Blueberry Research at the James Hutton Institute

An update on objectives and progress

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Aim:

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 is underway. 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.

There is great opportunity to fast track breeding by improving the speed and precision of phenotypic selection using imaging sensor and agricultural engineering systems, thereby reducing the cost of years of field assessment.

A new blueberry breeding programme has now been established at the James Hutton where we aim to identify varieties best adapted to local climate utilising and where possible extending the fresh market season.

Figure 1. One of the crosses produced at the James Hutton Institute in 2017 using a seedling developed from the programme in 2014

Research Objectives

1. Previous work 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 which results in volatility of UK supply.

2. The changing UK climate presents challenges to plant growth, particularly for woody perennial species. There are already indications that the trend towards warmer winters in UK is affecting the dormancy cycle and subsequent fruit development of some berry crop species.

3. Expansion of the UK blueberry industry is currently hindered by problems associated with the establishment of new crops and time to full yield and sustained growth of highbush blueberries.

4. New crop varieties that can tolerate environmental stresses, pests and diseases are essential for maintaining crop productivity in current and future growing environments. These abiotic and biotic stresses limit crop productivity, and new high quality varieties are essential for survival, growth and sustainability of the UK soft fruit industry.

Progress

- We are studying underlying mechanisms controlling yield stability to develop improved management practices and accurate yield prediction models. Research is being used to develop molecular markers for the accelerated breeding of UK adapted germplasm.

- We are developing an imaging platform with two hyperspectral sensors; a visible and near infrared (VNIR) hyperspectral camera covering the region between 400-950nm and a shortwave infrared (SWIR) hyperspectral camera covering the region 1000-2500nm.

- We are seeking to identify cultivars best adapted to local climate utilising and where possible extending the fresh market season. In addition, we are broadening the gene pool by looking at native wild blueberries in the hope of transferring traits such as higher anthocyanin content, plant vigour, fruit colouring and seasonality into the commercial blueberry.

- We are using symbiotic fungi found in wild blueberry populations to enhance plant establishment. By using hyperspectral imaging we can then detect differences in spectral properties associated with plant stress . This approach will advance variety development by incorporating physiological traits into our breeding program for improved environmental stress tolerance, resource use efficiency and yield.

Figure 2. Native wild blueberry species being utilised to enhance plant establishment

Figure 3. Hyperspectral camera platform being utilised to identify early plant stress signals

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Impact

- A successful UK variety that achieves significant market share across half the season, would be worth in excess of £90 Million per annum. 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.

- Changes in shoot and leaf physiology can provide an indirect indicator of abiotic and biotic root stresses, which can be monitored with imaging techniques.