



Transient Water Stress Responses in Young Potted

Malus domestica Borkh

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INTRODUCTION

- Irrigation management can be used as a horticultural tool and to conserve water resources.
- Problem:** There has been evidence to suggest that differences exist in water stress responses amongst apple cultivars
- Isohydic cultivars maintain constant leaf water potential by reducing stomatal conductance under water deficit conditions.
- Anisohydic cultivars on the other hand, keep their stomata open much longer under water deficit conditions and allow their leaf water potential to decrease to a specific threshold.
- Implications:** Caution should be used when using plant water status as a ecophysiological stress indicator for making irrigation decisions.
- Objective:** Test whether there three popular apple cultivars have different water stress response characteristics

MATERIALS AND METHODS

- 2nd leaf 'Gala', 'Granny Smith' & 'Honeycrisp' on M9 T337 rootstock
- Transient diurnal water stress with high evaporative demand (max temp was 98 °F, VPD 3.71 kPa)
- Plant water status measures as predawn leaf water potential (ψ_{pd}), midday stem water potential, (ψ_{md}), leaf water potential (ψ_l)



Stomatal conductance



Plant water status

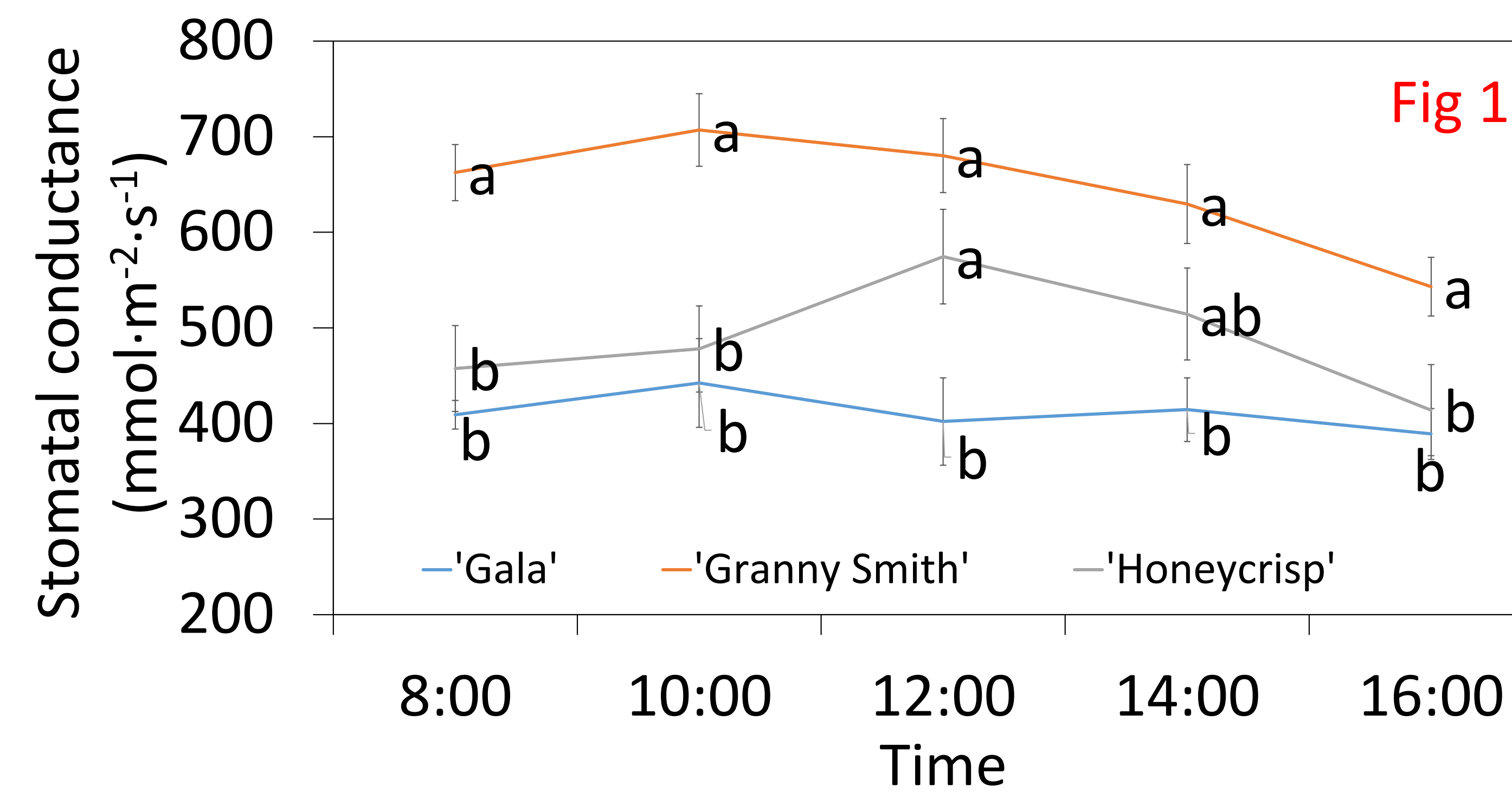


Chlorophyll fluorescence

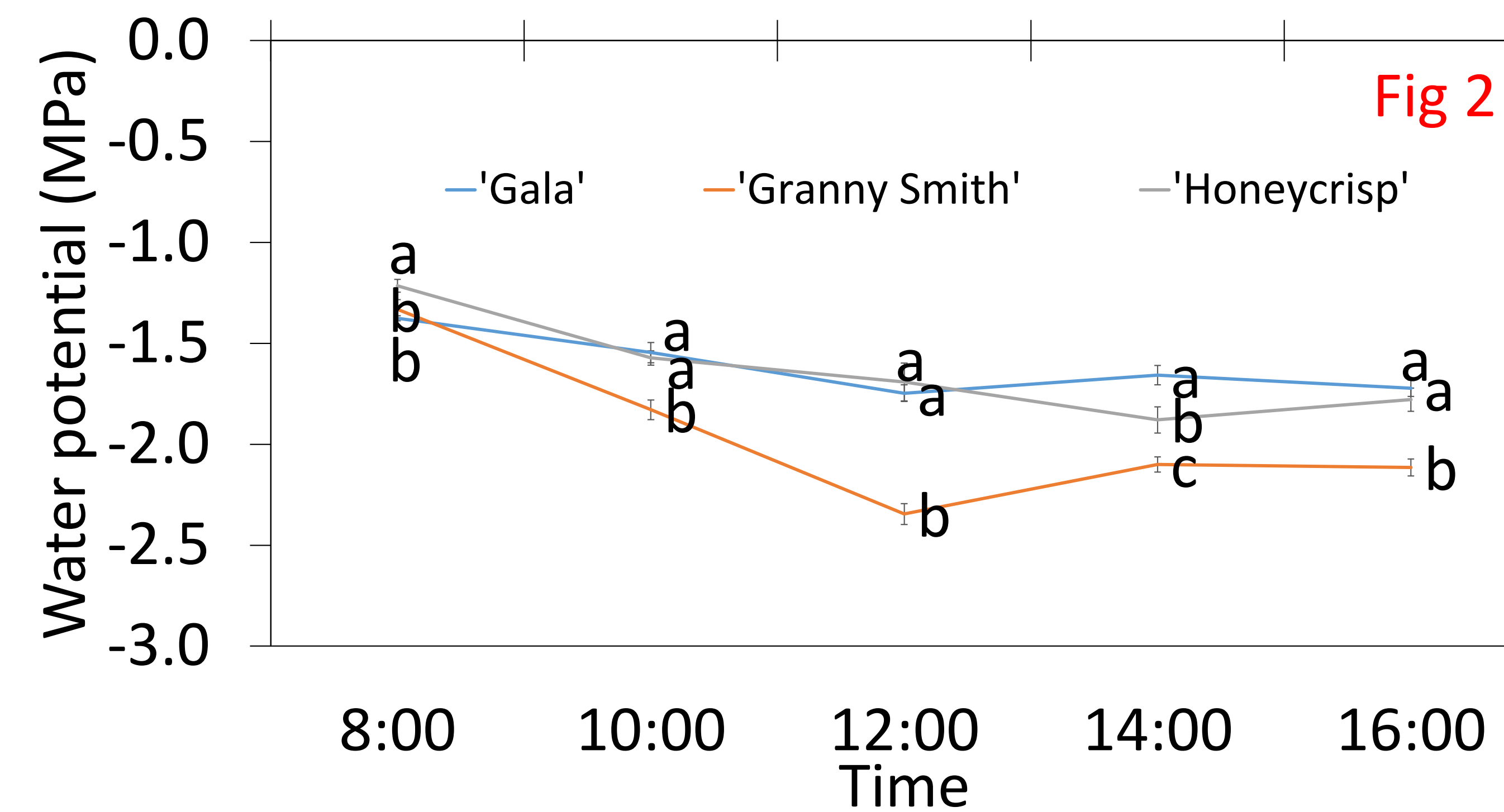


Leaf spectral reflectance

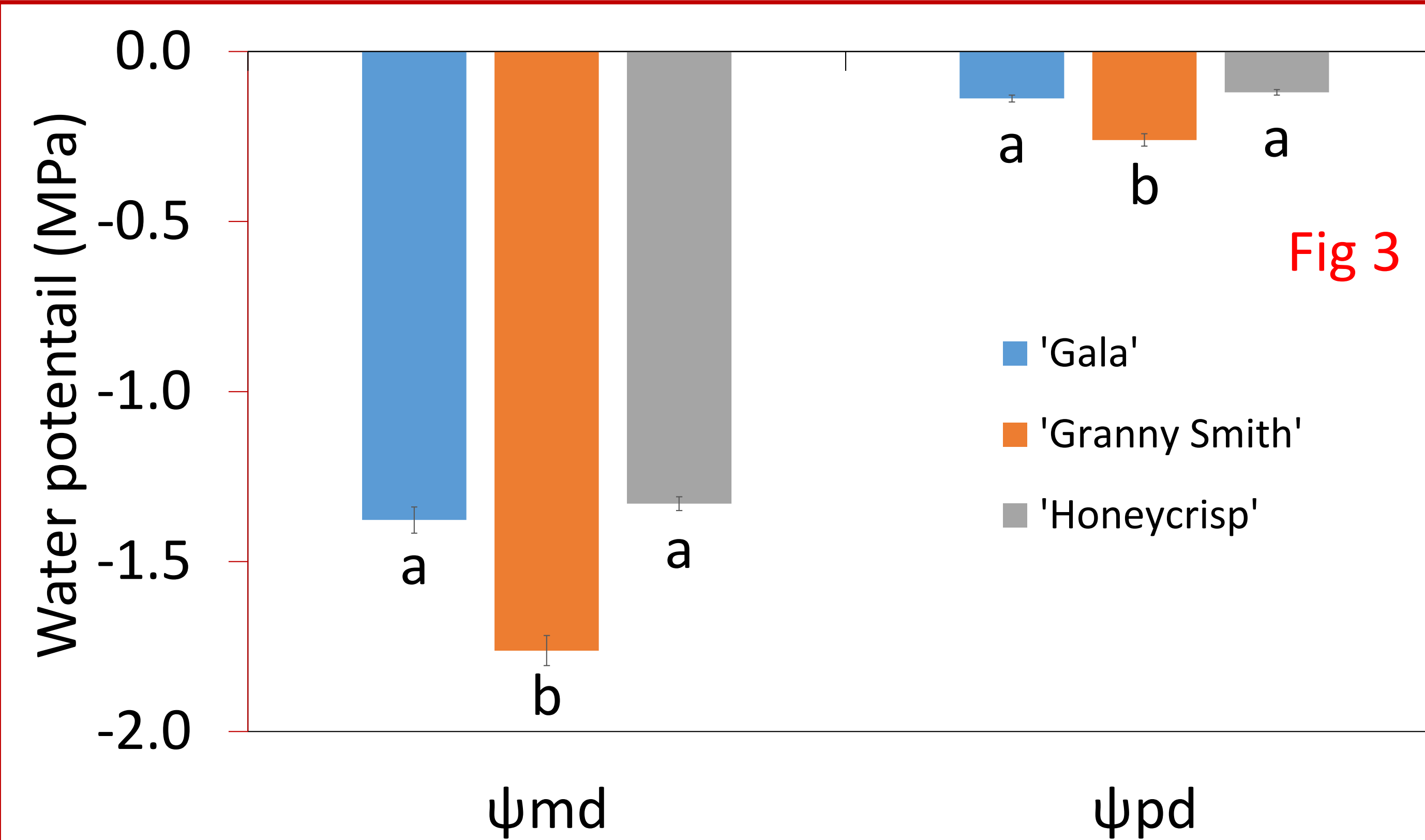
RESULTS



- Stomatal conductance was higher in 'Granny Smith' compared to 'Gala' and 'Honeycrisp' at all sampling times (Fig 1).



- Except for 08:00, ψ_l was more negative in 'Granny Smith' compared to 'Gala' and 'Honeycrisp' (Fig 2).



- ψ_{md} and ψ_{pd} were significantly lower in 'Granny Smith' compared to 'Gala' and 'Honeycrisp' (Fig 3).

- Volumetric soil water content was 20.66 m³·m⁻³ ('Honeycrisp'), 20.14 m³·m⁻³ ('Granny Smith'), and 19.93 m³·m⁻³ ('Gala'), therefore differences in soil water content did not affect plant water status.

RESULTS



'Granny Smith' 'Honeycrisp' 'Gala'

- Wilting response from long-term water deficit was first observed in 'Granny Smith' since it kept stomata open under water stress (Fig 4)
- There were no differences in maximum photochemical efficiency of PSII (Fv/Fm), quantum photosynthetic yield of PSII (Φ_{PSII}) between the three cultivars and photochemical reflectance index (PRI) (data not shown)

CONCLUSION & FUTURE DIRECTIONS

- 'Gala' and 'Honeycrisp' had a more controlled response to water stress (isohydic) compared to 'Granny Smith' (anisohydic)
- The use of plant water status as an ecophysiological water stress indicator needs to be revisited
- Irrigation in anisohydic cultivars should be more carefully managed

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