Foliar Calcium in Hydroponics

Calcium is essential yet poorly mobile in plants. Young leaves and fruit can go deficient even when solution Ca is adequate, because Ca rides the transpiration stream and is not readily redistributed. Foliar sprays target the tissues that most often lose the race for Ca. Evidence in hydroponics and soilless systems exists, but it is thinner for organic or chelated Ca forms than for simple salts. In this article I will point to some of the research on Ca foliar application, which salts work best and what dosing rates.

Calcium chloride (most commonly available as $CaCl_2.2H_2O$) is the most effective Ca source available for foliar spraying.

What the Research Shows

- **Calcium chloride ($CaCl_2$)** remains the fastest and most reliable for foliar entry. Tomato work directly comparing salts found $CaCl_2$ clearly superior to Ca-citrate (1).
- **Calcium nitrate ($Ca(NO_3)_2$)** is effective and less phytotoxic, but generally requires higher rates to supply the same Ca. Field potato studies showed yield and Ca increases (2).
- **Sorbitol-chelated Ca** has outperformed $Ca(NO_3)_2$ in

peanuts, improving leaf Ca and yield (3).

- **Calcium acetate** protected rice from ozone and heat stress better than $CaCl_2$ at equal molar concentrations (4) (5).
- **Calcium lactate** improved water status and yield in lettuce under deficit irrigation (6).
- **Calcium gluconate**, at high concentrations, improved grape cluster quality and storability, especially when combined with chitosan (7).

Practical Rates and Outcomes

Source (salt/product)	Example study & crop	Rate tested (g/gal)	Outcome
Calcium chloride ($CaCl_2$)	Tomato, direct foliar absorption comparison (1)	11–23 g/gal (0.3–0.6% w/v)	Fastest uptake; burn risk above ~20 g/gal
Calcium nitrate ($Ca(NO_3)_2$)	Potato foliar sprays (2)	~15–23 g/gal (0.4–0.6% w/v)	Improved tuber Ca and yield; milder than $CaCl_2$
Sorbitol-chelated Ca (80 g Ca/L stock)	Peanut, two field seasons (3)	≈85 g stock product/gal (6.8 g Ca/gal delivered)	Higher leaf Ca and 12–17% yield gain vs controls and $Ca(NO_3)_2$
Calcium acetate ($Ca(CH_3COO)_2$)	Rice under ozone stress (4), ozone + heat (5)	3.0–3.3 g/gal (5 mM)	Better photosynthesis and yield vs equal-molar $CaCl_2$

Source (salt/product)	Example study & crop	Rate tested (g/gal)	Outcome
Calcium lactate	Lettuce under deficit irrigation (6)	2.8–5.7 g/gal (0.75–1.5 g/L)	Improved water status, antioxidants, yield
Calcium gluconate	Grapes, two seasons (7)	38–76 g/gal (1–2% w/v)	Better fruit quality and storability; best with chitosan

How Fast Does It Work?

- Leaf Ca increases can be measured within **1–3 days** of spraying $CaCl_2$ (1). Expect **leaf Ca rises in days**, but visible symptom reduction or yield effects in **2–4 weeks of consistent spraying**.
- Stress mitigation (e.g. rice under ozone) required 2 sprays but benefits were seen in yield at harvest, weeks later (4).
- Yield gains in peanut with sorbitol-Ca required repeated sprays across the season (3).

Bottom Line

- **Best for quick entry**: $CaCl_2$, 10–20 g/gal, but can be phytotoxic above ~20 g/gal. Calcium chloride will always be wet (because of how hygroscopic it is) so almost all Ca that falls and remains on leaf surfaces will eventually be taken up (unless it's washed off).
- **Good alternative**: $Ca(NO_3)_2$, 15–25 g/gal, safer on

leaves, adds nitrate.

- **Organic/chelated options**: Sorbitol-Ca, calcium acetate, lactate, and gluconate show benefits in specific crops and stress conditions. They often need higher mass per gallon but may reduce leaf burn or improve persistence.
- **Trial first**: Responses vary by crop, environment, and formulation. Test small before scaling.