Project Title	Developing a raspberry toolkit for marker-assisted breeding for premium sensory characters in UK fruit
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Location of project:	Scottish Crop Research Institute Strathclyde University
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The results and conclusions in this report are based on a series of experiments conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

Grower Summary

Headline

- **Genetic markers and individual genes have been identified on the genetic map of raspberry that are responsible for different fruit quality traits.**

Background and expected deliverables

Poor fruit flavour, poor quality, limited shelf-life and short availability lead to consumer disappointment. Through breeding, the raspberry industry is fundamentally interested in improving genetic traits such as sweetness, flavour intensity, berry conformation (drupelet structure and cohesion) colour and firmness.

Non-controversial state-of-the-art molecular breeding technologies of proven success in other crops (e.g. tomato and peach) can now be applied to raspberry to ensure new varieties have specific sensory characters and quality parameters.

In raspberry, this is now possible through the SCRI genetic map of raspberry. This allows the study of inheritance of important traits and will allow knowledge and technology transfer from other major *Rosaceous* crops (notably the peach and apple) that have made good progress.

The collection of replicated trait data allows the information to be linked with genetic markers on the evolving raspberry genetic linkage map for quality to ensure new varieties have specific sensory characters and quality parameters.

It is expected that this project will improve the knowledge of which genes and sections of chromosome on the genetic map of raspberry are responsible for

different fruit quality traits. Using this knowledge, raspberry breeders will be able to improve the precision of their breeding techniques and speed up the identification and release of new improved raspberry varieties to the UK raspberry industry.

Summary of the project and main conclusions

Objective 1. Sensory and compositional analysis of sugars and acids

Seedling progeny from a Glen Moy x Latham cross were raised and planted in different environmental conditions. At SCRI, the progeny were planted in both an open field site and on a field site protected by polythene tunnels. At Thomas Thomson (Blairgowrie) Ltd, the progeny were planted on a field site protected by polythene tunnels.

The seedlings were grown on and established, then allowed to crop for the following two years. In each year, the fruit was harvested and sent to the University of Strathclyde for sensory analysis by trained sensory panels. Although there were variations in sensory traits between the seasons, there were consistent differences between the open field and protected crop fruit in both years.

The fruit grown and harvested under protection was far superior in both years, with berries being larger in size, brighter in colour, sweeter in flavour and less acidic.

Objective 2.0. Correlation of sensory and consumer data.

Seedling progeny that have been previously raised from the Glen Moy x Latham cross have been specifically used by the SCRI breeding team to aid the development of a genetic map for raspberry. It was the progeny from this

cross that were used in Objective 1 of the project, to examine sensory traits.

The work under objective 2 aimed to discover whether the principle used to gain results from these sensory tests could be applied to progeny raised from the current SCRI breeding programme. This work revealed that the sensory analysis undertaken for the Glen Moy x Latham cross correlates with sensory analysis of new selections in the breeding programme.

This will subsequently give the SCRI breeding team the confidence to use any progeny with good sensory traits in its breeding programmes.

Objective 3. Molecular data enhancing deliverables.

The purpose behind objective 3 was to identify genes on the genetic map of raspberry which contol the sensory traits examined in objectives 1 and 2 and to identify individual genes responsible for different traits.

To date, the work has identified genes responsible for controlling fruit colour, anthocyanins and volatile content of fruit.

Work is continuing to find genes responsible for sugar content, acid content, brix levels and fruit weight.

Objective 4. Mapping QTLs

The purpose of the work behind objective 4 is to identify where individual genes and areas of chromosome that confer traits such as anthocyanin content are actually found on the genetic map of raspberry. This work is ongoing and aims to determine where traits such as flavour and colour are controlled on the genetic map.

Objective 5. Assess allele diversity in wide gene pool

The geneticists at SCRI know that on the genetic map of raspberry, genes

that confer traits such as anthocyanin content can be present in different forms. Some forms of the gene can confer high levels of anthocyanins, whilst others confer low levels.

Work is ongoing to determine which forms of genes confer the highest quality traits for each parameter. This knowledge will be used to aid the SCRI breeding team in the rapid selection of seedlings with high quality traits.

Financial benefits

This work has already identified some key genes responsible for variation in the quality traits and will lead to an enhancement in the breeding programme for fruit quality. In effect, it will provide the breeding team at SCRI with more precision in breeding and selecting new varieties with high quality fruit parameters. It is hoped that this will speed the delivery of improved varieties to the commercial raspberry industry in the UK.

Action points for growers

This work will enhance the provision of new improved raspberry varieties to the UK raspberry industry.

- Specifically for growers, the work under objective 1 has identified that the quality of fruit produced under polythene tunnels is superior in sensory terms to field grown fruit.