

Crop Yield Predictions for Smallholder Farmers (Croppie)

Implemented by the *Fund for the Promotion of Innovation in Agriculture (i4Ag)*
As part of the special initiative *Transformation of Agricultural and Food Systems*

The Challenge

Lack of data limits smallholders' abilities to react to climate change and increases their economic risks

80% of the world's coffee is grown by smallholders; most do not earn a living income. Data-driven approaches to improving yields, financial planning and the management of risk could contribute significantly to alleviating poverty and hunger. Yet they remain largely inaccessible to smallholders.

A major reason for this is the lack of efficient data collection methods as many farmers still keep paper records. Traditional data management methods are too costly, static and standardised to benefit smallholders who need actionable data to make real-time decisions on their farms. A limited generation of reliable on-farm data also means that smallholders can't fully profit from the benefits of big data and AI. It prevents financial institutions from accurately quantifying risk and offering farmers affordable financial services.

Name of the Project	Digital crop forecasts for smallholder farms
Name of the Global Fund	Fund for the Promotion of Innovation in Agriculture (i4Ag)
Commissioned by	Federal Ministry for Economic Cooperation and Development (BMZ)
Project Region	Colombia, Peru
Implementing Partners	Producers Direct, Ideo.org, The Alliance of Bioversity and The International Center for Tropical Agriculture
Duration	09/2021 — 03/2024

The main objective
Empower farmers to generate and analyse the data they need

The Innovation

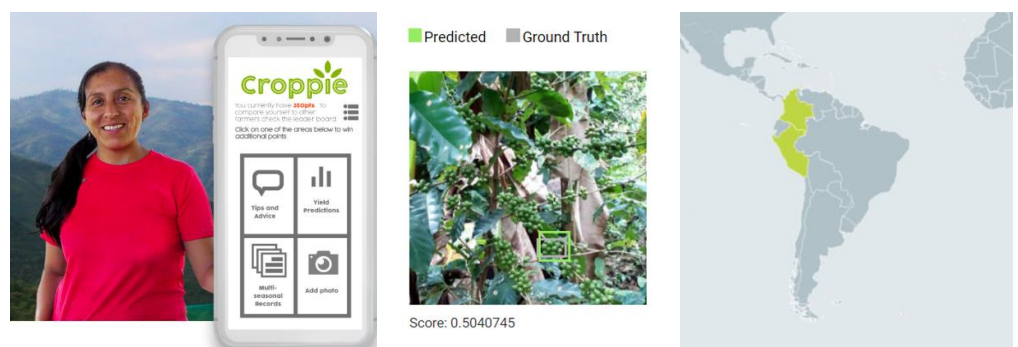
Croppie allows smallholders to generate yield predictions using smartphone pictures and AI

The project uses gamification, an approach to data generation which is set up as a game to make it more engaging and fun, to incentivise farmers to upload photos of their coffee plants into the Croppie App: Croppie's artificial intelligence (AI) algorithm then recognises and counts the coffee cherries on the images. It uses this count and additional data, such as GPS or weather data, to generate multi-seasonal yield forecasts.

The Croppie app will then provide farmers with actionable agronomic advice as to how best to adapt to these forecasts. Examples include reducing or increasing expenditure on down payments for equipment to dry and store the coffee. Farmers can also make decisions to diversify into other crops. Croppie can provide advice and tips for earning extra income. Equally important, Croppie provides guidance on how to prevent lower yields by suggesting mitigation interventions.

The insights and advice will be sourced from both agronomic experts and fellow farmers; it will be tailored towards individual farmers based on the data collected. Farmers will have the chance to rate the advice they received and will be connected to farmers with complimentary profiles who are facing similar farming problems.

During the second season of using Croppie, farmers will be able to receive more personalised advice based on their crop's performance during the previous year. This is where Croppie will be able to give advice on how to improve long-term coffee yields. For



L.: Croppie App, M.: Counting coffee cherries, R.: Project Region

example, if a farmer is deciding to invest in new coffee bushes, a prediction could be provided based on different coffee varieties and the number of seasons required to achieve a return on investment.

Methodological Approach and Innovation Partnership

The project is based on a partnership between the smallholder farmer-led NGO *Producers Direct*, the research for development centre, *The Alliance of Bioversity*, and CIAT and Ideo.org, a non-profit design studio.

Croppie's capacity development strategy ultimately empowers farmers to use their own data to improve the profitability of their farm and achieve more equitable market access.

The results of the research and practical application of Croppie will be shared with relevant national and supra-regional partners. Croppie adheres to the Principles for Digital Development as well as to EU data protection standards. An open-source solution, this unique data resource can be accessed by organisations worldwide.

Though designed as a smartphone app, Croppie will ensure farmers without smartphones and with limited digital skills can benefit from their data. This is reached by using extension workers as intermediaries to encourage the shared use of smartphones and by conducting trainings to build confidence in using digital tools among smallholders, especially women.

Sustainability and Scaling Strategy

Croppie will initially work with a small number of app users to drive the photo and data collection. Existing partnerships with NGOs, government agencies, private sector companies and UK supermarkets will subsequently be used to scale the app with more users. Croppie will simultaneously be working to develop a sustainable business model, testing different potential revenue streams such as:

- Farmers willing to pay a very small fee for using Croppie
- Financial service providers willing to pay for anonymised aggregated risk mitigation data or a small referral fee
- Or the private sector, such as supermarkets, who may pay for aggregated data insights

2,300 *smallholder farmers use Croppie*

700 *women improved digital skills for farm management*

10 *financial institutions and companies have applied Croppie in their services*

1 *tested model for scaling Croppie to other crops*

The project contributes to the achievement of these Sustainable Development Goals (SDGs):



Important Activities

- Conducting user-centred app-design with farmers
- Collecting pictures of coffee cherries by farmers via their smartphones using gamification
- Additional seasonal data collection overlaid with real-time and historical climate and soil data
- Development of tailor-made agronomic advice based on yield predictions, also in peer-to-peer and networking formats
- Conduct training for smallholder farmers on the application of digital farm management solutions as well as financial management
- Optimisation of Croppie's AI yield prediction model using the collected data which is fed into a deep learning algorithm
- Pilot project 1: Extend the yield predictions to additional crops (e.g., plantain, citrus fruits, cocoa)
- Conduct user-centred workshops with smallholder farmers on challenges and opportunities in accessing financial services
- Pilot project 2: With financial service providers, develop concepts and services based on available yield predictions.

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