

# 'Rocha' pear ripening restorage under 1-MCP evergreen effect: the effect of auxin treatment

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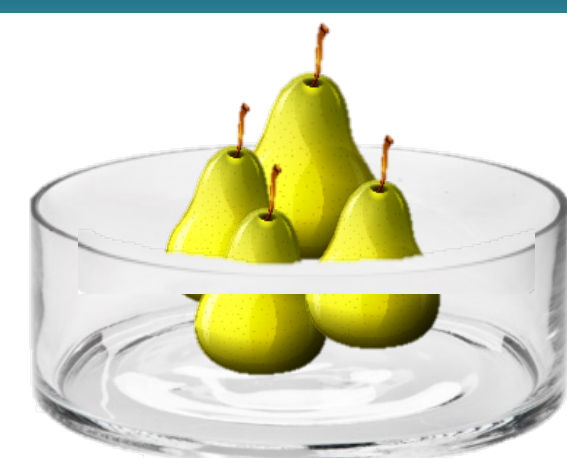
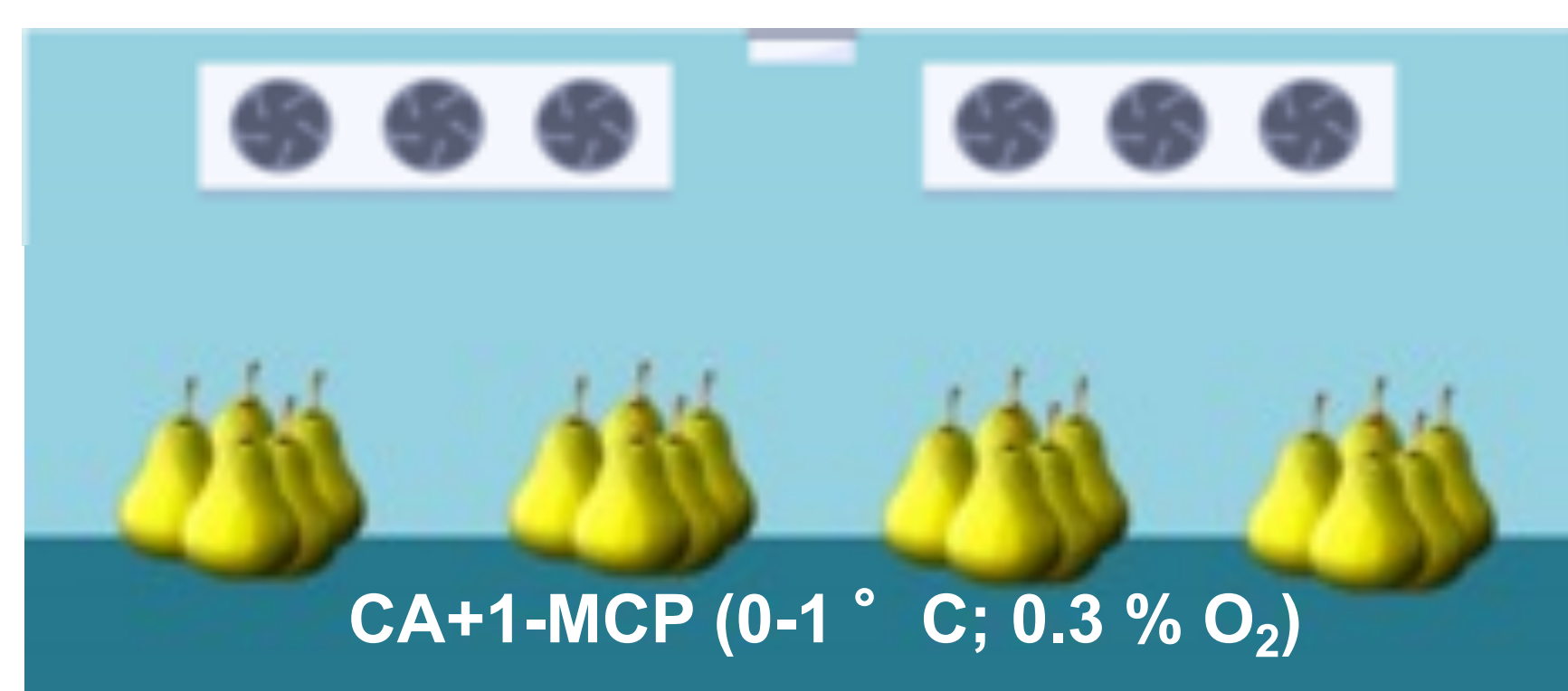
## Introduction

'Rocha' pear (*Pyrus communis* L. cv. Rocha), is a DOP (Denomination of Protected Origin) cultivar from West region of Portugal, representing the 4<sup>th</sup> pear cultivar in Europe and the main cultivar in Portugal, with an average annual production of 173 000 tons. It contributes to significant revenues for the Portuguese economy (120-130 M€/year) [1-2]. Soil-climatic factors and optimal orchard management generate this product with exceptional organoleptic and nutritional quality, appreciated worldwide. Its high exportation has raised the need to develop adequate conditions for long-term storage. For about forty years, the postharvest application of diphenylamine was an efficient strategy used to protect fruit from postharvest problems. However, in 2011 its use was prohibited. Nowadays, in combination with cold storage, 1-MCP has been one of the most applied techniques to extend the storage of 'Rocha' pear. However, fruit industry is facing a problem resulting from 1-MCP application which compromise producers' sustainability, because 1-MCP disrupts the normal process of ripening, denominated as "evergreen" effect. This phenomena affects the final quality of 'Rocha' pear and increase postharvest losses [3-4] since several biochemical modifications in fruit ripening behavior, including changes in appearance, flavor, texture, and aroma, occur.

Several strategies have been applied to reboot the ripening capacity of pear after treatment with 1-MCP, such as the application of higher temperatures, exogenous ethylene or a combination of both. However, these treatments demand high energy consumption. Auxin is another phytohormone known to promote ethylene production in many horticultural crops [5]. In this study, we have tested the restoring of ripening via exposure of 1-MCP treated fruits with auxin. Time course physiological and biochemical analysis comparison with 'Rocha' pear normal ripening and with 'Rocha' pear treated only with 1-MCP was performed.

## Methods

## Results



Auxin application by immersion

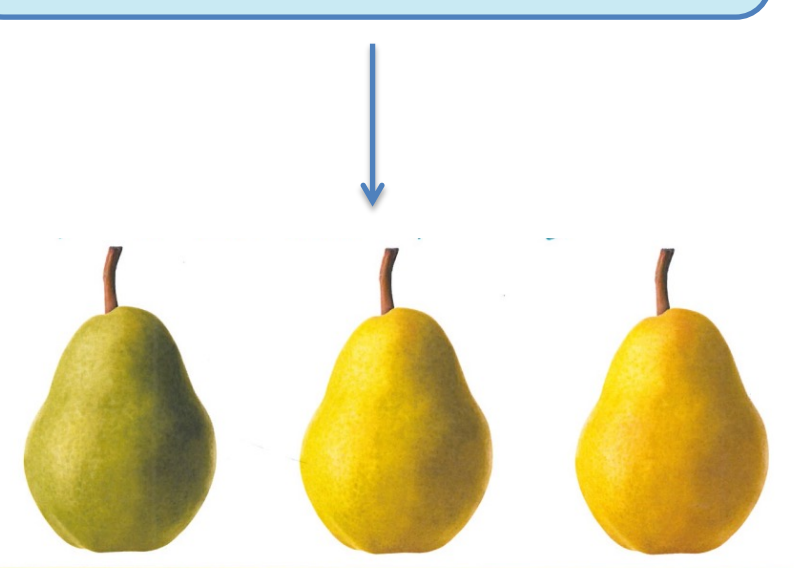
Sampling

T<sub>1</sub> = 7 d at RT; T<sub>2</sub> = 15 d at RT



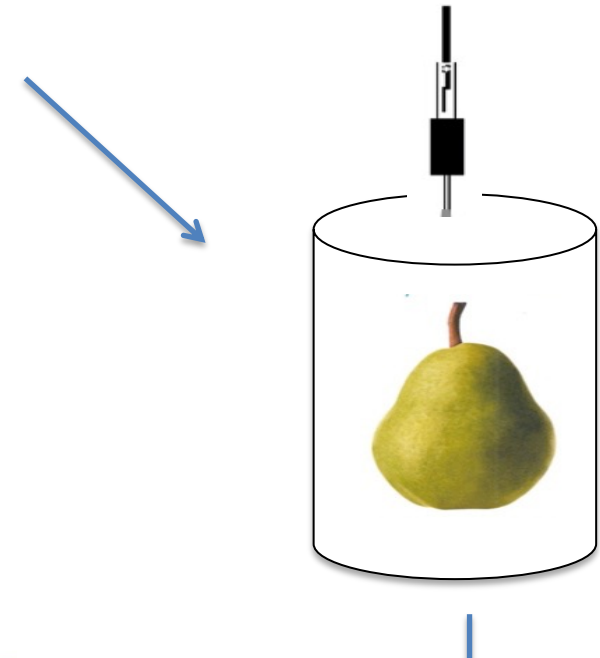
Digital refractometer

Total soluble solids (TSS)



Skin colour (Hue angle) according to McGuire, 1992

Firmness using a 5 mm cell probe



Detection by Flame Ionization

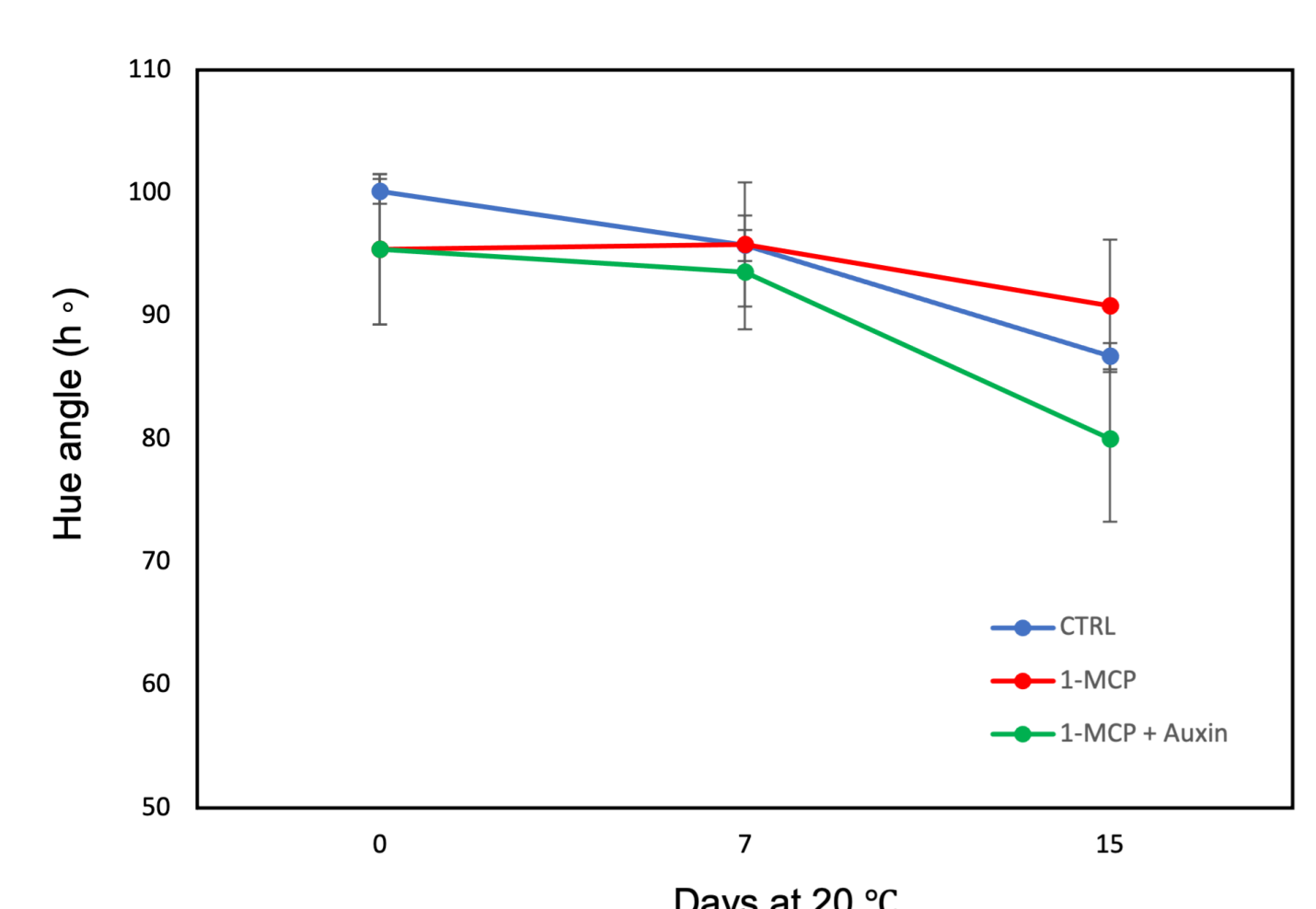
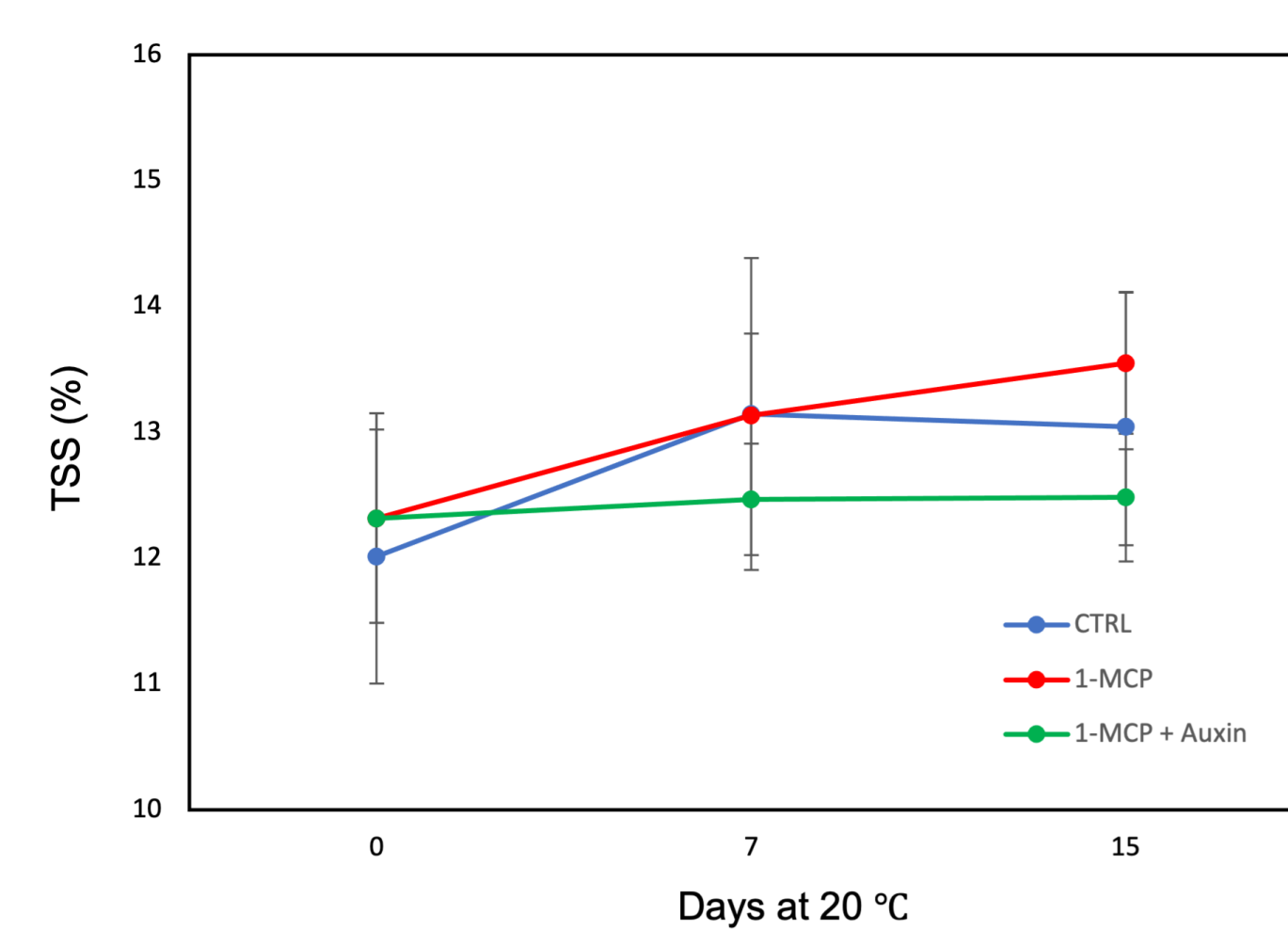
Ion Flow

Hydrogen Flame

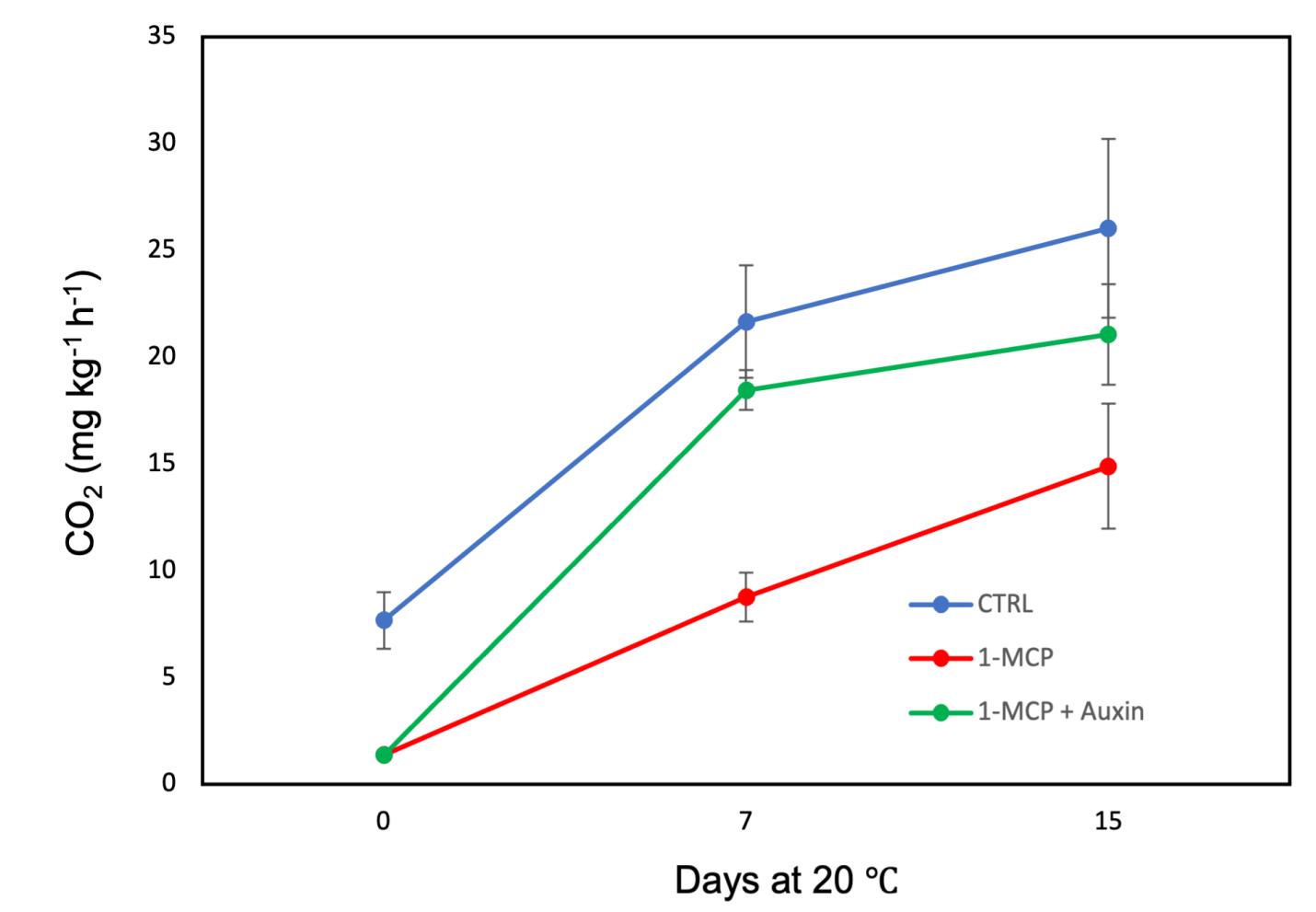
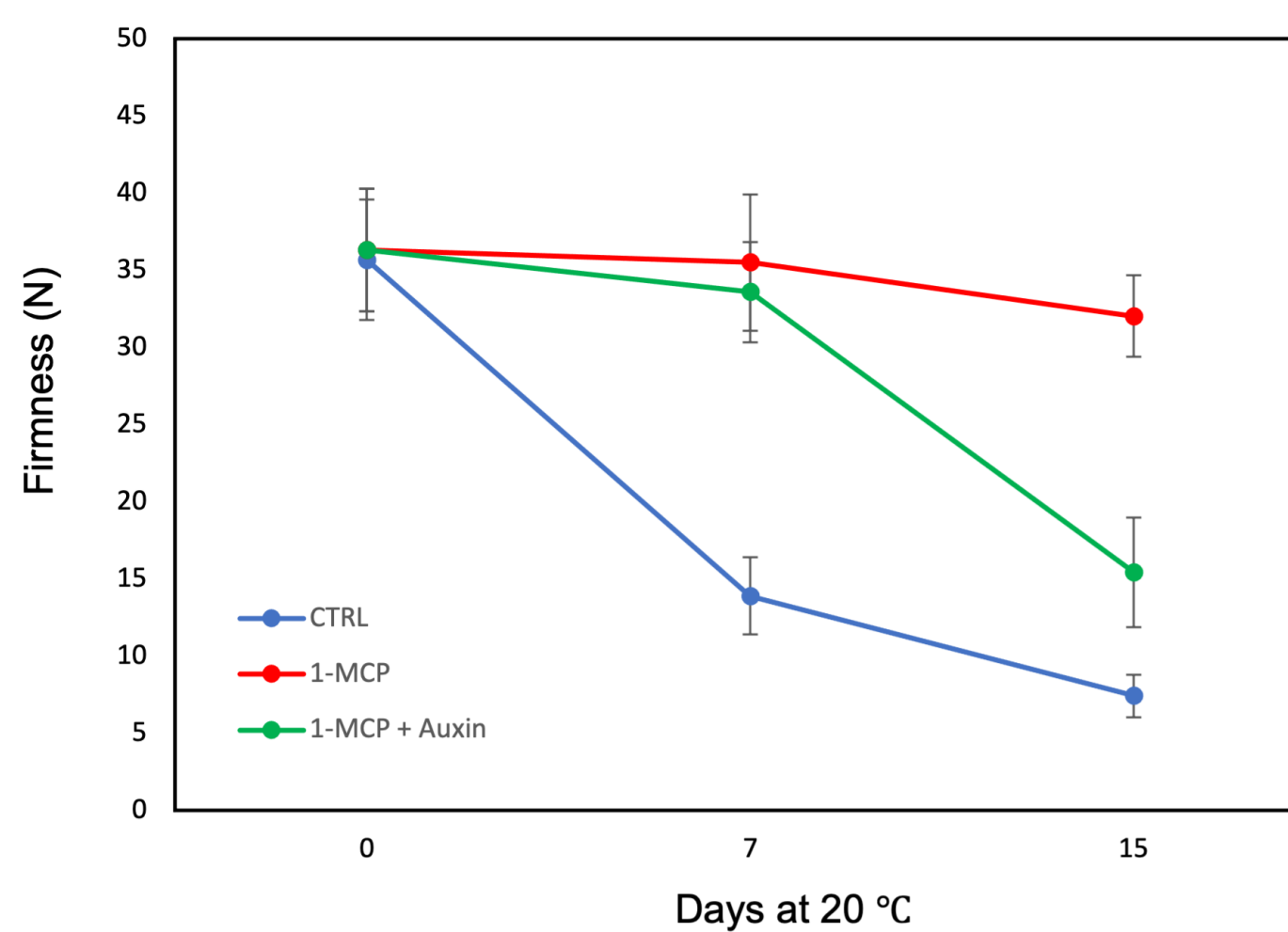
Detector

Ethylene measurement (Saquet & Almeida, 2017)

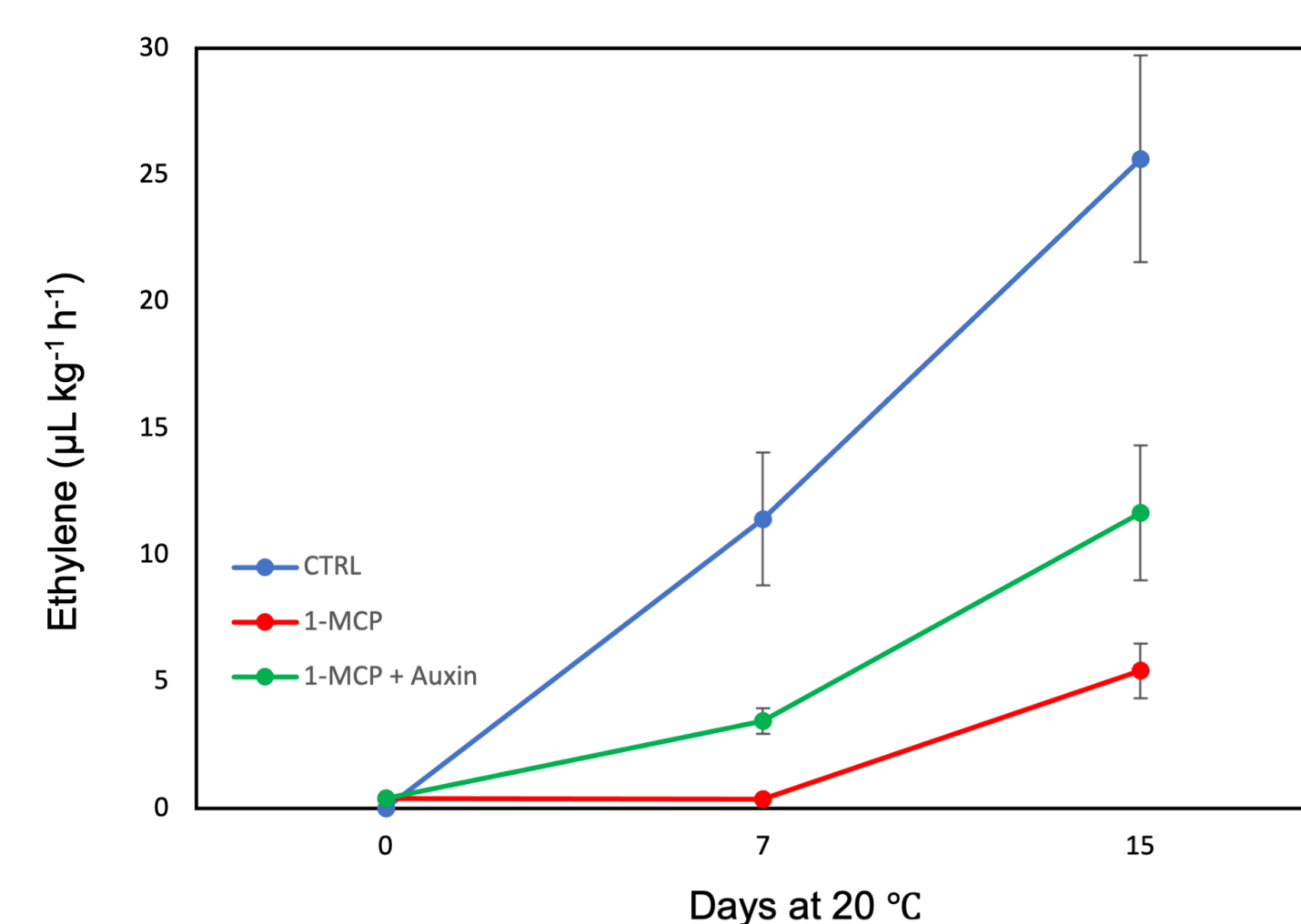
Respiration rate (Saquet & Almeida, 2017)



**Figure 1. Left:** Total soluble solids (TSS) of pear stored at RT for 7 and 15 days; **Right:** Hue angle of pear stored at RT for 7 and 15 days. CTRL (pear without any treatment); 1-MCP (pears previously treated with 1-MCP); 1-MCP + Auxin (1-MCP treated pears treated with auxin). Values are means  $\pm$  standard deviation of 6 determinations.



**Figure 2. Left:** Firmness of pear stored at RT for 7 and 15 days; **Right:** Respiration rate of pear stored at RT for 7 and 15 days. CTRL (pear without any treatment); 1-MCP (pears previously treated with 1-MCP); 1-MCP + Auxin (1-MCP treated pears treated with auxin). Values are means  $\pm$  standard deviation of 10 determinations for firmness and 3 determinations for respiration rate measurement.



**Figure 2. Ethylene production** of pear stored at RT for 7 and 15 days; CTRL (pear without any treatment); 1-MCP (pears previously treated with 1-MCP); 1-MCP + Auxin (1-MCP treated pears treated with auxin). Values are means  $\pm$  standard deviation of 3 determination with 3 pears each.

## Conclusions

- An overall impact on ripening promoted by 1-MCP and auxin is observed, especially on firmness, respiration rate and ethylene production. Comparing to CTRL it can be concluded the ripening blockage prompted by 1-MCP and the ripening induction due to the auxin treatment post-1-MCP.
- Despite having the higher content of soluble solids, the other ripening parameters revealed the lower respiration rate and lower ethylene production in 1-MCP treated pears, which is in accordance with a lower firmness and colour loss, since these pears are slower in terms of metabolic activity, thus expressing reduced ripening rate.
- Exogenous treatment with auxin effectively rebooted the ripening capacity since the values obtained for all the ripening parameters measured, especially after 15 days at RT are closer to the control. The higher ethylene production and respiration rate indicate a higher metabolic activity which is reflected on firmness and colour loss. Firmness loss can be related with higher activity of cell-wall enzymes activity.
- Time course physiological and biochemical analysis comparison with 'Rocha' pear normal ripening, revealed that ripening induction by the auxin treatment, after 1-MCP, is evident from around 60 % of fruit firmness loss and around 50 % increased internal ethylene production.
- The results provide information regarding how blockage caused by 1-MCP may be circumvented, thus opening avenues for consistent ripening of 'Rocha' pear and other cultivars.

## References

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## Acknowledgements

This work was co-supported by the European Fund for the Regional Development (FEDER), through the Internationalization and Competitiveness Operational Program (POCI), within the project: RE-EAT ROCHA PEAR (POCI-01-0247-FEDER-040016). We would also like to thank the scientific collaboration under the FCT project UIDB/50016/202 and FCT individual PhD grant (SFRH/BD/143560/2019)