Beyond application: Activating calcium utilisation with KELPURA™

KELPURA™ (Fertiliser Group 3, M442) is a concentrated kelp-derived biostimulant from *Ecklonia maxima*, produced through a low-temperature extraction process to retain its full spectrum of bioactive compounds.

These include phytohormones, phenolic acids, salicylic and benzoic acid-related compounds, and amino acids, all of which act together to improve the plant's ability to absorb, transport and structurally utilise foliar-applied calcium during reproductive development. In calcium programmes, particularly in combination with CALCINATOR™ (Fertiliser Group 2, B5022), KELPURA™ functions as the physiological driver that determines whether applied calcium becomes functionally integrated into plant tissues.

The effectiveness of this system is defined by how KELPURA™ interacts with the plant processes that normally limit calcium utilisation (Figure 1). Calcium is essential for cell wall stabilisation, membrane integrity and reproductive development, yet it is inherently immobile within the plant and cannot be redistributed to actively growing tissues such as flowers and fruit (White & Broadley, 2003; Marschner, 2012).

As a result, these tissues depend on continuous external supply through foliar application.

However, applied calcium only becomes functional if it remains mobile, reaches developing tissues, and is incorporated into the cell wall. KELPURA™ improves this efficiency by acting directly on each of these steps through its integrated biochemical composition.

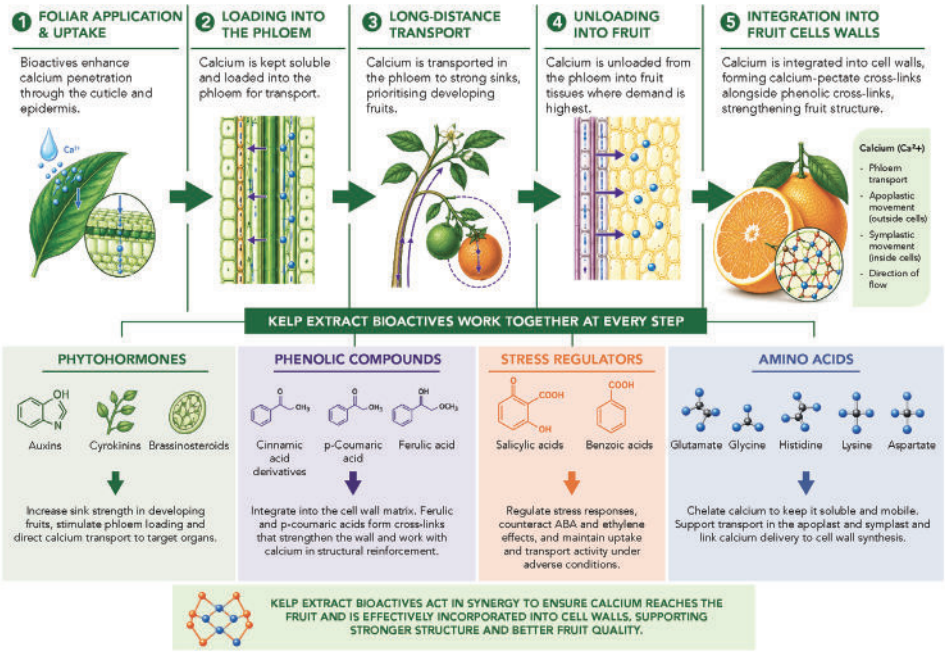


Figure 1: Mode of action of KELPURA™ on calcium uptake and utilisation.

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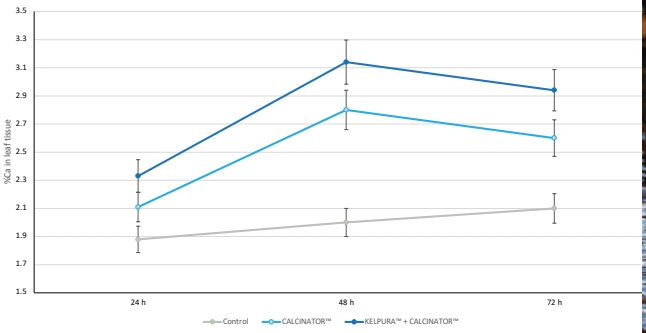




Figure 2: Calcium concentration (% Ca in leaf tissue) over time following foliar application of CALCINATOR™ (1 L/100 L), and KELPURA™ (500 ml/100 L).

Driving calcium efficiency with KELPURA™

This effect is reflected in calcium uptake dynamics following foliar application.

Across measured time points, the combination of KELPURA™ with CALCINATOR™ resulted in consistently higher calcium accumulation in leaf tissue, when compared to both the untreated control and CALCINATOR™ alone (Figure 2). Calcium levels increased rapidly following application, reaching a higher peak and remaining elevated, relative to other treatments. In contrast, the control showed limited calcium accumulation, while CALCINATOR™ alone improved uptake but did not achieve the same magnitude or consistency as the combined treatment.

These differences were maintained over time and translated into final calcium status. After 72 hours, the increase in leaf calcium was greatest where KELPURA™ was included with CALCINATOR™, confirming that calcium efficiency is determined not only by supply, but by the plant's ability to absorb, transport and utilise that supply effectively (Figures 2).

The phenolic fraction of KELPURA™, including cinnamic acid derivatives such as *p*-coumaric and ferulic acid, interacts directly with the structural environment of the cell wall. These compounds are part of the same biochemical system that governs cell wall reinforcement, where ferulic acid forms cross-links between polysaccharides and lignin-associated structures, increasing rigidity and defining wall permeability (Fry, 1986; Boerjan et al., 2003; Ralph et al., 2004).

Within this context, calcium movement is not independent of the wall structure; it is influenced by the degree of cross-linking and the resulting restriction of apoplastic transport. By supplying phenolic compounds, KELPURA™ operates within this system, supporting the incorporation of calcium into a structurally reinforced matrix, rather than allowing it to be excluded by reduced permeability.

This structural interaction is reinforced by the phytohormonal activity of KELPURA™, where auxins, cytokinins and brassinosteroids regulate growth, sink strength and membrane function. These hormones increase the demand for calcium in developing tissues while improving directional movement toward these sites, ensuring that calcium reaches areas where phenolic-mediated structural reinforcement is actively occurring (Davies, 2010; Vriet et al., 2012). In this way, KELPURA™ aligns calcium delivery with the plant's structural development processes. >>

At the same time, KELPURA™ maintains the physiological conditions required for calcium uptake under stress. During reproductive development, elevated abscisic acid and ethylene activity can suppress growth and reduce nutrient uptake, limiting calcium movement. The salicylic acid content of KELPURA™ regulates stress responses and supports continued metabolic activity, ensuring that calcium uptake and transport processes remain active.

Benzoic acid contributes to this system through its role in metabolic pathways associated with salicylic acid and cytokinin activity, reinforcing the plant's ability to maintain calcium utilisation under adverse conditions (Hayat et al., 2010; Khan et al., 2015).

The amino acid fraction of KELPURA™ further supports calcium efficiency by maintaining calcium in a mobile and plant-available form during foliar uptake and transport. Amino acids such as glutamate, glycine, histidine and lysine facilitate calcium movement across the leaf surface and within the apoplast, while glutamate and aspartate support internal transport.

Serine contributes to cell wall synthesis, linking calcium delivery directly to structural incorporation. This ensures that calcium remains available long enough to reach developing tissues and be integrated into the cell wall alongside phenolic components (Fernández & Eichert, 2009).



Conclusion

KELPURA™ determines the efficiency of calcium utilisation by driving the absorption, transport and structural incorporation of calcium within the plant. Through its integrated biochemical composition, it ensures that calcium is not merely present, but also functionally embedded within a phenolic-reinforced cell wall system where calcium-pectate stabilisation and cross-linking operate together.

When used in combination with CALCINATOR™, KELPURA™ further enhances the effectiveness of applied calcium, ensuring that supply is translated into functional structural integration during critical developmental stages.

References:

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