

Optimising a universal plant transformation system for orphan crops

Supervisory team:

Main supervisor: Dr Heather Whitney (University of Bristol)

Second supervisor: Prof Carman Galan (University of Bristol)

Prof Keith Edwards (University of Bristol)

Host institution: University of Bristol

Project description:

The ability to transform plants has been central to advances in both fundamental plant sciences and crop science. Rapid advances in both these areas are vital to feed a growing population in increasingly challenging climatic conditions. Plant transformation will also be central to future technologies such as plant synthetic biology, molecular farming and genome editing. However, a major bottleneck in taking full advantage of the potential of these technology advances has been that for most species transformation and plant regeneration is still a slow, arduous, inefficient and expensive process. Currently there is no one plant transformation system that combines advantages of *Agrobacterium*-based floral dip (ease of application, transformation occurs 'in planta' so no need for tissue culture) with advantages of biolistics (wider diversity of species and constructs, speed of transient expression) plus confers additional advantages (inexpensive, transformation of mature whole plants, flexibility of application via roots, leaves or seeds, lack of requirement for specialist growth conditions or equipment, specificity as to tissue or organelle targeted). We have developed just such a novel system using nanoparticles as carriers of genetic material to generate a new, flexible, quick and robust method for plant transformation and genome editing. We have demonstrated that this system leads to faster transformation or gene editing than current methods, requires relatively little technical expertise, works for a wide range of plant species, is equally effective for transient gene expression and genome editing, and works effectively via foliar application for both these applications (i.e. 'spray-on' CRISPR gene editing). As such this system provides several potential advantages to current methods of plant transformation.

This project would focus on applying this system to so called 'orphan crops' – a diverse group of minor crops that together form a vital food resource for much of the world's population, but which receive limited research attention and therefore may lack efficient or effective transformation protocols. Initially the project would focus on transient expression and gene editing in Sorghum, with further input as to target species from Syngenta.