



The ABC of Blueberry Research

An overview of the blueberry research undertaken at the James Hutton Institute, covering Advances, Breeding objectives and Challenges.

Susan McCallum¹, Christine Hackett² Dominic Williams³ and Julie Graham¹

¹The James Hutton Institute, Invergowrie, Dundee, DD2 5DA

²Biomathematics and statistics Scotland, Invergowrie, Dundee, DD2 5DA

³James Hutton Limited, Invergowrie, Dundee, DD2 5DA

Email: Susan.McCallum@hutton.ac.uk



Innovate UK



The James Hutton Institute

Introduction

High consumer demand for blueberries (*Vaccinium corymbosum*), combined with the lack of appropriate high quality cultivars suitable for UK climatic conditions, has resulted in a need for the development of new blueberry cultivars with high fruit and nutritional quality and expanded fruiting season to meet the demand for local grown soft fruit. UK blueberries supply only 5% of demand and projections have indicated that a rise in blueberry production of 50-100% is feasible given appropriate cultivars and management practices. Marker-assisted breeding could significantly aid in genetic improvement particularly when combining certain traits like climatic adaptation and season extension with other important traits like fruit quality and yield.



Fig.1. Two year old seedlings developed from our blueberry breeding programme currently under tunnel ready for initial evaluations.

Methods

Demand for blueberries is at record levels with UK fresh sales valued at £330 million in 2017. The incorporation of marker assisted techniques could result in more cost-effective cultivar development strategies, principally by allowing breeders to improve selection of parental plants for crosses and eliminate offspring with undesirable traits before they are field planted.

Advances:

A number of projects focusing on blueberry research have been awarded in the last few years and these include: **Innovate 102130**. Yield project, defining the underlying mechanisms controlling yield stability and develop improved management practices.

Innovate 101819. Imaging project to develop a hyperspectral imaging platform to identify key stresses in blueberries and raspberries

Innovate 131889. Developing genetic resources in blueberries to develop QTLs for breeding.

Breeding objectives:

Identify cultivars best adapted to local climate utilising and where possible extending the fresh market season. Broadening the gene pool by looking at relatives to the commercial blueberry in the hope of transferring traits such as higher anthocyanin content, plant vigour, fruit colouring and seasonality. By using hyperspectral imaging we can detect differences in spectral properties associated with plant stress.

Challenges:

Previous work, focusing on developing the UK blueberry industry (LINK HL0190), identified yield instability as a key barrier for successful and profitable production. Indeed, blueberry growers experience significant yield variation from year to year that prevents accurate prediction and profit maximisation, and results in volatility of UK supply. The problem is now well recognised within industry, but the causes of this variation in yield are unknown.

Previous work has shown cultivar choice is not simply a case of importing cultivars adapted elsewhere, as these often fail to establish, ripen or perform in the same way once trialled under different climatic conditions.

Linkage mapping in blueberries is complicated by the difficulties of genetic studies in a tetraploid species.

Results

There has been increased demand for blueberries in recent years fuelled in part due to their many recognised health benefits. Development of new blueberry cultivars with high fruit and nutritional quality combined with early and late ripening and appropriate climatic adaptation is underway. With the availability of more genomic resources, marker-assisted breeding could be used in cultivar development to more efficiently combine traits for fruit and nutritional qualities specific to local climatic adaptation.

A new mapping population specific for traits of interest for the UK has been produced and genetic analysis using genotyping by sequencing has been carried out resulting in a new linkage map currently under construction.



Fig.2. One of the crosses produced at the James Hutton Institute in 2017 using a seedling developed from the programme in 2014

Conclusions

- A successful UK variety that achieves significant market share across half the season, would be worth in excess of £90 Million per annum.
- Blueberry is one of the few fruit crops with realistic export potential filling a void in world production by the UK season.
- This research identifies the combined impact of genetics and environment on the development of blueberry fruit and has led to the formation of the first UK led blueberry breeding consortium.

Acknowledgements

AHDB	JHL Blueberry breeding consortium
M&S plc	SoilEssentials
Berry Gardens	Delta-T Devices
Total Produce	Thomas Thomson (Blairgowrie) Ltd
S&A (UK) plc	Castleton Farm Ltd



Scottish Government
Riaghaltas na h-Alba
gov.scot



Blueberry Breeding Consortium