What is your idea?

Many smallholder farmers rely on inefficient agricultural practices that are insufficiently adaptive to climate change. Customized agricultural advice for specific crops grown by a farmer, based on localized weather and soil data, pests and diseases, as well as input availability can improve management practices, productivity and profitability. But personalized message services do not incorporate potentially very useful information on what farmers observe themselves, for instance crop color, texture and how the crop is growing over time.

Our idea is to provide personalized agricultural advice not only based on localized information but also on visible crop characteristics derived from a stream of farmers' own smartphone pictures. These ground pictures give advisory services eyes on the ground, empowering both them and farmers to optimize agronomic decision-making.

Using farmers' self-collected camera data to provide agricultural services is unprecedented. In the recent past, costs associated with sending and processing large quantities of real-time plot-level camera data were too high, as smartphone ownership and mobile network penetration were low, and processing images would require significant human resources, data storage and bandwidth. However, advances in technology have improved smartphone ownership and reduced costs associated with collecting smartphone camera data. Our goal is to pioneer in testing whether smartphone camera data can strengthen agro-advice, and share the resulting tools as public goods.

We hypothesize that real-time crop data obtained from smartphone pictures can strengthen agricultural advice in four ways. First, visible crop characteristics provide more information, allowing agronomic experts to target messages more towards a farmer's individual situation. Second, the tangibility of a picture-based approach can increase ownership and take-up of the advice. Third, collected (camera) data can be stored and organized in a systematic way for different types of plots, weather conditions and practices, empowering both farmers and experts in detecting patterns on how these variables relate to crop growth. Fourth, there is a clear business case, as insurers have started using camera data for damage assessment, and are interested in bundling insurance with advisories.

How will you pilot it?

Implementation plan – Our implementation plan for the pilot phase focuses on a proof of concept in Haryana, a state in northern India. CABI, through its flagship Direct2Farm (D2F), has developed tools that use various sources of information for a variety crops to reach farmers with personalized agricultural advice. D2F uses different modes of mobile communication, including text messages, IVR, short videos, and the ability to contact local experts for personalized advice. The resulting two-way communication supports farmers' decision-making capacity on how to optimize their management practices. The proposed study will, for selected crops, train local experts to use a stream of pictures—tracking visible plot characteristics including growth and texture indices over time—to further personalize the advice.

Doing so, we will work with farmers who have picture-based insurance coverage through a product that is offered by HDFC Ergo General Insurance Company in partnership with IFPRI. The insurance product assesses crop damage based on a stream of crop pictures, taken by farmers using their own

smartphones at least once or twice a week from sowing to harvest. To take and upload the pictures, farmers are using an existing smartphone app with built-in features designed to facilitate this process, enforcing that pictures are always taken of the same site. In this context, the CABI experts will for every insured plot (1) review localized information and regularly captured crop pictures, (2) personalize default customized messages, and (3) send these personalized messages through the smartphone app.

To evaluate impact, we will send these messages only to a randomly selected subsample of farmers, and compare take-up (whether farmers adopt the advice) as well as productivity and profitability between on one hand the control group (farmers receiving the default customized messages), and on the other hand the treatment group (farmers randomly selected to receive picture-based advice). Differences in take-up, productivity and profitability will reveal whether picture-based message services help empower data-driven farming and improve agronomic decision-making. A case study on the potential of this approach, including data, will be made available for farmers, experts and researchers.

Budget and timeline – The product will build on an existing insurance product, offered to farmers in Haryana, which assesses damage from smartphone pictures of the insured crops. We will hence rely on the tools created for, and data collected through, the picture-based insurance project. The main activities for the proposed study include capacity building of local experts (Oct – Nov 2017), providing and disseminating picture-based content during the Rabi (winter) season (Dec 2017 – Apr 2018), and monitoring and evaluation, including data analyses and reporting, until September 2018.

Total funding of $100,000 will be divided equally between IFPRI and CABI. The IFPRI budget allocates $23,863.27 to labor, $5,736.15 to travel, $5,870.70 to service center costs, and $14,529.92 to indirect costs. In-kind contributions are made by providing the smartphone app and associated data collection. The CABI budget includes $14,000 for content provisioning to a 20K farmer base, including the staff cost for local experts reviewing the smartphone camera data and modifying default messages; $ 7,500 for dissemination of the messages; $ 17,500 for capacity building; and $11,000 for monitoring and evaluation, including a case study publication.

Essential data generated – Localized information on weather and soil conditions, input availability and types of crops grown by farmers; weekly smartphone camera data and short follow-up questionnaires on crop management (irrigation, fertilizer application, etc.), productivity and profitability; customized agricultural advice and personalized messages incorporating visible plot characteristics from the smartphone camera data.

Next steps – Scaling up. We will use data science, treating the pilot data as training data, to predict optimal management practices using both localized information and the camera data. Resulting tools (algorithms) will be tested and refined, and made available as a public good. We are planning to apply these tools at scale within existing crop insurance schemes; through telecom operators; and, to test the external validity of our approach, we will aim to replicate findings by scaling up through CABI's in-house mPlantwise program in Tamil Nadu (a state in southern India). This program provides farmers with advice on integrated pest management and is interested in moving towards a picture-based advisory approach.