

How Does Timing of Carbon Limitation Affect Flower Production in Pyrethrum

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Introduction

- ❖ Pyrethrum is a perennial member of the Asteraceae family.
- ❖ Production occurs in Northern Tasmania and Ballarat region of Victoria
- ❖ First harvest occurs 18 months from sowing



Spring

Summer

Autumn

Winter

Spring

Summer

Introduction

- ❖ Insecticidal compounds (Pyrethrins) are extracted from the flowers.
- ❖ Flowers contain approximately 90% of plant pyrethrins
- ❖ Natural pyrethrum insecticides used in agricultural, home and industrial settings world wide
- ❖ Australian production supplies between 60 to 70% of the world market with a farm gate value of \$20 million



Importance

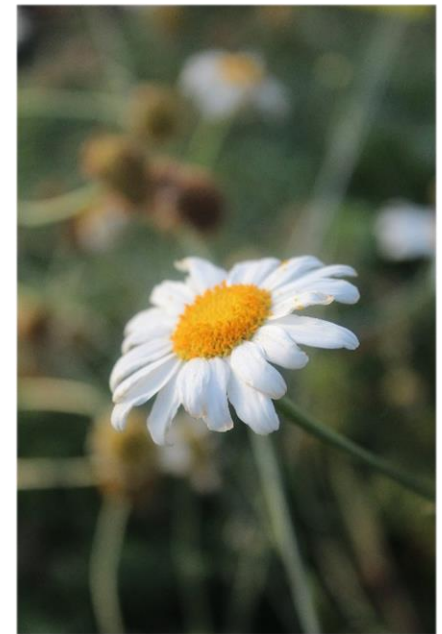
The main challenge for growers is variation in pyrethrin yields

Pyrethrin yield:

- ❖ Flower biomass (number and size)
- ❖ Concentration of pyrethrins

What influences flower number and size?

- ❖ Vernalisation? – yes
- ❖ Day length? – no
- ❖ Light capture? - yes



Knowledge gaps

- ❖ How light intensity influences key stages of flower development
- ❖ How limited light intensity influences key stages of flower development

Aim

To investigate how limited light intensity at key stages of plant development effects flower growth and development.



Hypotheses

1. Decreased light intensity pre-flowering will result in fewer and smaller flowers
2. Decreased light intensity experienced during flowering will have less impact on flower number and size rather than pre-flowering.



Experimental Design

8 genotypes, each with 5 clones (replicates)

Established in glasshouse at 20 °C

Vernalised for 6 weeks at 6 °C

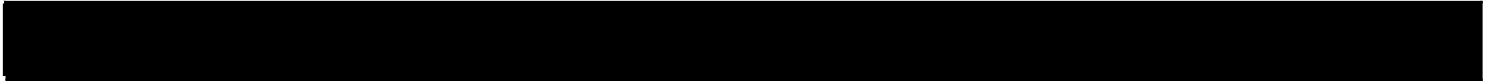
Light intensity was reduced by 70%

One replicate of each genotype was randomly allocated to each shade timing treatment

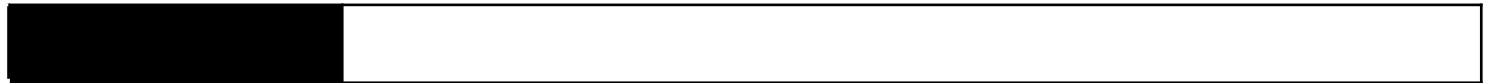


Treatments

Full Shade



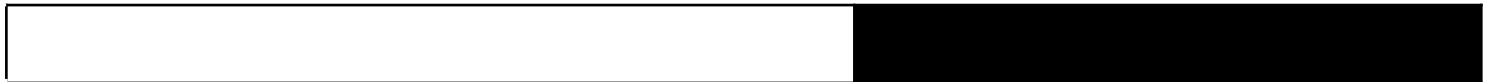
Vegetative



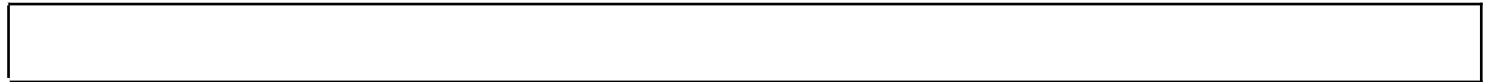
Early RG



Late RG



Full Sun



Vegetative



Reproductive Growth



Measurements

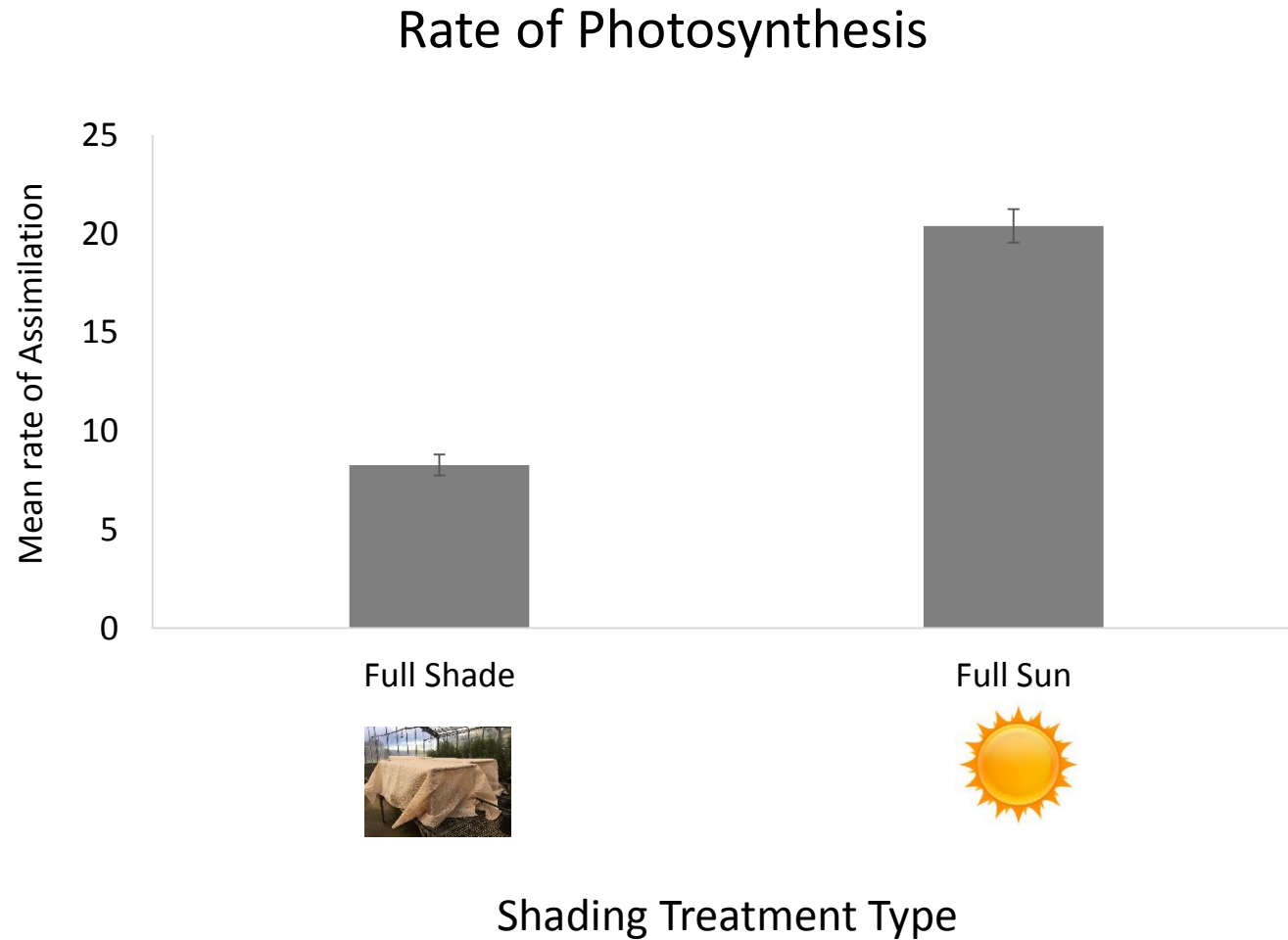
Morphological Measurements



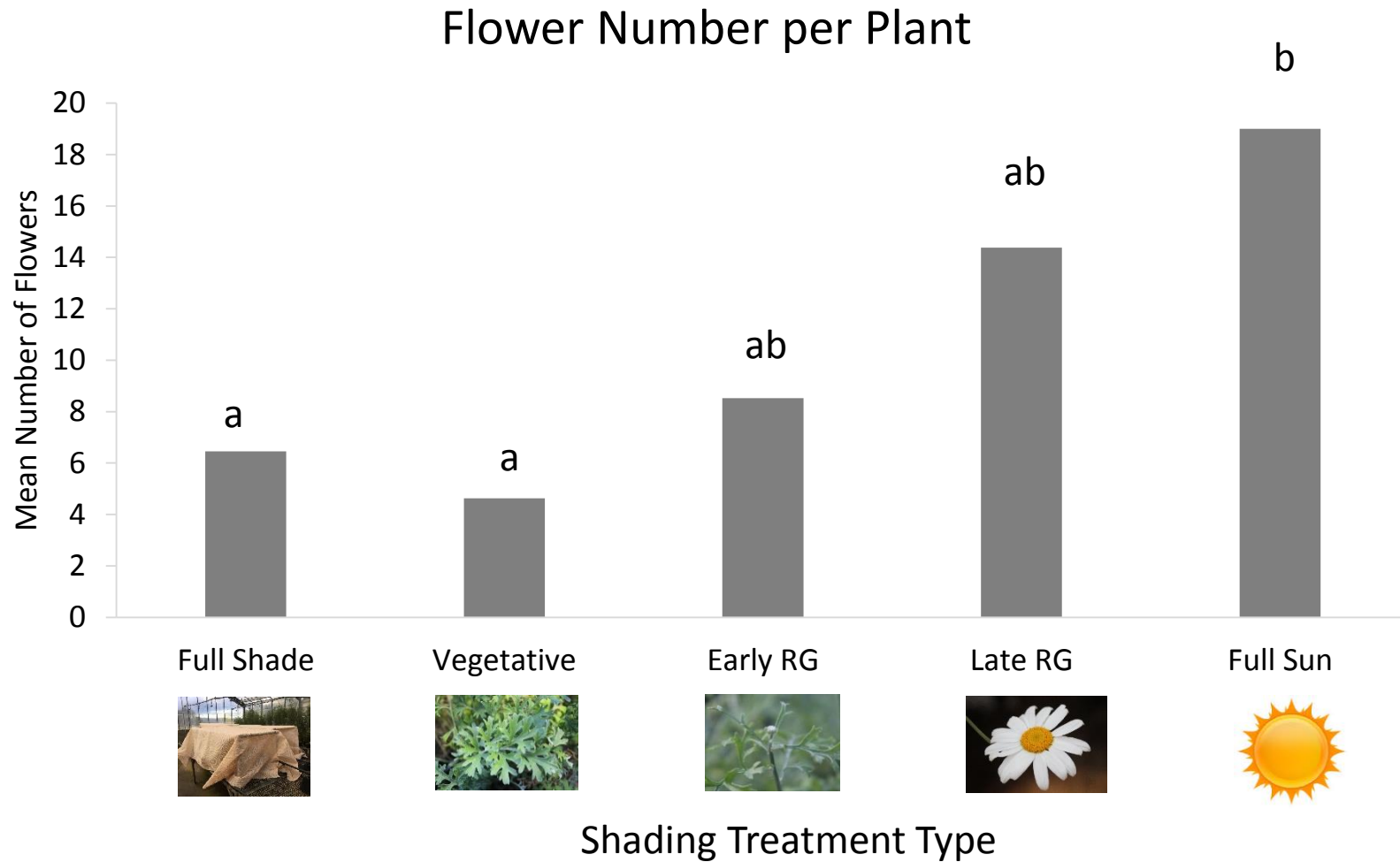
Assimilation Measurements



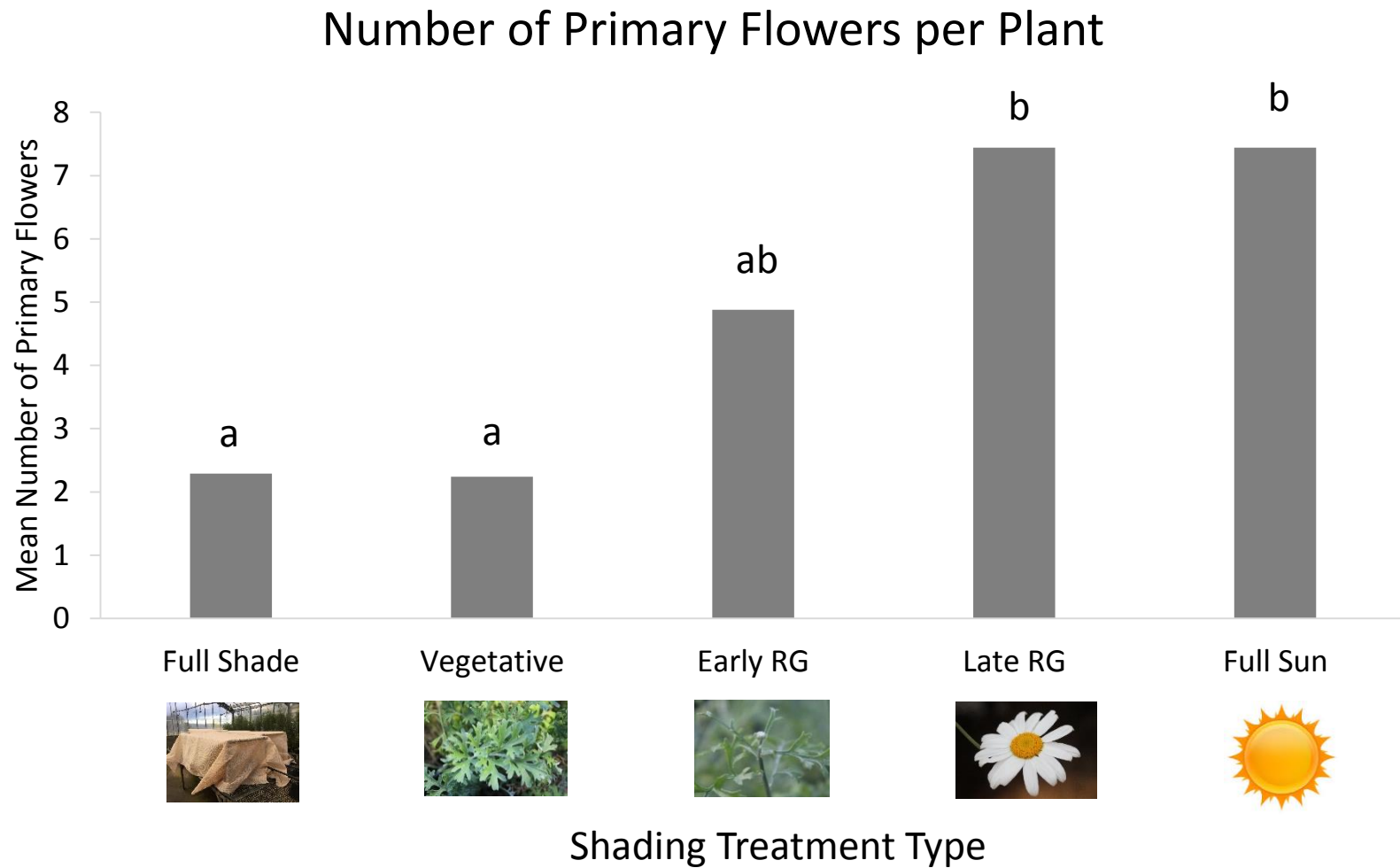
Results: *Assimilation*



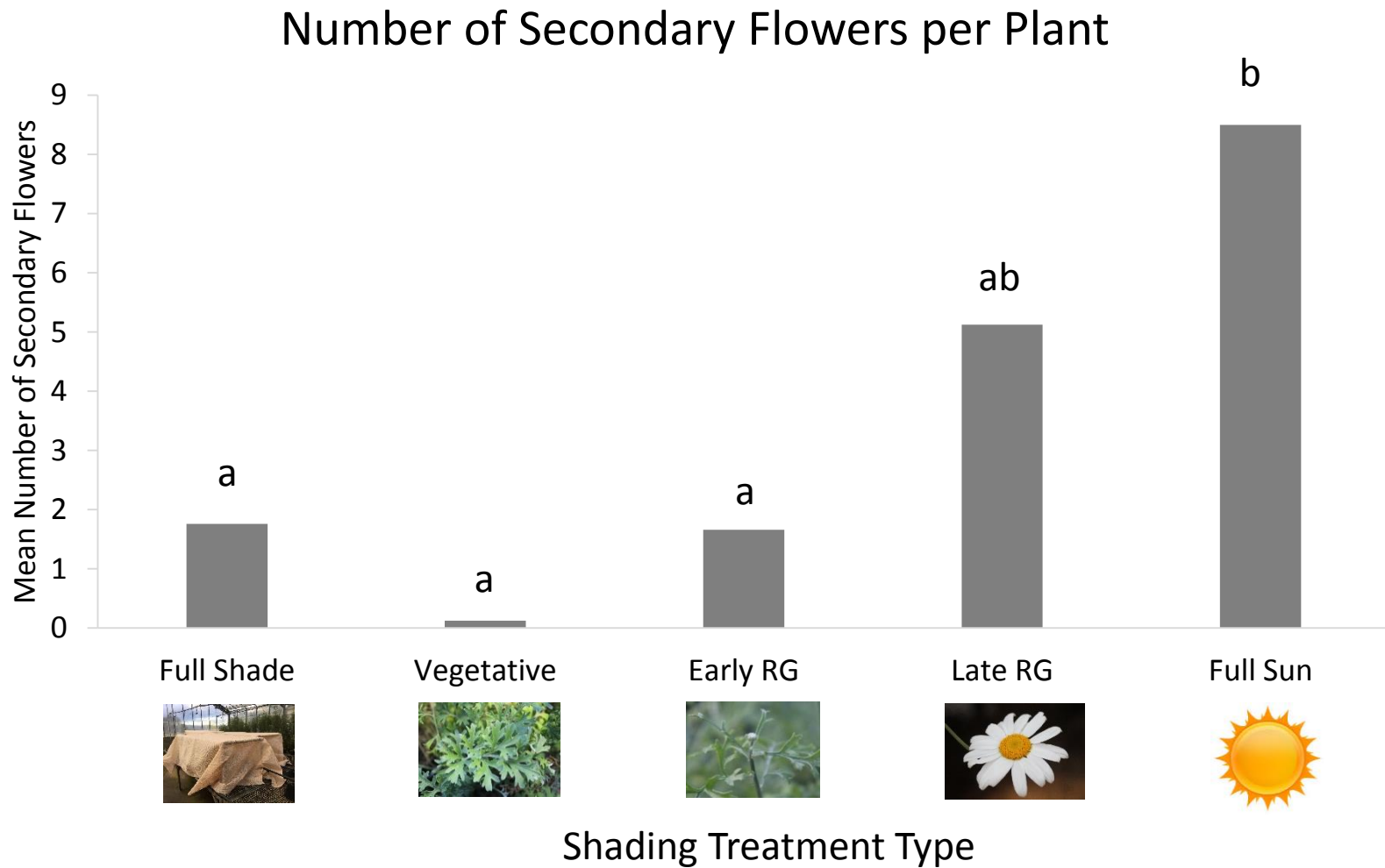
Results: *Flower Number*



Results: *Flower Number*



Results: *Flower Number*



Recap: *Flower Number*

Plants shaded during vegetative growth:

- ❖ Produced less flowers per plant
 - lower number of primary and secondary flowers

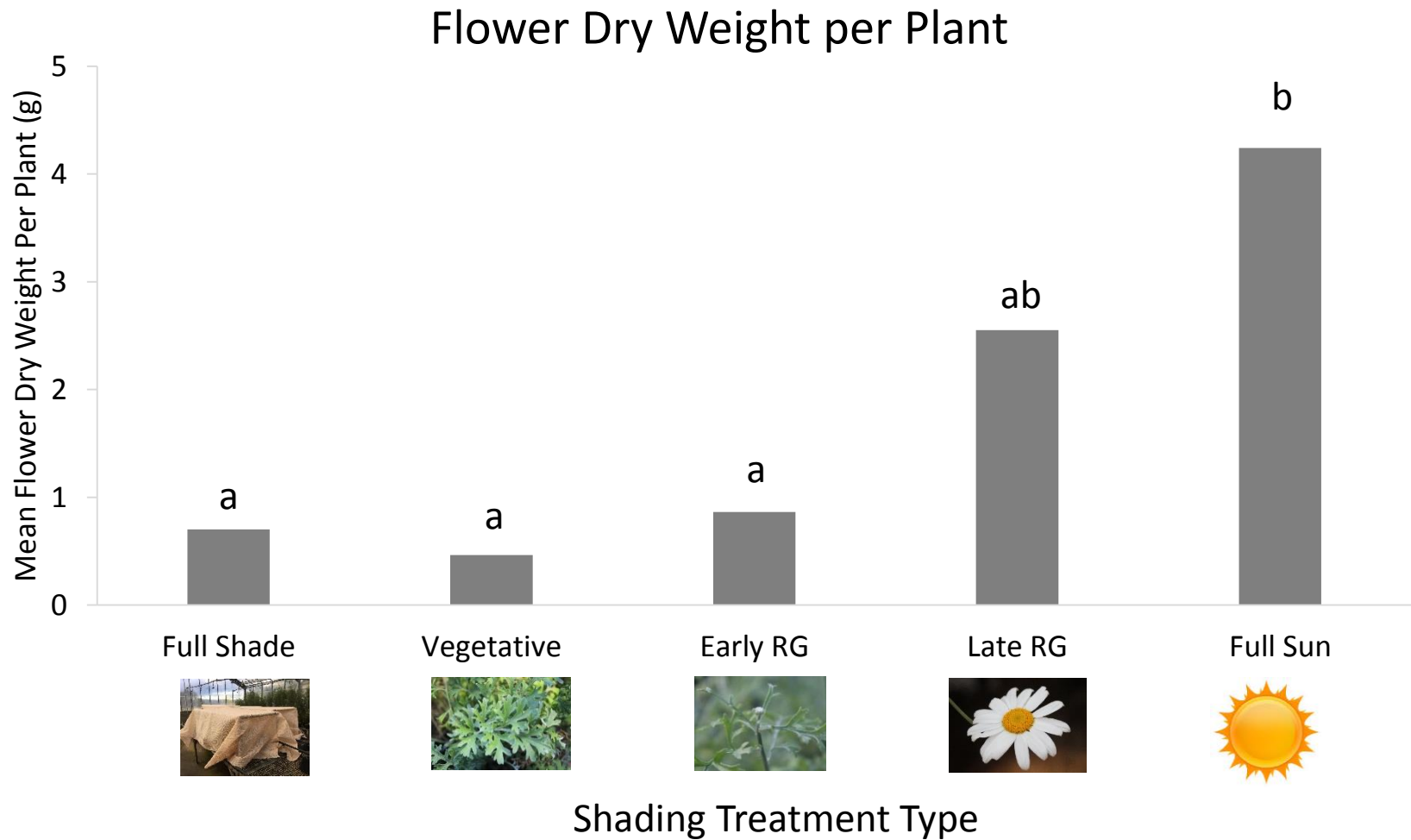
Shading during early reproductive growth:

- ❖ Resulted in a lower number of secondary flowers

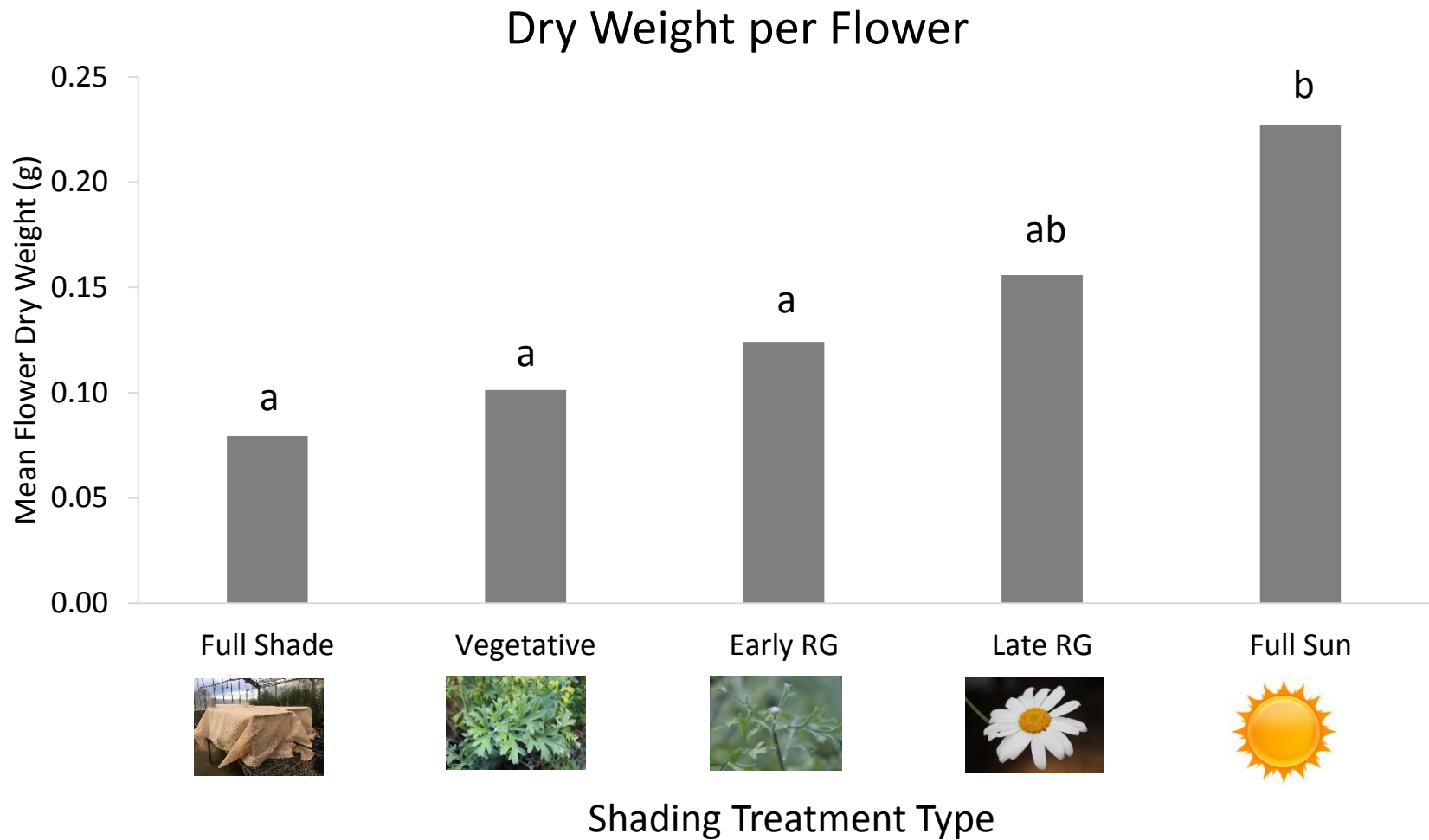
Shading during late reproductive growth:

- ❖ Did not significantly influence the number of flowers

Results: *Dry Weight*



Results: *Dry Weight*



Take Home Messages

Project Conclusions

Carbon limitation during vegetative Stage:

- ❖ Least number of flowers and flower weight



Carbon Limitation during early reproductive growth:

- ❖ Less secondary flowers
- ❖ Lower flower weight



Carbon limitation during late reproductive growth:

- ❖ Flower number and weight was not significantly influenced



Take Home Messages

Industry Relevance

- ❖ Carbon uptake during vegetative growth following vernalisation has a greater impact on flower production in pyrethrum
- ❖ Limitation of other resources may also influence flower growth and development

Crop management is crucial during the vegetative stage of growth to ensure adequate flower production to maximise pyrethrin yield

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