

Developing Potatoes Resilient to Environmental Stresses



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The Problem and Rationale

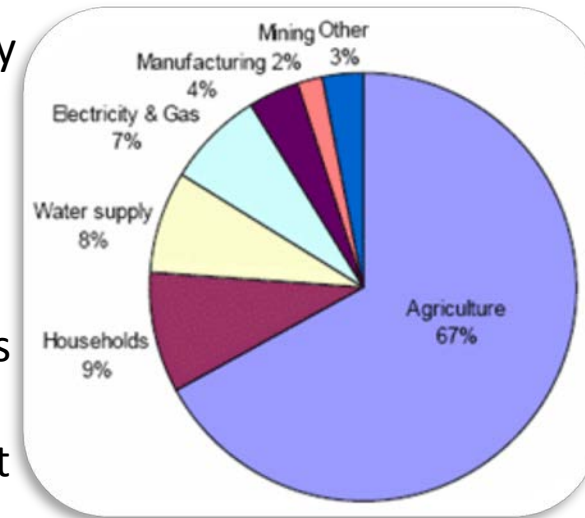
- Major stresses
- Water stress
- Salinity
- Elevated Temperature
- Frost



Food Security and Water Security

- ➔ Global population is expected to reach 8.1 billion by 2030
- ➔ Worldwide food prerequisite is expected to increase by 55%
- ➔ Without water security, there will be no food security.

Producing enough food for one person for one day requires about 3,000 litres of water – or about 1 litre per calorie. When compared with the 2–5 litres required for drinking, it is clear that water for food production is a critical issue as populations and wealth grow. [From GWP publication](#)



FAO, 2009



Irrigation and Water Use for Potato in the UK

- Potatoes receive 54% of all water applied as spray irrigation in England and Wales
- Irrigation usage is increasing in recent seasons
- With less predictable weather patterns, the majority of the potato area is now grown on lighter soils.
- Legislation and irrigation – The EU Water Framework Directive



Irrigation and water use
(Best practice guide for
potatoes, May 2015)

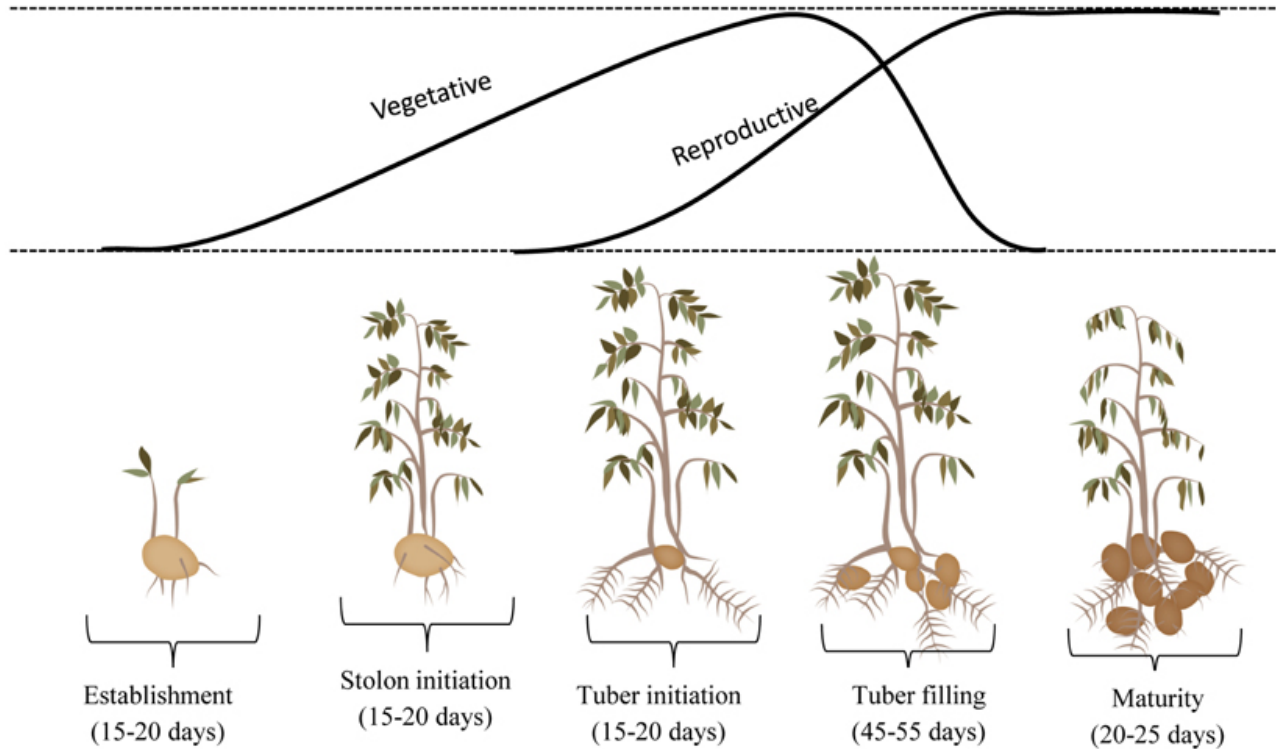
AHDB
POTATOES



Effects of Water Stress



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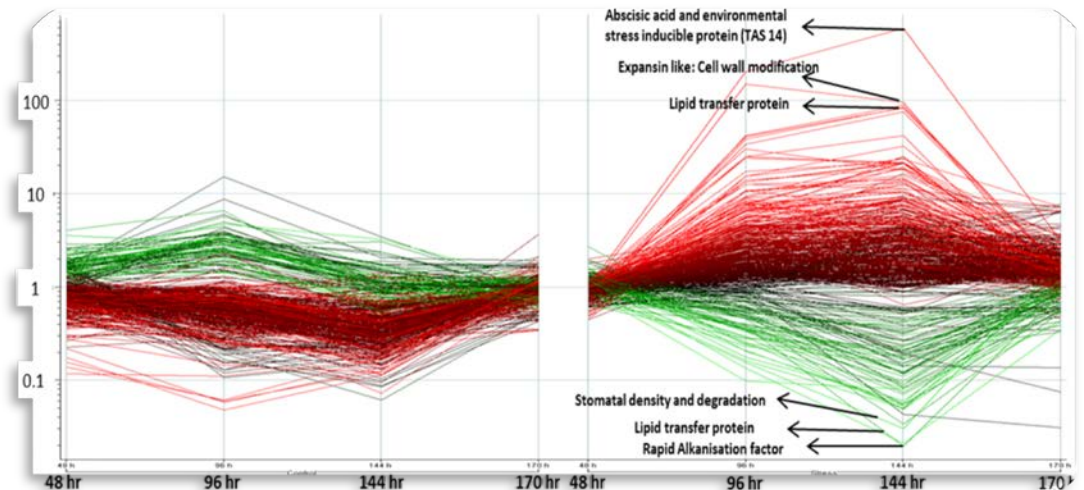
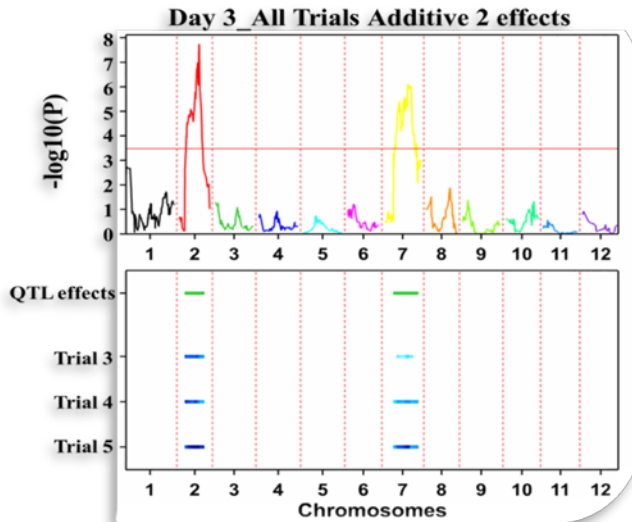


Impact of water deficit	Delayed emergence	Restrict plant development	Limited foliage and plant development	Limited plant and tuber development	Limited relative tuber density
	Restrict root establishment	Limited stolon initiation	Limited tuber initiation	Restricts tuber size	Limited tuber size
	Restrict plant development	Limited number of stolon	Limited number of tubers	Promotes distorted tuber shape	
	Presence of fewer stalks/stem	Restrict root growth		Faster senescence	
		Restricts uptake and response to nutrients			

High Throughput Phenotyping - Infra-red Thermography



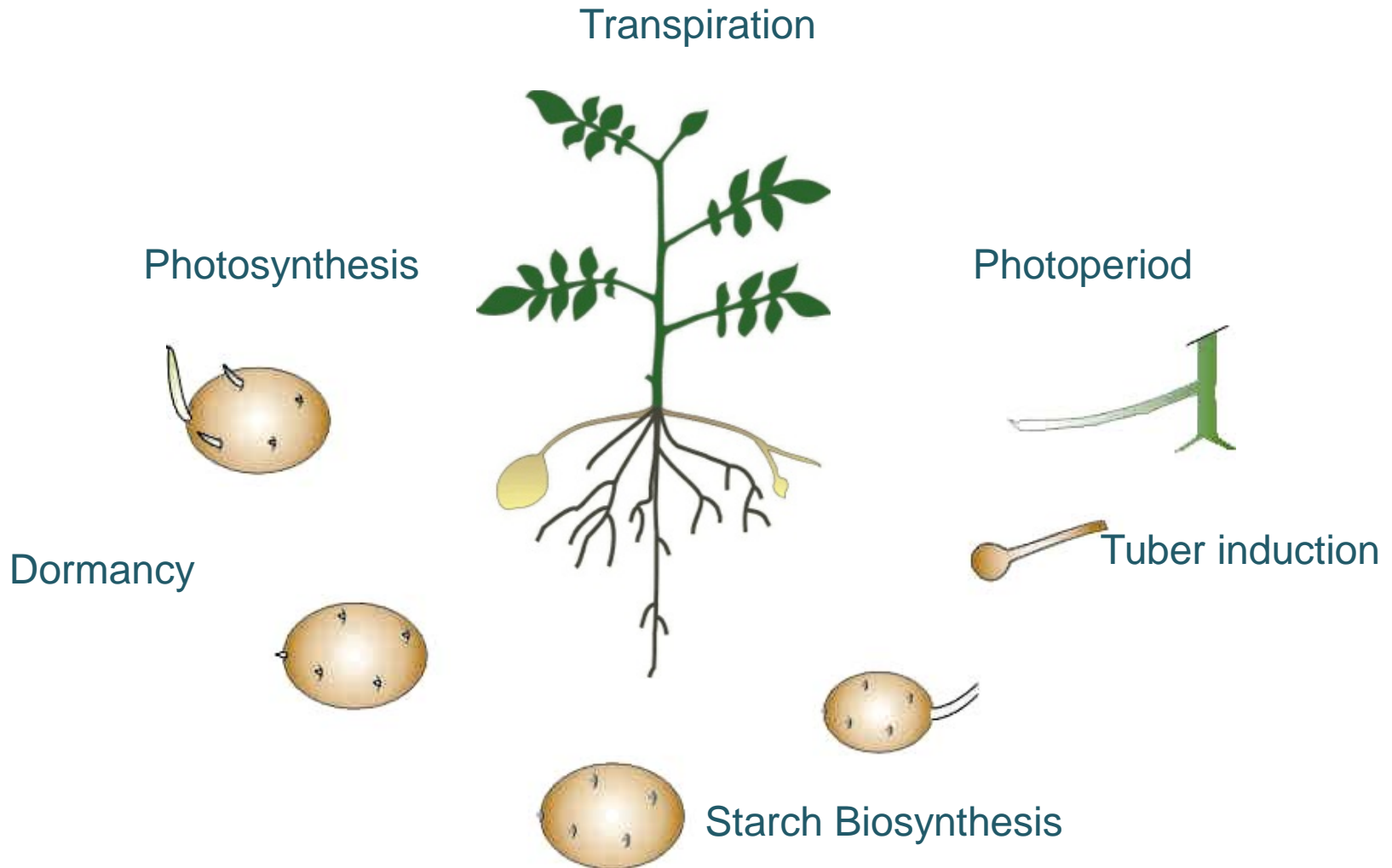
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Prashar et al., *PLoS One* 8(2013)



Temperature Effects on Plant Development





Temperature Effects on Tuberisation



Heat
sprouting



Chain tubers

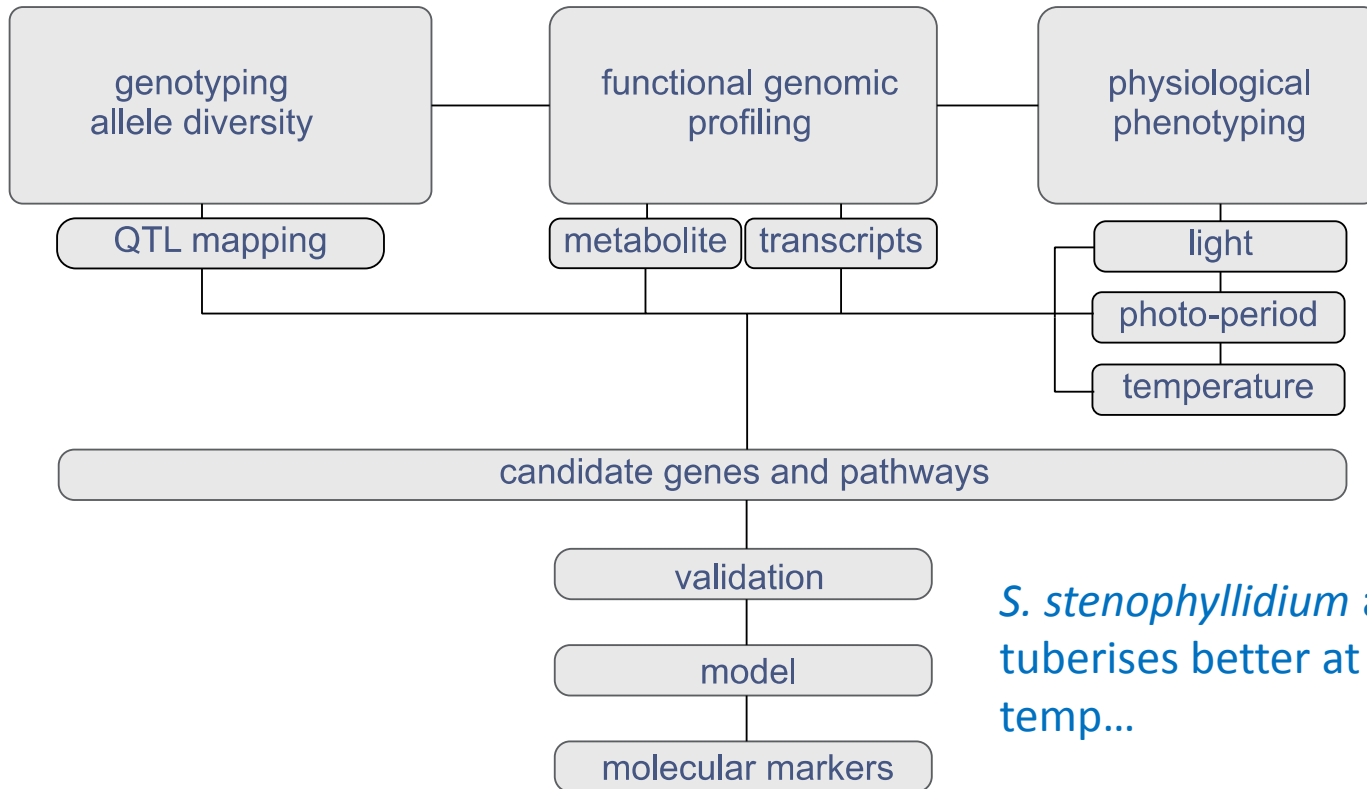


Misshaped tubers

Yield reduction - Quality impact



Approaches to Tackle the Problem



S. stenophyllidium accession tuberises better at higher temp...

20°C



30°C

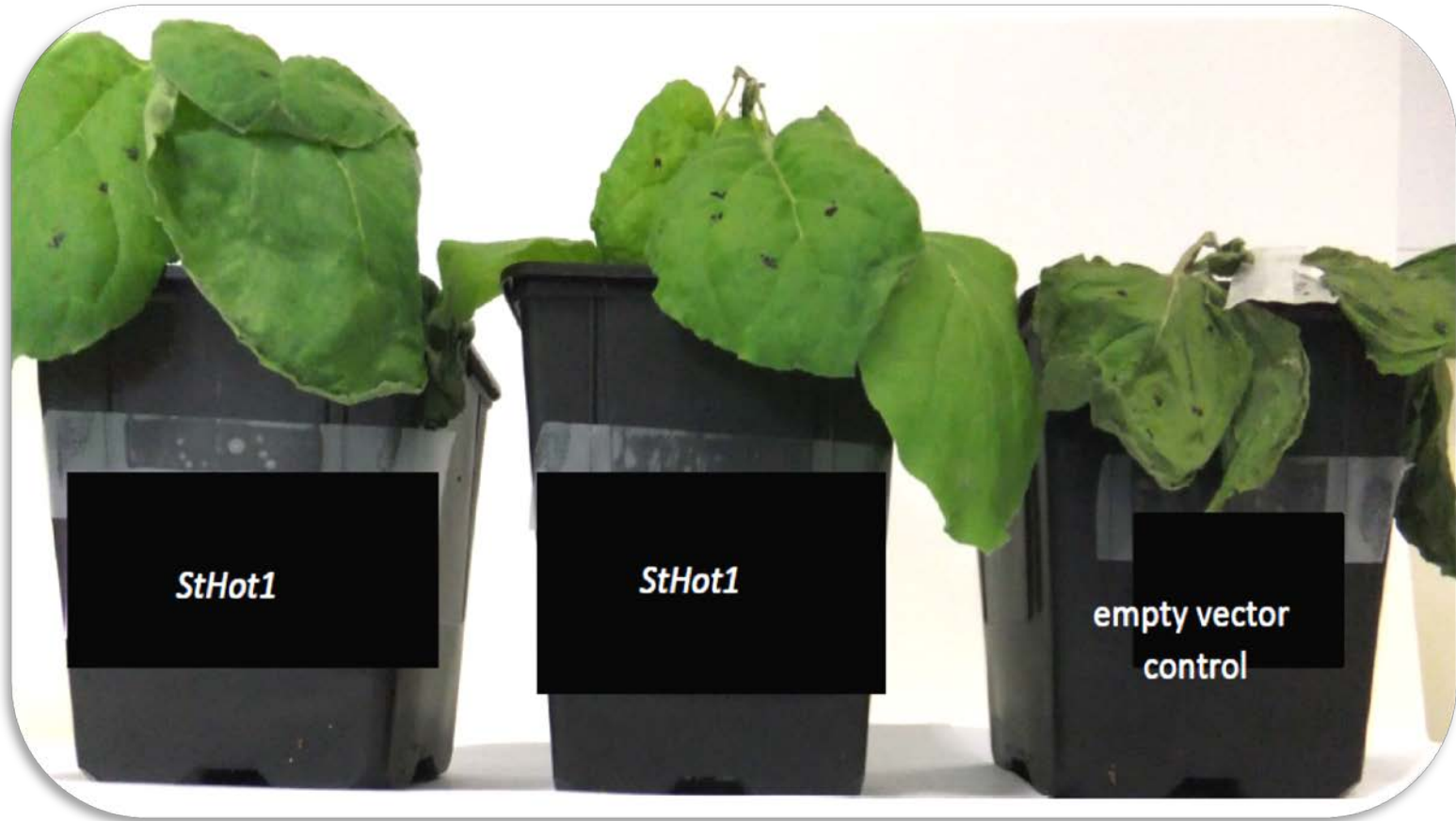




Validation of Gene Function



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The Future

- Marker identification
- Translation to new products with more resilience
- Combinations of stresses – heat/drought
- Other stresses – salinity and frost tolerance



Acknowledgements



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