

# **Title: Development of a rapid and cost effective ‘on-site’ detection method for Cacao Swollen Shoot Virus (CSSV)**

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**Abstract:** Cacao (*Theobroma cacao* L.) is affected by a range of pests and diseases, with some estimates putting losses as high as 30% to 40% of global production. The most debilitating virus affecting the crop is a pathogen endemic to West Africa: *Cacao Swollen Shoot Virus* (CSSV). It is a mealybug<sup>1</sup> transmitted badnavirus that can cause significant yield reduction to, and death of, cacao trees within 5 years of infection. Despite decades of efforts aimed at controlling the spread of the disease in West Africa through a cordon sanitaire approach, the condition continues to cause major crop losses in Togo, Ghana, Nigeria and Ivory Coast (the world’s largest exporter of cocoa). Disease detection is hindered by a latent period and the fact that appearance of symptoms of infection generally only show in the plant at times of new growth. Detection of infection by ELISA has had limited success due to the insensitivity of the tests and their viral strain dependence<sup>2</sup>. Other more sensitive molecular techniques using Polymerase Chain Reaction (PCR) have been used to characterise strains of CSSV but all these assays require laboratory facilities and trained personnel.

The aim of this project is to develop a simple, robust field based detection system to monitor the spread of the disease that would allow for prompt identification of the pathogen and thereby facilitate more effective control on individual farms that experience the disease. There would also be potential applications in managing the safe supply of new planting material to farmers and this would therefore greatly improve the management of this disease in West Africa, with direct benefits to the industry.

The Resonant Coil Magnetometer (RCM) is a biosensor that detects and quantifies paramagnetic particles<sup>3</sup>. Magneto-immunoassays have been developed where PMPs can be bound above the sensor surface by antigen-antibody interactions with assay times of a few minutes<sup>4</sup>. The presence of bound PMPs is detected by the RCM to give a digital readout. This device is portable, relatively cheap to manufacture and the technology is therefore suitable for development for use ‘on-site’. This technology has yet to be evaluated for nucleic acid detection. If successful, this would not only allow the detection of CSSV but also open up a whole range of uses for the magnetometer technology for ‘on-site’ uses in the food, veterinary, agricultural and medical applications at the point-of-care.