# GWL 2℃下梨之關鍵生育期溫度影響評估

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## 摘　要

臺灣位於亞熱帶地區，若要生產溫帶果樹即需克服氣候條件的落差。梨為臺灣主要經濟溫帶果樹之一，依據栽培方式可概分為溫帶梨(高海拔梨)與高接梨，兩者生長期皆對溫度相當敏感。梨為落葉喬木果樹，休眠期需累積足夠低溫，才能克服內生性休眠，此也關聯後續是否可順利開花結果及接穗順利癒合；但若順利開花結果後溫度過低又可能造成低溫損害。依據 2011 年至 2020 年農業部農業損失統計，暖冬(含乾旱)為梨主要受災類型，其造成損失百分比高達 75%，例如 2019 年年初即因積冷量所需低溫不足，又適逢高接梨接穗期，使得梨穗結果率低落。同樣依據前列農業損失統計，開花結果時遭逢的低溫則為梨次嚴重的災害源，其造成的損失百分比達 29.6%，梨開花結果受低溫衝擊的栽培面積更逾一萬公頃。每年冬季梨穗累積低溫至開花結果期，低溫發生的時間區間牽動梨生育期的脆弱程度變化。

依據文獻所述，溫帶果樹打破休眠低溫需求條件為 7.2℃，開花結果後的低溫損失門檻為 10℃。本研究以氣候變遷下國家調適應用情境全球暖化程度 2℃(GWL 2℃)為主要分析情境，氣候資料來源為國科會「臺灣氣候變遷推估資訊與調適知識平台計畫(TCCIP)」所產製之 IPCC AR6 提供之統計降尺度溫度日資料，應用於比較基期(1995 年-2014 年)與 GWL 2℃(2041 年-2060 年)情境下，溫帶梨及高接梨分別於休眠期(12 月)至開花結果期(隔年 3 月)低溫發生日數的變化率。

本研究比較基期與 GWL 2℃情境下之梨打破休眠低溫需求變化率及低溫損失門檻結果顯示：(1) 打破休眠期－溫帶梨產區(12 月至 2 月間)各旬低溫發生日數較基期減少約 6%~20%，而高接梨產區(12 月至 1 月間)各旬低溫發生日數則較基期減少約 42%~59%；(2) 低溫損失門檻－整體低溫低於 10℃的發生率較基期呈現下降趨勢，其中溫帶梨開花後期低溫發生率較基期減少 6%~27%；高接梨發生率則減少 29%~41%。

冬季積冷量能否滿足溫帶果樹生理需求，將影響樹體養份、接穗癒合及嫁接成功率。GWL 2℃情境下，溫帶梨打破休眠期積冷量減少，為接續將面臨的首要衝擊；高接梨仍可靠成熟的栽培技術與管理減輕影響，但需留意梨穗供應穩定性。相反地，因 GWL 2℃情境下低溫發生率減少，未來梨因低溫損害的機會也會降低，但如高溫逢開花結果期，可先採用物理性降溫方式，如增加梨花遮陰。

**關鍵詞：**溫帶梨與高接梨、低溫、生長期、積冷量、氣候變遷

# Assessment of Temperature Impact on Critical Phases of Pear Growth by Scenario GWL 2℃


## Abstract

Pear is one of Taiwan's main economic fruit trees. Depending on the cultivation method, pears can be broadly categorized into temperate pears (high-altitude pears) and high-grafted pears; both types are highly sensitive to temperature during their growth period. Pears are deciduous tall trees that require sufficient low temperatures during dormancy to overcome endodormancy, which is crucial for subsequent flowering and fruiting as well as successful grafting. However, if the temperature is rather low after successful flowering and fruiting, pears may affect by cold damage. The phase from low temperature accumulation to flowering and fruiting would significantly affect the pear's vulnerability of growth in winter.

The chilling requirement for temperate fruit trees to break dormancy is 7.2°C, and the threshold for cold damage to flowers and fruit is 10°C. Results of this study by compares the changes in chilling requirements and cold damage thresholds for pear trees under scenarios of the baseline and GWL 2°C: (1) chilling period - compared to the baseline, the number of days with low temperatures in temperate pear growing regions (from December to February) decreased by about 6% to 20%, while in high-grafted pear regions (from December to January), the number of days decreased by about 42% to 59%; (2) loss threshold of low temperature - compared to the baseline, the overall incidence of temperatures below 10℃ shows a decreasing trend with a 6%-27% reduction in low temperatures during the late flowering stage of temperate pears and a 29%-41% reduction for high-grafted pears.

Whether the accumulated winter chill can meet the physiological requirements of temperate fruit trees that may affects nutrient absorption, scion healing, and grafting success rate. Under the GWL 2℃ scenario, the decrease in chill accumulation for temperate pears to break dormancy will be the primary challenge. Advanced cultivation techniques and management can mitigate the impact on high-grafted pears, but scion supply stability must be monitored. Conversely, the reduced occurrence of low temperatures under the GWL 2℃ scenario will lessen the future risk of cold damage to pears. However, if high temperatures coincide with the periods of flowering and fruiting that physical cooling methods such as increasing shade for pear blossoms can be adopted.



**Keywords:** Temperate pears and high-grafted pears, growth period, low temperature accumulation, loss threshold, climate change