Early warning for wheat rusts in Ethiopia, Bangladesh and Nepal

Surveillance

- Crowdsourced Phone Surveys
- 4+ million subscribers
- National field surveys (ODK)

Early warning unit in-country (integrated data hub)

Advisories and alerts

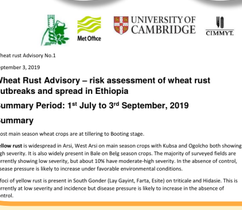
"Control ahead of disease in key areas"

(Allen-Sader et al., 2019)

Reach (Small-holder farmers and extension workers):

- Advisories >150,000
- SMS >500,000

Ministry → Regions → Extension agents → Small-holder farmers



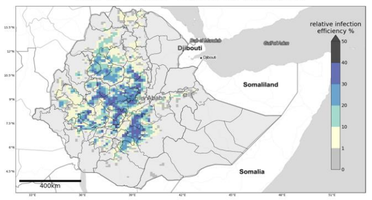
Weekly advisories and targeted SMS alerts

Numerical weather prediction

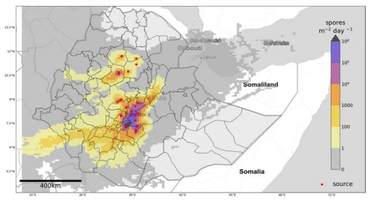
3 hourly meteorological outputs on a 10x10 km resolution

7 day forecast models for risk of wheat rust infection

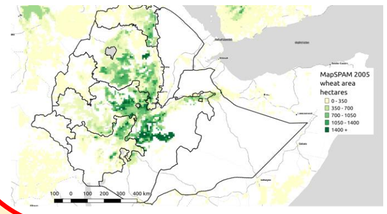
Environmental suitability



Deposition of spores



Susceptible host landscape



Fungicide control

Infection dynamics:

$$\frac{dI}{dt} = \beta S E(D + P)F$$

I: Infection rate
β : Infection rate constant
S: Susceptible host landscape
E: Environmental suitability for spore infection
D: Deposition of spores
P: Primary infection rate from local sporulating sources
F: Fungicide control strategies (test and inform)

UNIVERSITY OF CAMBRIDGE
CIMMYT International Maize and Wheat Improvement Center
Met Office

Stable wheat production is crucial for food security in many countries. Today, crops in many regions are at risk to new and virulent races of stem, stripe and leaf rusts. The spores of these fungal pathogens can travel long distances in the wind and cause infection if the environment is suitable, reducing yields.

Early Warning Systems use the latest surveillance data, together with advanced meteorological forecasts and epidemiological models to provide near real-time forecasts about the risks of spore deposition and the likelihood of suitability conditions for infection on wheat crops throughout target countries. Early warnings from the models are cascaded through government agencies and extension agents to small holder farmers.

Target countries:

- Ethiopia: largest wheat producer in sub-Saharan Africa, where > 4.2 million households rely on rain-fed wheat
- Bangladesh: wheat is second most consumed crop, with predicted increase to 1.25 million tonnes in 2020-21
- Nepal: wheat is third most consumed crop with > 700,000 ha

EIAR
ATA
ARRCC Asia Regional Resilience to a Changing Climate
BWMRI
NARC
Government of Nepal
Department of Hydrology and Meteorology