Reducing seed loss and waste in umbelliferous crops

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Project Description: Umbelliferae species flower and set seed over a period of about 6 weeks depending on weather conditions. As a result, the bulk seed harvested contains seed at various stages of maturity and therefore of different quality. Seed companies must separate the high-quality, high germination seed from the harvested bulk. This is mainly done by differences in size, weight and chlorophyll content. The high seed heterogenicity though, leads to a lot of seed being wasted before a saleable batch is obtained.

Currently, breeding programmes focus mainly on the improvement of agronomic traits, such as yield and resistance to pests and diseases. In order for seed companies to reduce the loss of seed in the field and the waste during processing (due to inadequate seed quality), their breeding programmes need to be enhanced to include selection for relevant traits associated with seed variability.

The aim of this project is to use a combination of phenomics coupled with modern forward and reverse genetics approaches in order to, 1) investigate the genetic control of seed abscission, plant architecture and flowering time umbelliferous crops, and 2) select elite parsnip lines with superior characteristics in order to ensure that flowering time is shorter, seed stays longer on the plant, and that it is of increased quality (uniform, with higher germination capacity and improved vigour).

The project will provide the student an excellent opportunity for multi-disciplinary training in molecular genetics, phenomics and bioinformatics as it will include a) the generation of hybrid parsnip populations that segregate for the desirable traits, and b) the detailed phenotypic and genotypic characterization of breeding lines using 3D scanning phenotyping and Genotype-by-Sequencing (GBS) technologies respectively, in order to identify causative Quantitative Trait Loci (QTLs). The ultimate goal of the project is to generate suitable markers that could be used for Marker Assisted Selection (MAS) in parsnip breeding programmes.

The student will work closely with a plant breeding and seed supply company, the market leading Elsoms Seeds Ltd. This will provide them a unique opportunity to get an insight into the breeding industry and undertake research at industry-level standards.