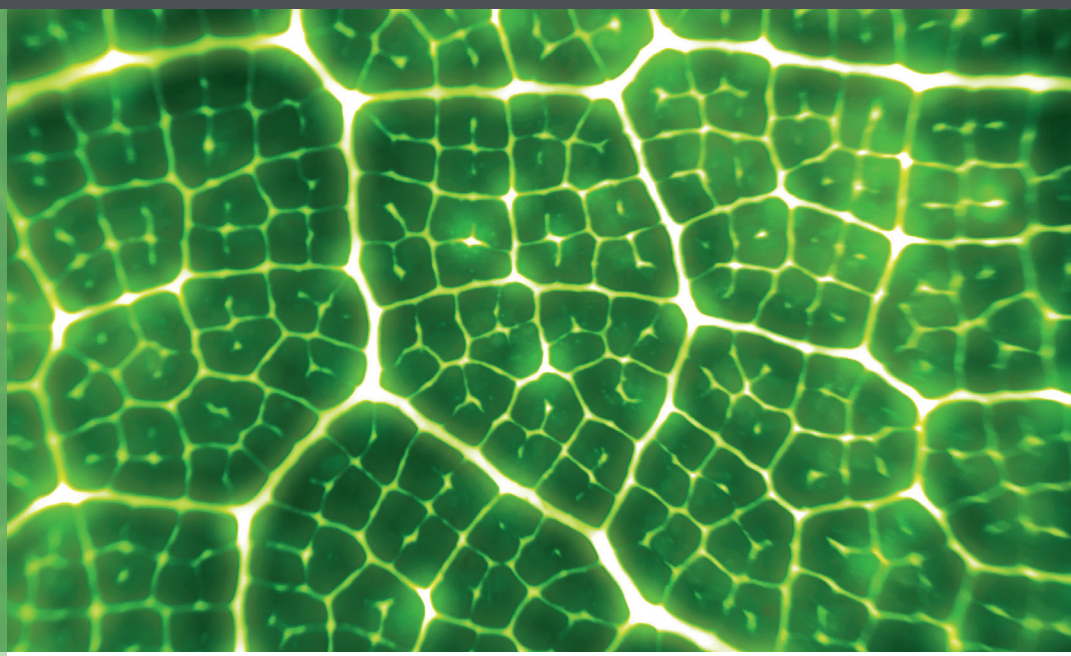
Importance of calcium and CaT mode of action

Our patented CaT™ technology is designed to improve localised calcium movement, reducing calcium disorders and improving marketable yield.



Benefits of CaT technology

- Systemic response with elevated calcium concentrations in cells
- Aids localised calcium movement
- More uniform calcium distribution
- Reduction in calcium disorders
- Improved crop quality, storage and shelf-life
- Less crop waste and more marketable yield
- Compatibility with other AgChem foliar sprays.

Bitter pit in apple

Role of calcium in plants

Calcium is an essential plant nutrient. It is essential for cell wall structure, providing intramolecular linkages between pectin molecules. Calcium is also vital for membrane integrity, ensuring selective permeability. Calcium deficiency can result in localised cell collapse, with disorders such as bitter pit in apples, blossom end rot in tomatoes, and tip burn in lettuce.

Calcium movement in plants

Calcium is principally taken up with water in the transpiration stream and moves in the xylem. It is not readily phloem mobile due to low concentrations inside living cells. As a result, organs with high transpiration rates, such as leaves, receive more calcium.
Conversely, organs with low transpiration rates, such as fruits, can suffer from calcium disorders despite ample calcium availability in the soil. Calcium demand in fruit during rapid growth periods often exceeds what is provided in the transpiration stream. Leaves can also suffer from calcium disorders, usually in young, rapidly expanding or enclosed tissues.

Even when calcium deficiencies are not normally observed, for example in arable crops like soybeans, there can be advantages in applying a CaT product to improve calcium distribution in flowers and pods.

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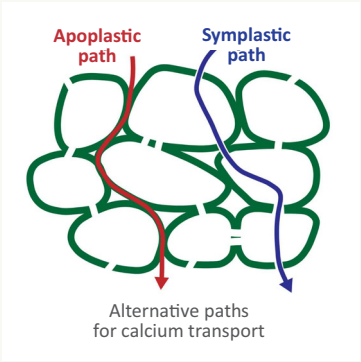
Simulating calcium movement

Once delivered via the xylem, calcium typically moves in tissues via the apoplastic pathway, where water (with solutes) moves between cells, or through cell walls, but does not enter the cell membrane. When movement via the apoplastic flow is limited due to low transpiration, movement via the symplastic pathway is likely to become more important.

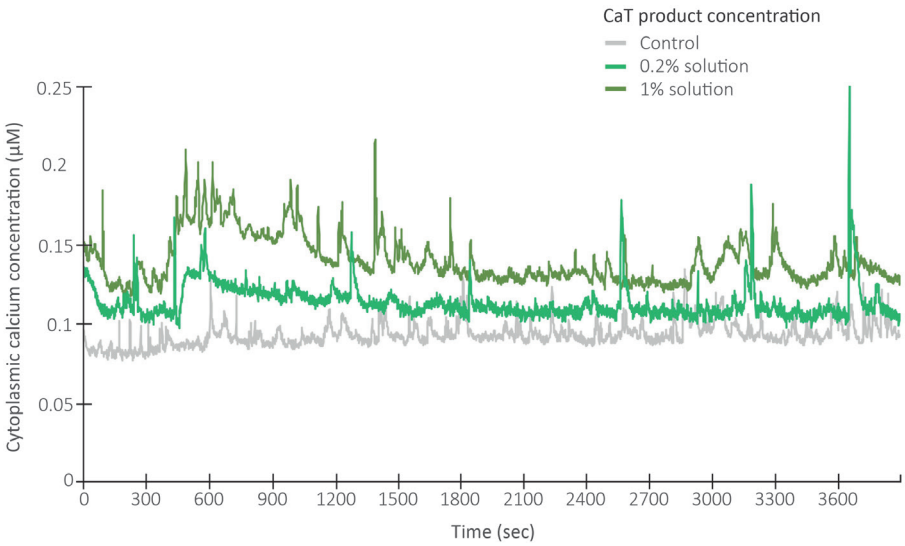


Alternative paths for calcium transport

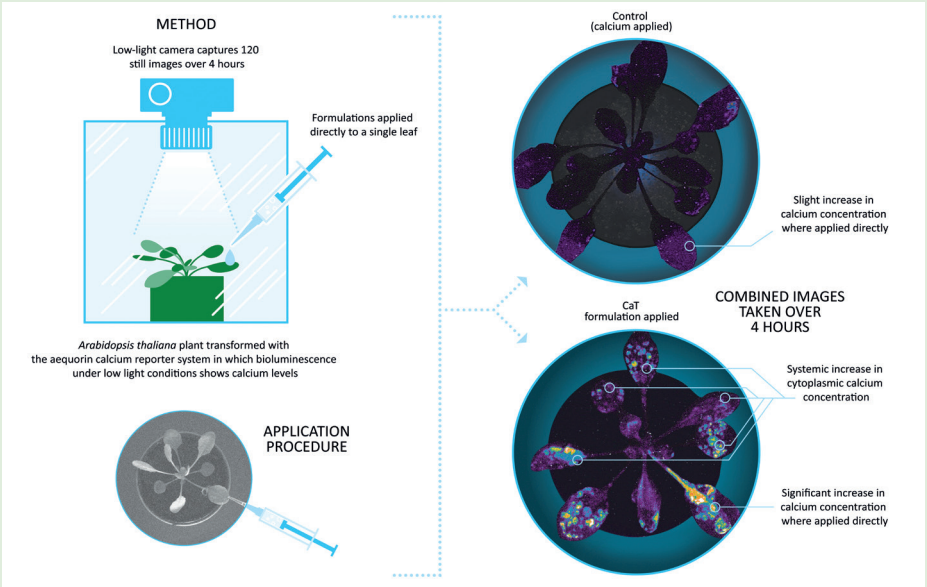
CaT stimulates selective ion transport channels in membranes, increasing the calcium concentration within cells. In doing so, this improves localised calcium movement.

Measuring calcium concentrations within cells

The Plant Impact R&D team worked with experts at Lancaster University to measure the effect of CaT products on the calcium concentration within cells. This was done using *Arabidopsis thaliana* transformed with the aequorin calcium reporter, where bioluminescence can be measured to quantify the calcium concentration within cells (in the cytoplasm). When small plants were incubated in a solution, and a CaT product was added at different concentrations, the cytoplasmic calcium concentration was elevated (see below).



Even when an external stress was applied (using hydrogen peroxide) to stimulate a natural elevation of calcium concentration, the effect of a CaT product was still clearly observed and was more prolonged in response.



Imaging of calcium movement

Lancaster University also used the aequorin calcium reporter together with a very sensitive camera to capture images of the response. Plants were treated with either a CaT product or a calcium nitrate control, applied only to one leaf. The CaT treated plant showed a rapid elevation in calcium concentration, followed by a systemic increase in untreated leaves (see opposite). Furthermore, the CaT effect was far more pronounced compared to the calcium nitrate control treatment.

CaT™

Find more information on our CaT technology at:
www.plantimpact.com

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