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FungiAlert: a compact device to reduce the use of pesticides and the loss of crops

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Abstract: Plant disease prevention and eradication are costing the British economy billions of pounds every year. Current detection methods are time consuming and expensive, and pesticide overuse consequently is damaging to the environment as well as to farmers' pockets. FungiAlert is developing a new in situ detection device for instant alerts when spores are present in soil or water, reducing crop loss and pesticide overuse, saving both time and money. Currently designed to detect Phytophthora spores, co-founders Dr. Kerry O'Donnelly Weaver and Dr Angela de Manzanos are now working on expanding the number of pathogens detectable and making the device 'smart' for the modern world. This article delves into the world of FungiAlert, from their PhD beginnings, to their future plans for the technology and entering the UK berry market at the end of this year.

Keywords: FungiAlert, Plant disease detection, Phytophthora, Oomycete, sustainability

1. The success story

Changes in climates and increasing trade are leading to the increased activity of plant pathogens such as Phytophthora, threatening the sustainability of farms and ecosystems [1,2]. Eradicating a single outbreak can cost the landowners an estimated £40,000, with non-native species, including Phytophthora, costing the British economy approximately £1.7bn every year [2]. Crop disease does not only lead to huge money expenditure but also damages the environment, leading to the overuse of pesticides and reducing biodiversity [1].

FungiAlert is the first *in situ* continual monitoring device for the early detection of soil and water borne plant pathogens, in the form of a compact, cheap, easy to use product (see figure 1). Founded in 2015, their goal is to improve the sustainability and cost of farming by reducing unnecessary pesticide use and preventing crop damage and loss. The *in situ* device speeds up the detection and diagnosis stage by giving instant feedback, allowing the user to act before an infection becomes widespread, costing thousands of pounds. This is a huge step forward

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compared to current techniques which can take a week to return diagnostic results, by which time the crop could have been lost.

Figure 1. The FungiAlert plant pathogen detection device *in situ*.

2. The technology

As a compact filtering system (see Figure 2), it can detect spores in the soil before infection and before visible symptoms appear on the crop, giving time for remedial action. The device works by baiting spores to the device using a cocktail of specific chemoattractants. The spores travel through the device to reach a detection chamber where their presence is detected through a chemical trigger, causing a visual colour change.

Many current methods used are based on molecular biology techniques which cannot distinguish between alive or dead pathogens, this leads to the overuse of pesticides. In contrast, FungiAlert can only detect pathogens that are alive, giving a clearer indication of the health of the soil, reducing pesticide misuse and therefore the costs to the user and environment. Currently, the device only detects *Phytophthora*, a common plant damaging Oomycete, although the company plan to branch out into a range of different crop diseases to have a more universal device.

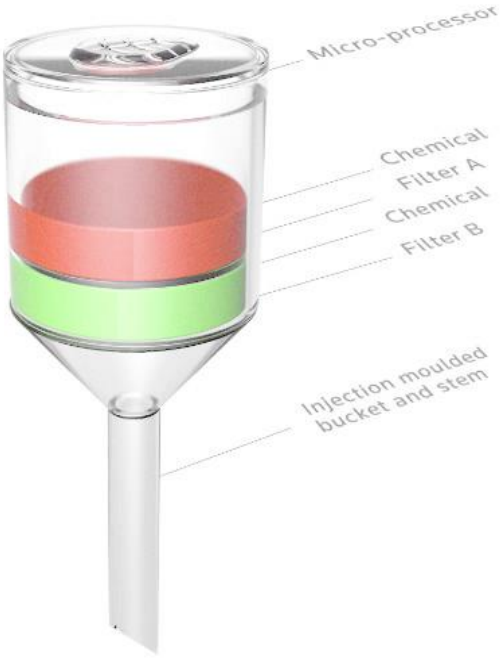

Figure 2. An outline of the FungiAlert device layout and structure.

3. The journey so far

Co-founders Dr. Kerry O'Donnelly Weaver and Dr. Angela de Manzanos completed their PhDs in chemical biology at Imperial College London, focusing on increasing photosynthetic efficiency for increased crop yields. During this time, they attended many conferences which highlighted the need for more disease management strategies. Along with a family history of orange tree orchards and the troublesome diseases that go hand in hand with farming, their interest in finding a cheap and simple disease detection device began to grow. By entering entrepreneurial competitions alongside their university work, they were able to explore and expand their idea; since founding their company they have been awarded the CDT Den 2015, Venture Catalyst Challenge 2015 and the Althea-Imperial Prize 2015. Now based at the Agri-business incubation center at Rothamsted Research, Angela and Kerry work full time optimizing their prototype. Receiving support from their university department, and interest from industry leaders has helped them through the pitfalls of founding a startup, the support from fellow scientists and businesses in the Agri-business incubation centre has also been a bonus. In 2015, Dr. Paul Atherton, a serial technology entrepreneur, started mentoring the duo, and eventually became an investor and chairman, as well as an invaluable source of experience. They describe their journey as intense but very rewarding and are driven to make their idea a worldwide reality.

4. Looking to the futire

By being a small and cheap product to solve a billion-pound problem, FungiAlert has the capability of being a basic need for farmers around the world. Currently, FungiAlert is continuing their research and development stages. Their main goal, for now, is to develop strategic partnerships, allowing them to test their technology proposition in-field, and to shape the device for different market segments. As mentioned above, they are considering how to incorporate detection systems for a larger variety of plant diseases. They also wish to make the system friendlier to modern life, by including remote sensing technology to allow for notifications to be sent to an app. Their plans are to test the device in fields during spring 2017 and enter the UK berry market before late 2017 or early 2018, closely followed by European markets with Californian fields on the horizon.

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Anna Worsley is a PhD student undertaking research in biomaterials for wound healing, with the LIDo BBSRC PhD programme at UCL and the RVC. While finishing off her first year she also joined IF UCL as an Editor and helped to promote the branch online. Anna first entered academia with her BSc in Anatomy and Human Biology at The University of Liverpool. She then went on to complete the Nanotechnology and Regenerative Medicine MSc at UCL, receiving the Dean's list nomination for her year.