Enhancing citrus fruit quality and extending shelf life with CALFORMATE and OSMOSHIELD!

agreya™
Sustainable Agriculture

MASSÓ
AGRO DEPARTMENT

Synergistic Mode of Action

CALCIUM FORMATE:

- Maintains the integrity of the cell wall
- Improves fruit strength and firmness
- Strong fruit is less susceptible to disease

GLYCINE BETAINE:

- Activate metabolic pathways by increasing the activity of antioxidant enzymes
- Maintains the integrity of the cell membrane
- Maintains fruit hydration and reduces the loss of firmness
- Increases tolerance to chilling injury (CI)

Introduction:

Poor outturns of citrus fruit in overseas markets has a high cost to growers, packers and the citrus industry.

Recent international research has provided strong evidence that foliar applications CALFORMATE and OSMOSHIELD applied prior to the harvest of fruit, can have an enormous affect on improving fruit strength, quality and extending shelf life after harvest.

These results prepared by the University Miguel Hernandez (UMH) clearly identify the benefits of the above applications on a wide range of quality parameters, critical to deliver the best outturns.

Composition:

CALFORMATE

OPTIMISED FORMULATION OF CALCIUM FORMATE WITH GLYCINE BETAINE

CALFORMATE® is a high concentration calcium formulation based on calcium formate. The small size of calcium formate particle allows a quick penetration in the fruit skin.

GUARANTEED COMPOSITION:

Calcium (Ca)	24 % w/w
Total Nitrogen (N)	1.2 % w/w
Organic Nitrogen (N)	1.2 % w/w

OSMOSHIELD

GLYCINE BETAINE FROM NATURAL ORIGIN

OSMOSHIELD® is a formulation of glycine betaine from natural origin, providing an osmoregulation effect in the fruit cell.

GUARANTEED COMPOSITION:

Total nitrogen (N)	12% w/w
Organic nitrogen (N)	11.5% w/w
Organic carbon	56 % w/w
C/N relation	4.9 w/w

Trial results: Trial conducted by Miguel Hernández University (Elche, Spain).

Treatments	Application time
Osmoshield 1,45 g/l (15 mM GB)	**A:** Beginning colour break. **B:** Colour break . **C:** 7 days before harvest.
Calformate 2,50 g/l (15 mM CaO-B)	
Calformate 2,50 g/l + Osmoshield 1,45 g/l (CaO-B-GB)	
Untreated	-

Cultivar: Afourer mandarin.

Assessment time:

Harvest | 30 days at 1°C | 30 days at 1°C + 10 days at 20°C | 60 days at 1°C | 60 days at 1°c + 10 days at 20 °c

Trial results

UNIVERSITAS Miguel Hernández

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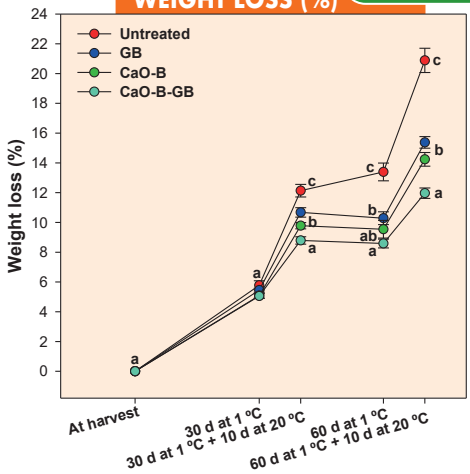
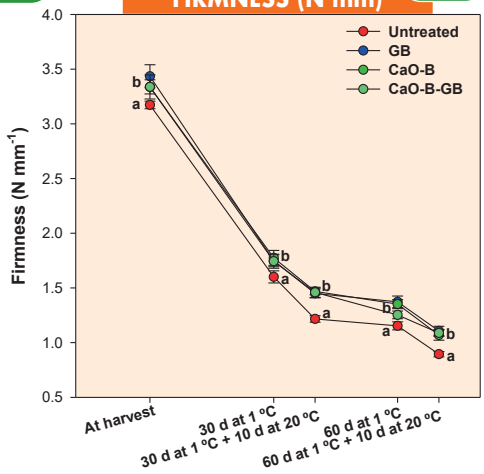
WEIGHT LOSS (%) (-9% abs./-45% rel.)



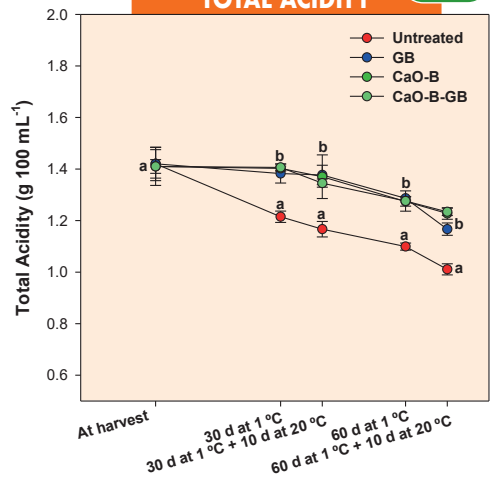
Control of weight loss after harvest is essential for freshness, firmness, quality and long shelf life. **CALFORMATE®** and **OSMOSHIELD®** reduced weight loss by 9% (absolute) or 45% (relative).

FIRMNESS (N mm) (+22%)



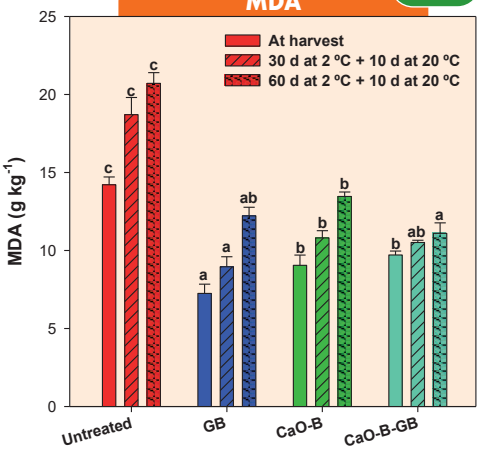
Fruit firmness at harvest was higher in the treated fruits and this difference is maintained through storage and shelf life. **CALFORMATE®** and/or **OSMOSHIELD®** maintained more firmness by 22%.

TOTAL ACIDITY (+22%)



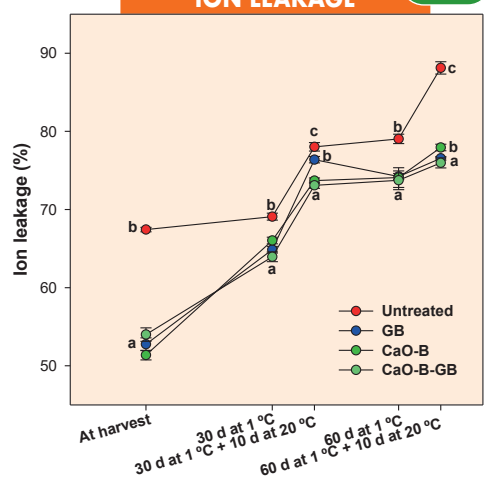
A slow reduction in acidity is critical to maintain fruit condition and fresh taste. **CALFORMATE®** and/or **OSMOSHIELD®** significantly reduced the drop in acidity by 22%, improving quality and minimising any over mature flavour.

MDA (-47%)



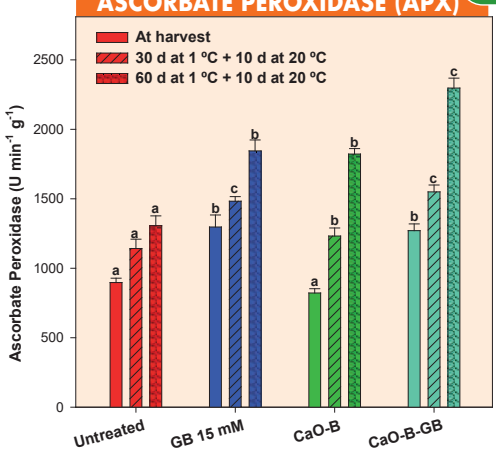
Malondialdehyde (MDA) content is a biomarker of lipid peroxidation produced by reactive oxygen species (ROS). A lower MDA content shows a greater integrity of the cell membrane and less skin breakdown. **CALFORMATE®** and **OSMOSHIELD®** reduced MDA by 47%.

ION LEAKAGE (-14%)



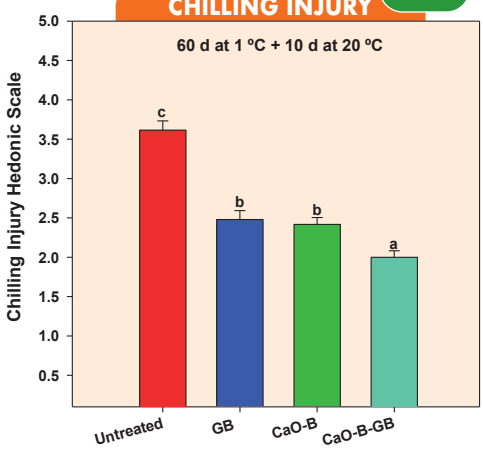
Ion - electrolyte leakage (EL) index measures the integrity of cell membrane. A higher EL (%) relates to ion migration and higher concentration outside the membrane, due to it being more damaged. **CALFORMATE®** and **OSMOSHIELD®** reduced EL by 14%.

ASCORBATE PEROXIDASE (APX) (+76%)



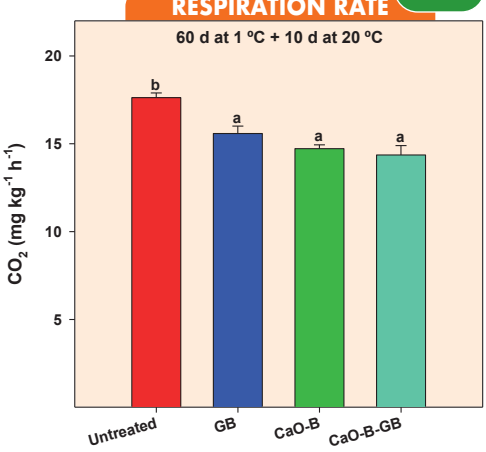
Ascorbate peroxidase (APX) is a key antioxidant enzyme that scavenges and detoxifies excess toxic reactive oxygen species (ROS) in plant cells under stress conditions. **CALFORMATE®** and **OSMOSHIELD®** increased APX by 76%.

CHILLING INJURY (-45%)



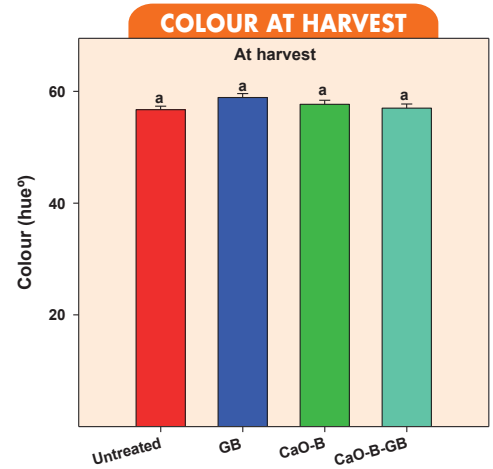
Citrus are sensitive to CI when exposed to low temperatures and can result in significant claims and downgrades of the fruit in the market. **CALFORMATE®** and **OSMOSHIELD®** reduced CI by 45% by visual assessment (hedonic scale).

RESPIRATION RATE (-19%)



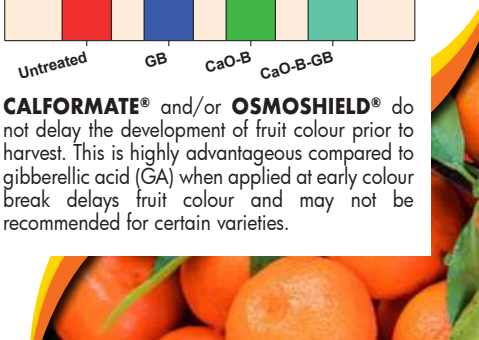
After harvest, the respiration rate measured by the CO_2 concentration is reduced by 19% for **CALFORMATE®** and **OSMOSHIELD®** applications, slowing metabolic activity and the senescence process, improving shelf life.

COLOUR AT HARVEST



CALFORMATE® and/or **OSMOSHIELD®** do not delay the development of fruit colour prior to harvest. This is highly advantageous compared to gibberellic acid (GA) when applied at early colour break delays fruit colour and may not be recommended for certain varieties.

*Percentages represent the differences between the untreated and the combination of **CALFORMATE®** and **OSMOSHIELD®** at **60 days at 1°C + 10 days at 20°C.***



CONCLUSIONS:

The treatments with CALFORMATE® + OSMOSHIELD® at 60 days at 1ºC + 10 days at 20º compared with untreated fruits displayed:

- LESS FRUIT WEIGHT LOSS
- MORE FRUIT FIRMNESS
- HIGER ACID CONTENT
- LESS CHILLING INJURY
- MORE CELLULAR MEMBRANE INTEGRITY (MDA AND ION LEAKAGE INDEX)
- MORE ANTIOXIDANT ACTIVITY (APX)

CALFORMATE + OSMOSHIELD

UNTREATED	OSMOSHIELD+CALFORMATE

Recommendation:

This treatment is a preharvest application for postharvest affect.

Applications will enhance internal fruit quality, strengthen the citrus rind and minimising skin breakdown for better fruit outturns.

Timing:

- First application should be made at initial colour break, coinciding with 2,4-D (Stop Drop).
- A second application, commencing from 30 days after the first application, is beneficial for varieties with a history of poor quality and condition, and/or fruit exposed to adverse weather conditions. (Eg. Excessive rain, frost, wind…)

CALFORMATE: 200 - 250g / 100L (5 – 6 Kg/ha) **OSMOSHIELD: 100 - 150g / 100L (2 – 3 Kg/ha)**

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