

# CMR



International Conference on  
Multidisciplinary Research

## Effect of Naphthaleneacetic acid on restoring 'Rocha' pear ripening under 1-MCP evergreen effect



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# OUTLINE



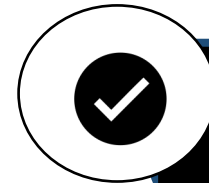
State of the art



Methodology



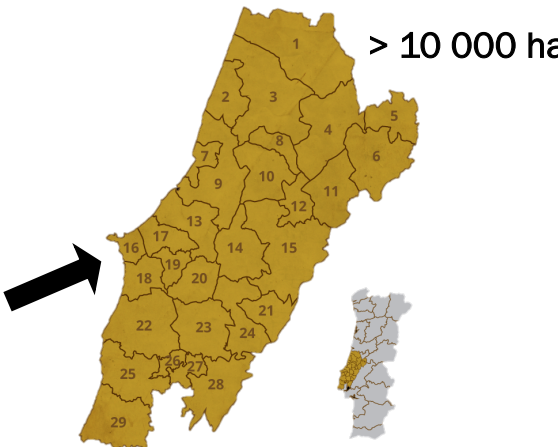
Results



Final remarks

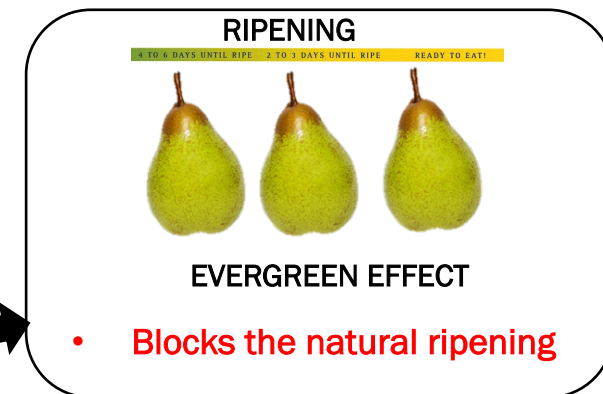
## 💡 State of the art

'Rocha' pear (*Pyrus communis* L. cv. Rocha)

- Exclusive cultivar from Portugal appreciated worldwide
- Denomination of Protected Origin (DOP) → "Pera Rocha do Oeste" → 
- Market
  - ✓ Average production: 173 000 tons/year
  - ✓ Main cultivar in Portugal ( $\pm$  93% of national pear production) and 4<sup>th</sup> in Europe
  - ✓ + 20 foreign markets
  - ✓ 60 % of production exported
  - ✓ 120 – 130 M€ revenue/year

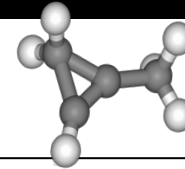
• Long-term storage for postharvest disorders prevention

- ✓ Until 2011: Cold storage + diphenylamine (DPA)
- ✓ Until now: Cold storage + 1-methylcyclopropene (1-MCP)

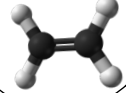


# Effect of Naphthaleneacetic acid on restoring 'Rocha' pear ripening under 1-MCP evergreen effect

## 1- Methylcyclopropene



### Ethylene



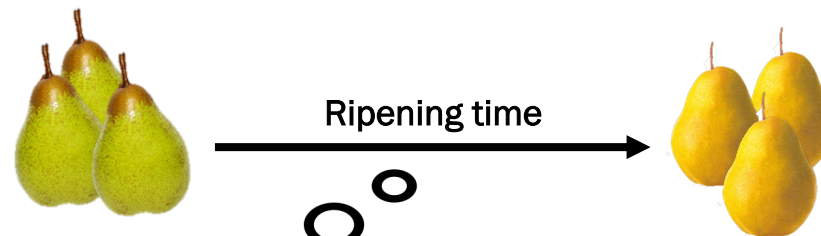
1-MCP is a **competitive inhibitor of ethylene action** since it binds irreversibly to the ethylene receptors, **preventing ethylene from binding and initiate ripening.**



Ethylene blocking does not allow pear to develop the **unique sensorial characteristics**, such as **colour, texture, aroma and flavour.**



There is the need for developing **strategies to recover 'Rocha' pear ripening capacity.**





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The postharvest ripening of strawberry fruits induced by abscisic acid and sucrose differs from their *in vivo* ripening

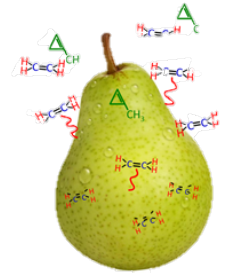
Tatiane Jéssica Siebeneichler, Rosane Lopes Crizel, Gustavo Henrique Camozatto, Bruna Trindade Paim, Rafael da Silva Messias, César Valmor Rombaldi, Vanessa Galli,



Auxin-activated MdARF5 induces the expression of ethylene biosynthetic genes to initiate apple fruit ripening

Pengtao Yue<sup>1</sup> , Qian Lu<sup>1</sup>, Zhi Liu<sup>2</sup>, Tianxing Lv<sup>2</sup>, Xinyue Li<sup>1</sup> , Haidong Bu<sup>1</sup> , Weiting Liu<sup>1</sup>, Yaxiu Xu<sup>1</sup>, Hui Yuan<sup>1</sup> and Aide Wang<sup>1</sup>

<sup>1</sup>College of Horticulture, Shenyang Agricultural University, Shenyang 110866, China; <sup>2</sup>Liaoning Institute of Pomology, Xiongyue 115009, China



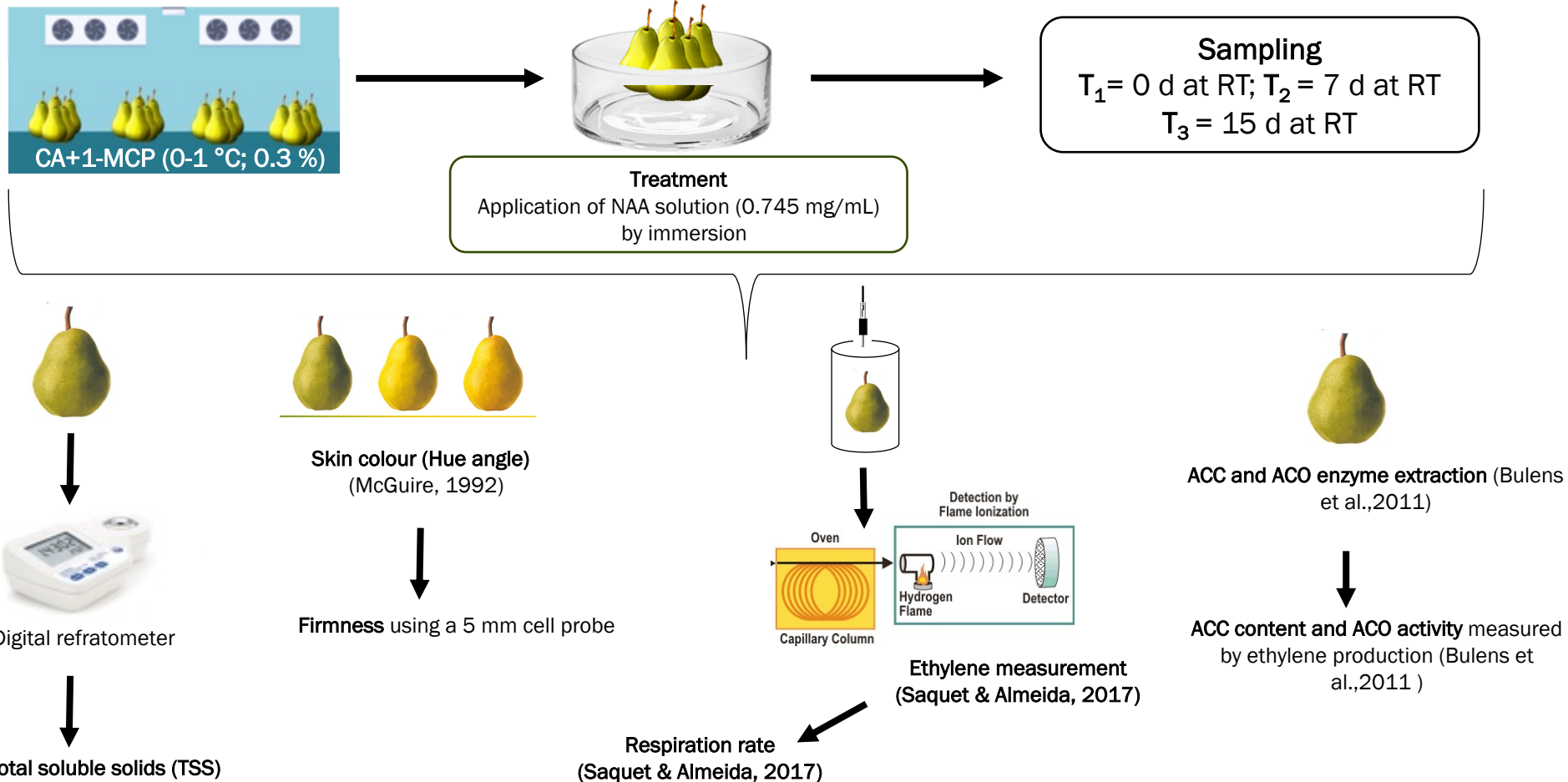
Hormones and other  
chemicals



Physical treatments with  
exogenous ethylene,  
temperature, CO<sub>2</sub>

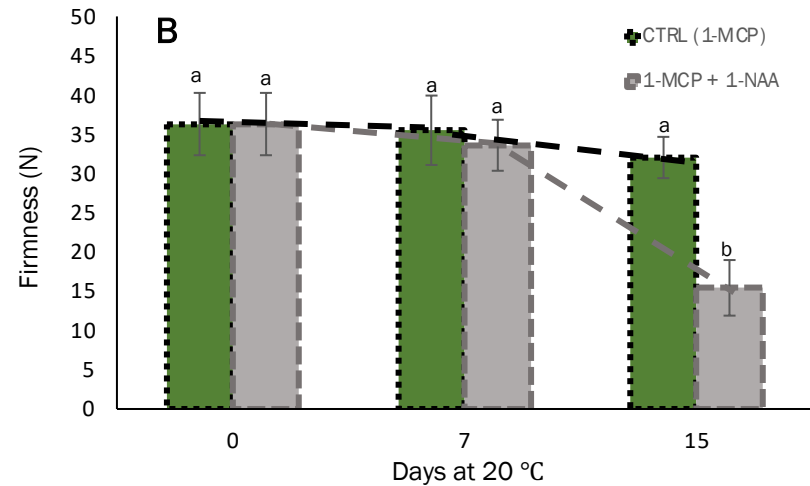
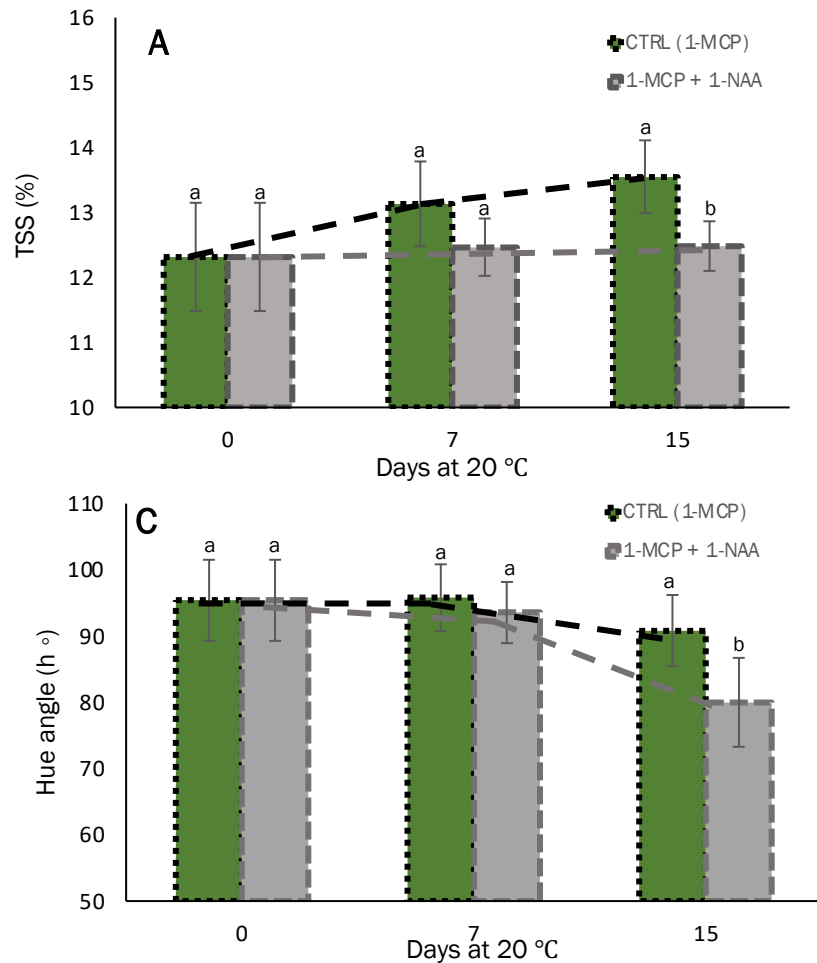
- The majority of the strategies are based on the application of **temperature** and **exogenous ethylene** or both, but demand high energy consumption.
- **Naphthaleneacetic acid (NAA)** is a **plant hormone** belonging to the **auxin family**, used in agriculture as **plant regulator**.
- **NAA application** on apples have demonstrated to **increase ACC oxidase enzyme activity**, responsible for the **production of ethylene**.

## Methodology



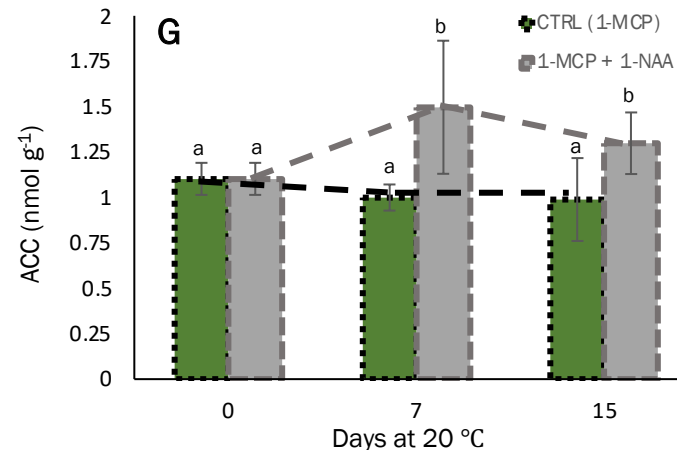
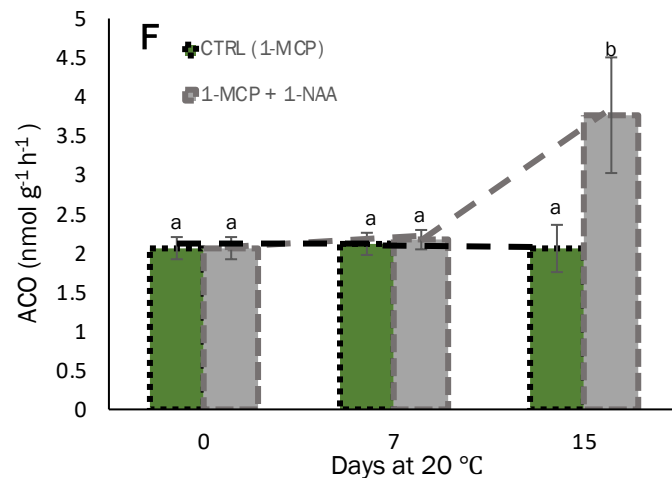
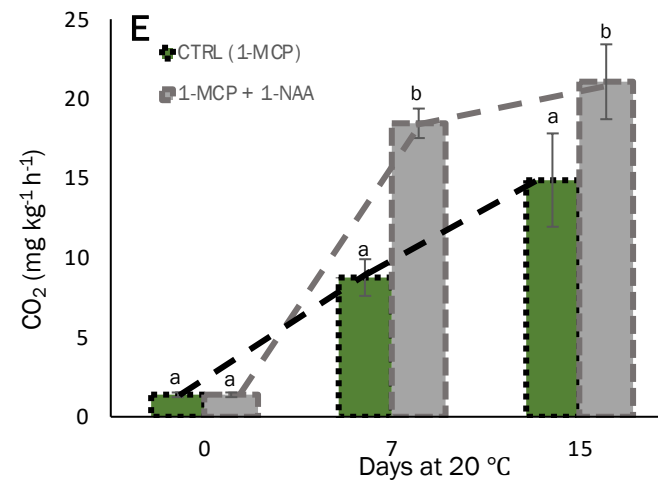
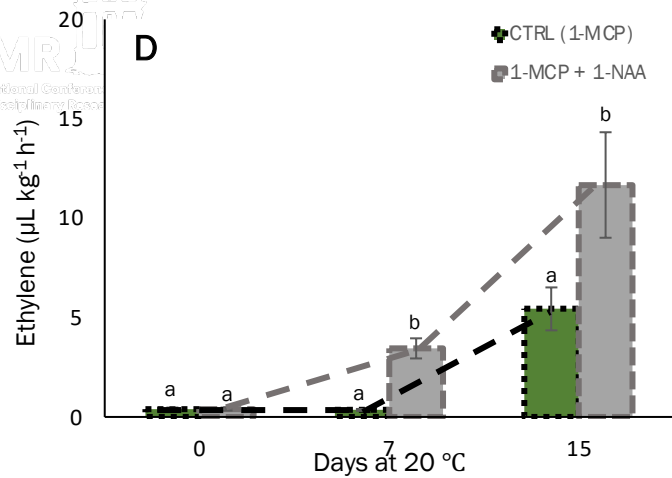


## Results



- CTRL (1-MCP) pear demonstrated **higher TSS** values, which is in **disagreement** with the results obtained regarding firmness and color loss.
- 1-MCP + 1-NAA pear show a **higher firmness** and **colour loss**, indicating that these pear had a **higher ripening rate** compared to 1-MCP treated pears.
- Ripening is known to promote **cell wall and chlorophyll degradation**, corroborating the effect of 1-NAA on promoting a faster ripening.

**Figure 1.** A: Total soluble solids (TSS) of pear stored at RT for 0, 7 and 15 days; B: Firmness of pear stored at RT for 0, 7 and 15 days. C: Hue angle of pear stored at RT for 0, 7 and 15 days. CTRL (pear only treated with 1-MCP); 1-MCP + 1-NAA (pears treated with 1-NAA after 1-MCP application). Values are means  $\pm$  standard deviation of 6 determinations. Different small letters indicate significant differences at  $p < 0.05$  calculated by t-student at each time-point.



**Figure 2. D:** Ethylene production of pear stored at RT for 0, 7 and 15 days; **E:** Respiration of pear stored at RT for 0, 7 and 15 days. **F:** ACO activity of pear stored at RT for 0, 7 and 15 days. **G:** ACC content of pear stored at RT for 0, 7 and 15 days. CTRL (pear only treated with 1-MCP); 1-MCP + 1-NAA (pears treated with 1-NAA after 1-MCP application). Values are means  $\pm$  standard deviation of 6 determinations. Different small letters indicate significant differences at  $p < 0.05$  calculated by t-student at each time-point.

- Ethylene production and respiration rate are in accordance with the previous results regarding firmness and colour loss. **Treatment with NAA significantly promoted ethylene production and respiration.**
- 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.**
- ACO** enzyme results revealed **higher activity** after **15 days at RT** corroborating the **higher ethylene production**. **ACC** content, despite not accompanying the profile of ACO activity revealed **higher content in NAA treated pear**, contributing in some part to the **higher ethylene production.**

## Final Remarks

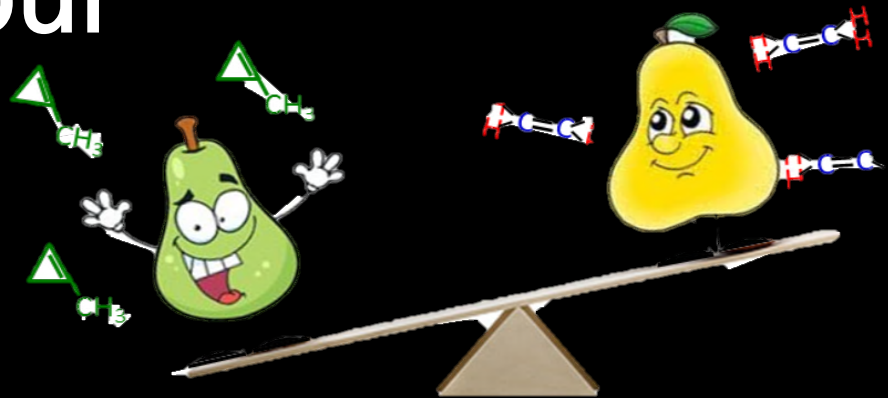
- An overall impact on ripening promoted by NAA post-1-MCP is observed, especially on **firmness, respiration rate, ethylene production and ACO activity**.
- Despite having the higher content of soluble solids, the other ripening parameters revealed the **lower respiration rate, ethylene production and ACO activity 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 NAA effectively rebooted the ripening capacity** since the values obtained for all the ripening parameters measured, especially after 15 days at RT are higher than the control. **The higher ACO activity led to a higher ethylene production and respiration rate indicating a higher metabolic activity** which is reflected on **higher firmness and colour loss**.
- 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.
- Further **genetic regulatory mechanisms will be studied** to better understand the action of this auxin.

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# Thank You For Your Attention!



## Acknowledgment

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