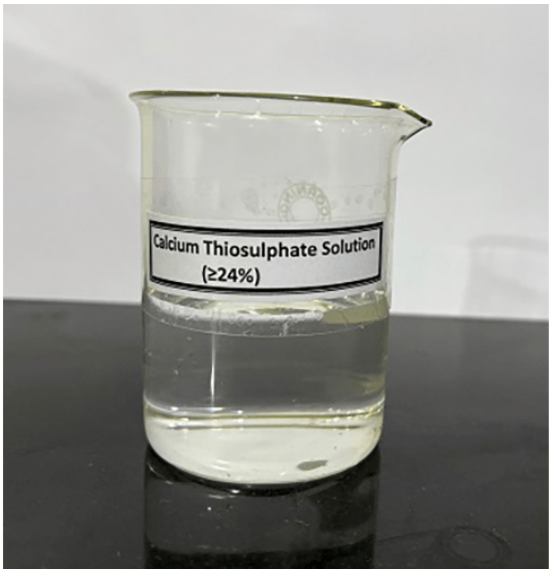
Calcium Thiosulfate as a Nitrate-Free Calcium Source in Soilless Culture

Growers often supply calcium (Ca) with calcium nitrate, but that introduces unwanted nitrogen (N). To achieve a 0% N finish in a hydroponic or soilless system (for instance to reduce residual nitrates or alter plant metabolism), an alternative Ca source is required. One option is calcium thiosulfate (CaS_2O_3), a clear, water-soluble liquid containing about **6% Ca** and **10% thiosulfate sulfur**. Tessenderlo Kerley's CaTSR product is labeled 0-0-0-10S-6Ca (no N), and can replace $Ca(NO_3)_2$ or $CaCl_2$ in late-stage fertigation (zero-nitrogen) regimes.



Calcium thiosulfate is very soluble and can be used to prepare highly concentrated solutions

Calcium fertilizer	Ca (%)	N (%)	Other ions / comments
Calcium nitrate ($Ca(NO_3)_2$)	~19	~16	NO_3^- (adds N)

Calcium fertilizer	Ca (%)	N (%)	Other ions / comments
Calcium chloride ($CaCl_2 \cdot 2H_2O$)	~27	0	add a lot of Cl^- (1.7ppm per ppm of Ca); very soluble
Calcium sulfate ($CaSO_4 \cdot 2H_2O$)	~23	0	SO_4^{2-}; low solubility (gypsum), cannot be used to make stocks
Calcium thiosulfate (liquid)	~6	0	$S_2O_3^{2-}$; high solubility, ~10% S

Evidence and Discussion

Because research specifically on calcium thiosulfate (CaTS) is scarce, I evaluated what I *could* verify.

- A peer-reviewed article “Effects of Thiosulfate as a Sulfur Source on Plant Growth, Metabolites Accumulation and Gene Expression in Arabidopsis and Rice” studied whether plants could use thiosulfate (instead of sulfate) in hydroponic medium. The study found that both Arabidopsis (dicot) and rice (monocot) take up thiosulfate into roots, and that at modest sulfur levels (≈300 µM) rice shows similar biomass whether S is supplied as thiosulfate or sulfate. The Arabidopsis biomass was lower when thiosulfate was used above certain concentration thresholds. This shows thiosulfate is bioavailable, though with caveats depending on species, concentration and potential toxicity or metabolic cost in dicots (1).
- Another verified study “Soil Calcium Status Unrelated to Tipburn of Romaine” (Hartz et al., 2007) compared calcium nitrate, calcium thiosulfate, and calcium chloride injections via drip in field soil on romaine

lettuce. They applied 17-28 kg Ca/ha in the last 1-3 weeks before harvest and found **no significant improvement** in leaf Ca concentration of inner leaves, nor reduction of tipburn severity, regardless of Ca source (2).

- Also, “Calcium Fertigation Ineffective at Increasing Fruit Yield and Quality of Muskmelon and Honeydew Melons in California” (Johnstone et al., 2008) compared calcium from calcium nitrate, calcium thiosulfate, and calcium chloride under drip irrigation in melon. Applications of typical industry rates of Ca via CTS or CN or Cl did **not** improve fruit yield, quality, or tissue Ca concentration compared to no-Ca-fertigation control (3).

So far **no** peer-reviewed study was found that examines Ca thiosulfate in *pure hydroponic* or soilless culture to replace calcium nitrate when aiming for zero N finish (apart from its use as a sulfur source). The field soil/field drip results tend to show minimal effect of late calcium injection for inner leaves or fruit quality under the tested conditions. With that said, studies have not revealed any negative effects from using calcium thiosulfate. My experience has shown no problems when using Ca thiosulfate as a zero-nitrogen Ca source at reasonable concentrations.

Implications

Given limited evidence, growers should be skeptical about expecting large gains in tissue calcium or disorder reduction simply by switching sources late in growth, especially under field or substrate conditions. However, using CaTSR is valid if your goal is to maintain calcium without adding nitrogen. Because it is soluble and delivers Ca in a bioavailable way (and provides thiosulfate that plants can absorb), it’s a

workable tool in finish regimes where N must be zero or near zero.

The tradeoffs include:

- Possible metabolic cost in some species under certain S forms or concentrations
- If the calcium demand is high, source competition or diffusion limitations may still constrain uptake
- The very late supply may not change internal partitioning or yield, as many trials showed

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Preparing a Stock Solution and Dosing

Here is a practical plan to use CaTSR to reach **120 ppm Ca** in the final crop solution, with a **1:100 injection ratio**, without introducing nitrogen:

1. **Determine Ca content.** CaTSR is labeled as ~6% Ca by weight (≈60 g Ca per liter if density ~1 kg/L). Confirm with product label or lab test.
2. **Stock concentration target.** To get 120 ppm in the working solution via 1:100 injection, the stock needs to be ~100× that: **12000 ppm Ca** in stock.
3. **Stock solution dilution.** Since CaTSR has ~60000 ppm Ca when pure (100%), you need ~20% of that pure product in stock to get 12000 ppm. This means uou should add ~200mL/L (~750mL/gal) of stock with the rest being distilled or RO water. This should replace your normal Ca nitrate stock.
4. **Injection.** Use an injector that can do 1% injection (38mL/gal). That gives ~120 ppm Ca.

5. **Adjustments.** If the product is more dilute or denser, revise proportionally; check electrical conductivity (EC) and pH when adding CaTSR as it may shift pH or interact with other ions.

Summary

Using calcium thiosulfate (e.g. CaTSR 0-0-0-10S-6Ca) allows growers to maintain calcium levels while eliminating added nitrogen. The dilution above (~20% product in stock, injected 1:100) yields ~120 ppm Ca. Existing studies show thiosulfate is absorbed and usable (1), but field trials using CaTS late in growth often do **not** show improvements in tissue Ca, yield, or quality when compared to controls using other Ca sources or none (2), (3). Growers should expect moderate effects at best in substrate or field systems, unless other limiting factors are addressed.