

Climate effects on blackcurrant – research at the James Hutton Institute, Dundee



The James
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Institute

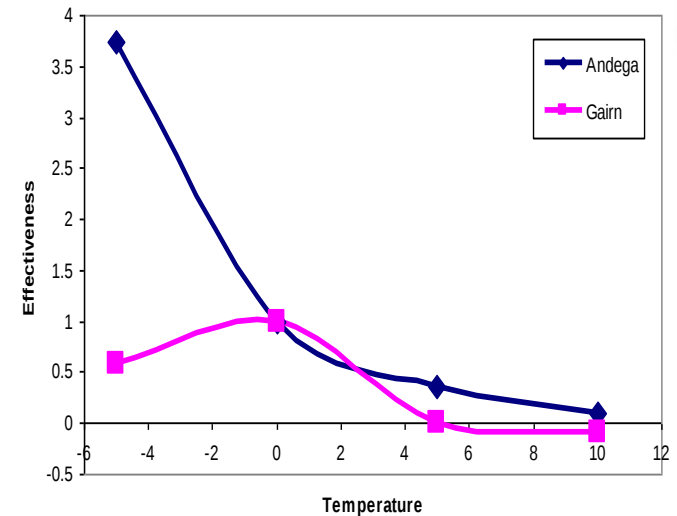
Climate Research in *Ribes* at JHI

- Two main areas of research:
 - Development of rapid high-throughput screening techniques for breeding populations from JHI programme
 - Identification of climate-controlled mechanisms in blackcurrant
 - ▶ Includes winter chilling effects on dormancy
 - ▶ Gene discovery and marker development
 - ▶ Search for generic mechanisms in other woody species

Screening of blackcurrant germplasm

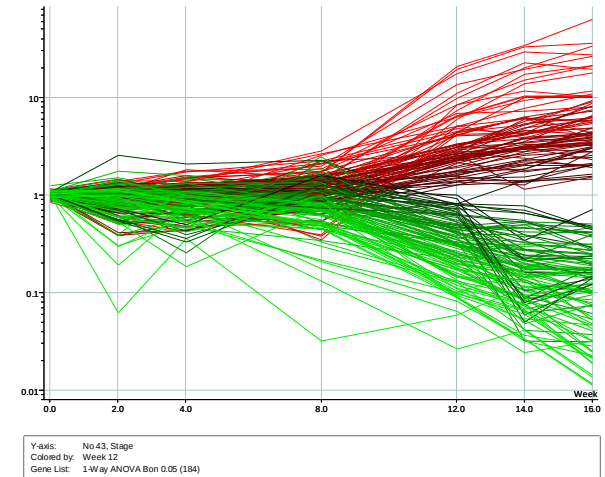
- Initial work in CE rooms found that different cultivars have different temperature responses
 - ▶ Effectiveness of various chilling temperatures in satisfying chilling requirement varied significantly between cultivars
 - ▶ The standard baseline measure of hours below 7.2 °C was inappropriate in the majority of cases

- Current work is based on field sampling and modelling of different base temperatures
 - ▶ Samples of diverse genotypes (UK, NZ) taken weekly in field and brought into forcing environment
 - ▶ Models applied to data from budbreak and flowering to identify the optimum base temperature for chilling



Dormancy research in *Ribes* at JHI

- Gene expression at dormancy break assessed using microarrays
- Candidate genes showing differential regulation at dormancy identified
 - ▶ Mapped onto blackcurrant linkage map, and co-locate with QTL for budbreak
 - ▶ Same gene(s) also reported in other woody species
 - ✦ Eg. SERB02K12, a β tubulin, associated with dormancy release in tree buds
- Variation between high- and low-chill cvs. and populations is under evaluation
 - ▶ Potential for gene-based marker development for rapid assessments
 - ▶ Utilisation of extensive genomic resources at JHI, including outline genome sequence currently under development



Collaborative work with P&F NZ

- Use of low-chill NZ germplasm in crossing programme at JHI
- Mapping population of Ben Dorain x Sefton (high chill x low chill)
 - ▶ Population raised in NZ, subset sent to JHI in autumn 2012
 - ▶ DNA extracted from individuals, profiling scheduled for 2013, alignment with phenotype data from NZ
 - ▶ Phenotype data from Scotland planned from 2014
 - ▶ Identification of key QTL linked to dormancy break/chilling response



Relevant publications from JHI

- Jones, H.G., and Brennan, R.M. (2009) Potential impacts of climate change on soft fruit production: the example of winter chill in *Ribes*. *Acta Horticulturae* **838**: 27-32
- Hedley, P.E., Russell, J.R., Jorgensen, L., Gordon, S., Morris, J.A., Hackett, C.A., Cardle, L. and Brennan, R.M. (2010). Candidate genes associated with bud dormancy release in blackcurrant (*Ribes nigrum* L.). *BMC Genomics* **10**: 202
- Jones, H.G., Hillis, R.M., Gordon, S.L. and Brennan, R.M. (2013) An approach to the determination of winter chill requirements for different *Ribes* cultivars. *Plant Biology* **15**: 18-27
- Atkinson, C., Brennan, R.M. and Jones, H.G. (2013). Declining chilling and its impact on temperate perennial crops. *Environmental and Experimental Biology* **91**: 48-62