio-Sul may be applied with irrigation water. For best management practices, applications should be made when the crop may best utilize the nitrogen and sulfur. Apply 5 to 10 gallons per acre of Thio-Sul on lighter soils and 8 to 12 gallons per acre on heavier soils. Apply throughout majority of the crop's irrigation period.

**Row and Vegetable Crops:** Apply 5 to 10 gallons of Thio-Sul per acre per application with irrigation water.

**Trees and Vines:** Apply 5 to 10 gallons of Thio-Sul per acre per application with irrigation water.

**Alfalfa:** Apply 4 to 8 gallons per acre of Thio-Sul to seedling alfalfa with irrigation water. Apply 5 to 10 gallons per acre with irrigation water to an established crop.

### Drip Irrigation

**Row and Vegetable Crops (drip tape and subsurface drip):** Apply 1 to 3 gallons of Thio-Sul per acre per treatment with full irrigation. Repeat application, as needed, every 7 to 10 days to provide adequate sulfur nutrition.

**Trees and Vines (subsurface drip):** Apply 2 to 4 gallons of Thio-Sul per acre per treatment with full irrigation. Repeat application after 14 to 21 days, or as needed, to provide adequate sulfur nutrition.

**Trees and Vines (drippers and micro sprinklers):** Apply 6 to 8 gallons of Thio-Sul per acre with a full irrigation. For young trees and vines apply 2 to 4 gallons of Thio-Sul per acre with a full irrigation. Repeat application, as needed, in 14 to 21 days.

## THIO-SUL AS AN ACIDIFIER

Since Thio-Sul contains both ammonium nitrogen and reduced sulfur, it generates more acidification than other

nitrogen and liquid sulfur sources. As a dual nutrient source-acidifier the use of Thio-Sul is a highly effective and economical practice for lowering soil pH. Thio-Sul can be used to manage high pH soil, and to help improve the availability of other nutrients, including phosphorous and micronutrients like iron and manganese. Additionally, Thio-Sul can be used to lower the soil pH for the following purposes: 1) For crops that prefer acidic soil conditions (e.g., blueberries), 2) For combatting citrus greening disease, 3) To release unavailable calcium from calcareous soils (soils high in calcium carbonate).

When applying Thio-Sul for purposes of acidification, it is important to take periodic soil tests, and consult with local recommendations and a crop advisor. Over-acidification of soils in some cases can be detrimental to crop growth. When applying Thio-Sul through drip irrigation, the concentration of product in the smaller-wetted zone, should be considered.

### Use in Solubilizing Calcium Carbonate

These recommendations are for calcareous soils only.

In calcareous soils, Thio-Sul can be used to dissolve calcium carbonate to release calcium in soils containing 1% calcium carbonate or higher. The calcium is then available to help improve soil physical properties and to improve water infiltration and movement through the soil (important in helping to manage salinity/sodicity). Thio-Sul can be used during the preparation for planting, either sprayed over the soil surface, or applied in the pre-irrigation water at rates from 5 to 15 gallons per acre. After the crop has been established, apply Thio-Sul at rates recommended in the "Fertigation" section of this application guide.

## CROP INSIGHTS

### Use in Combating Citrus Greening

These recommendations are valid in situations where the irrigation water has a higher alkalinity. These recommendations are based on research performed in the state of Florida.

University of Florida research has shown that fields irrigated with alkaline water create soils with higher than optimum soil pH for combating citrus greening. Thio-Sul has been shown to lower soil pH more uniformly throughout the top two feet of soil than other acidifiers. For use in greening-affected citrus apply up to 12 gallons per acre of Thio-Sul into micro sprinkler irrigation. Repeat every 14 days, as needed.

### Use in Blueberries

The ideal soil pH for blueberries is between 4.5 and 5.5. Thio-Sul can be applied through drip systems, to effectively lower soil pH in the plant root zone. Apply Thio-Sul at a rate of 2 to 4 gallons per acre through the drip and repeat every 14 days until desired soil pH is reached.

## STRAW DECOMPOSITION

Thio-Sul may be used as an aid to straw decomposition. The effectiveness depends on the time of application, soil moisture and spray coverage on the straw.

While temperatures are still warm, lightly disc or chisel the ground after harvest. Spray a mixture of Thio-Sul and water over the stubble. Wait at least 6 weeks before another field cultivation. Apply 3 to 4 gallons of Thio-Sul for every ton of straw to be treated. Thio-Sul should be mixed in enough water or UAN/water solution to supply a minimum of 20 gallons of spray solution per acre. To be effective, thorough spray coverage of the straw is essential.

## PH AND CROP PRODUCTIVITY

Soil pH has a direct effect on nutrient availability as well as soil microbial activity. A low soil pH can indicate the presence of high levels of toxic ions such as manganese, iron and/or aluminum while high pH can indicate the presence of free lime in the soil. Most crops do best with

soil pH between 6.0 and 7.5 for optimum nutrient uptake. Periodic testing of soils is the only way to determine soil pH and the appropriate course of action to maintain soils at their full productive potential. Minimize or avoid applications of Thio-Sul if the pH of the soil is below 6.0 and there is no liming program in place.

## BLENDING PRECAUTIONS

A jar test is recommended when adding Thio-Sul to blends with other fertilizers and pesticides to check for physical compatibility. Blends of Thio-Sul should not be acidified below a pH of 6.0. When mixing Thio-Sul with pesticides, always keep the agitators running during filling and spraying operations, to avoid separation of products and uneven spray applications.

For more information about the compatibility and blending of Thio-Sul visit [www.cropvitality.com/compatibility](http://www.cropvitality.com/compatibility) or contact a Crop Vitality representative.

## APPLICATION PRECAUTIONS

The directions on this label are believed to be reliable and should be followed carefully. Crop injury may result from unusual weather conditions, failure to follow application guide recommendations, or improper application practices, all of which are out of control of the manufacturer or seller.

DO NOT apply Thio-Sul as a foliar spray on trees or vegetable crops. When working with an unfamiliar blend formulation or application method, always do a small test plot before treating the whole field.

The application of Thio-Sul for purposes other than those listed on this application guide is not recommended.



# TECHNICAL DATA

## THIO-SUL

### Plant Nutrient Content Weight %

Total Nitrogen (N) as Ammoniacal Nitrogen	<b>12</b>
Total Sulfur (S)	<b>26</b>

### Typical Properties

Specific Gravity	<b>1.33</b>
pH	<b>6.5 - 8.5</b>
Appearance	<b>Clear, Colorless to Yellow</b>
Salt-Out Temperature	<b>45°F</b>

See SDS for additional information on safety and handling at: [cropvitality.com/thio-sul](http://cropvitality.com/thio-sul)

Keep out of reach of children. Use caution when handling.



### Warranty and Limitation of Damages

Tessenlerlo Kerley, Inc. (TKI) warrants only that this product conforms to the product description in the Application Guide. Except as warranted by this description, TKI makes no representation or warranty or guarantee, whether expressed or implied, of fitness for a particular purpose of merchantability, or of product performance. TKI does not authorize any agent or representative to make any such representation, warranty or guarantee. To the extent consistent with applicable law, TKI's maximum liability for breach of its warranty or for use of this product, regardless of the form of action, shall be limited to the purchase price of this product. To the extent consistent with applicable law, buyer and user acknowledge and assume all risks and disposal liability resulting from handling, storage, use and disposal of this product. If buyer does not agree with or accept these warranty and liability limitations, buyer may return the unopened container to the place of purchase for full refund. Buyer's use of this product shall constitute conclusive evidence of buyer's acknowledgment and acceptance of the foregoing limitations. Some jurisdictions do not allow the exclusion of implied warranties or the limitation of certain damages, so the above may not apply. The purchase, delivery, acceptance and use of this product by the buyer are subject to the terms and conditions of seller's sales invoice for this product.

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