**The circadian clock modulates bud outgrowth in pea via the strigolactone signalling pathway**

Dun EA1, Jones S1, Dudley C1, Amoo O1, Rameau C2, Weller JL3, Beveridge CA1

*e.dun@uq.edu.au*

1 School of Agriculture and Food Sustainability and ARC Centre of Excellence for Plant Success in Nature and Agriculture, The University of Queensland, St Lucia, QLD 4072 Australia

2 INRAE, AgroParisTech, Institut Jean-Pierre Bourgin, 78000 Versailles, France

3 School of Biological Sciences and ARC Centre of Excellence for Plant Success in Nature and Agriculture, University of Tasmania, Hobart, Tasmania 7001 Australia

Shoot architecture is an important determinant of yield in several crops. Outgrowth of axillary buds is altered by changes in photoperiod and in photoperiod-insensitive mutants. The mechanism by which photoperiod regulates bud outgrowth is unknown, but photoperiod effects are observed in many plants including garden pea (*Pisum sativum*). We utilised the photoperiod-insensitive circadian clock mutant *die neutralis* (*dne*) to study photoperiodic and circadian clock effects. *DNE* is orthologous to arabidopsis *EARLY FLOWERING4* that encodes a member of the Evening Complex, a core circadian clock component. We show that circadian clock regulation of bud outgrowth involves long-distance signalling and activation of genes involved in the strigolactone response and downstream pathway. Experiments with *dne* and strigolactone double mutants showed that strigolactone response*,* but not strigolactone synthesis, is required for circadian clock regulation of bud outgrowth. It is likely that the circadian clock pre-conditions buds for differing growth response capacities to endogenous signals through modulating strigolactone signalling. In this study, we observed effects of the absolute photoperiod (the number of hours within a 24 hour period during which the plant receives light), separately to the metabolic photoperiod (the period across the day during which a plant has a net carbon gain). Experimentation with different light intensities and photoperiods suggest that the circadian clock and DNE enables plants to adapt to environmental conditions by predicting energy availablity. These insights will help future endeavours to predict and optimise flowering and branching responses in different environments, providing knowledge relevent to crop yield and reproductive success.