

# Early warning for wheat rusts in Ethiopia, Bangladesh and Nepal

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



## 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



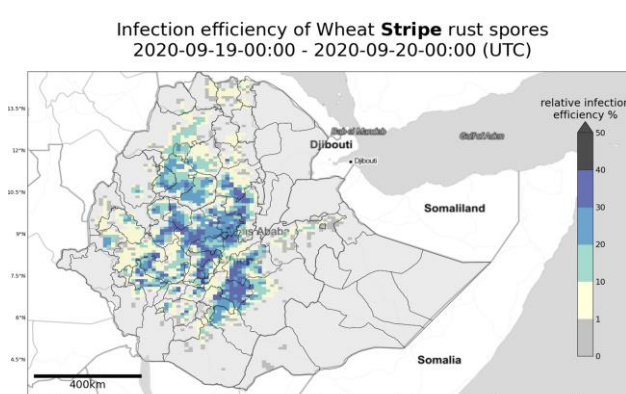
Wheat Rust Advisory No. 1  
September 3, 2019  
Wheat Rust Advisory – risk assessment of wheat rust outbreaks and spread in Ethiopia  
Summary Period: 1<sup>st</sup> July to 3<sup>rd</sup> September, 2019  
Summary  
Most main season wheat crops are at tillering to Booting stage.  
Yellow rust is widespread in Arsi, West Arsi on main season crops with Kubisa and Ogilbo both showing high severity. It is also widely present in Bako on field season crops. The majority of surveyed fields are currently showing low severity, but about 10% have moderate to high severity. In the absence of control, disease pressure is likely to increase under favorable environmental conditions.  
A field of yellow rust is present in South Gondar (Jay Gayint, Farta, Eske) on triticale and Hidake. This is currently at low severity and incidence but disease pressure is likely to increase in the absence of control.

Weekly advisories and targeted SMS alerts

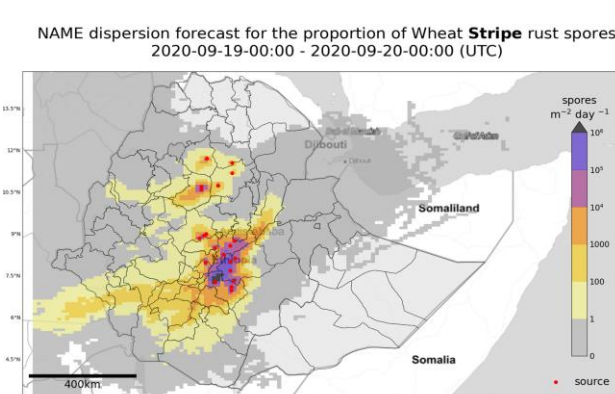


## 7 day forecast models for risk of wheat rust infection

Environmental suitability



Deposition of spores

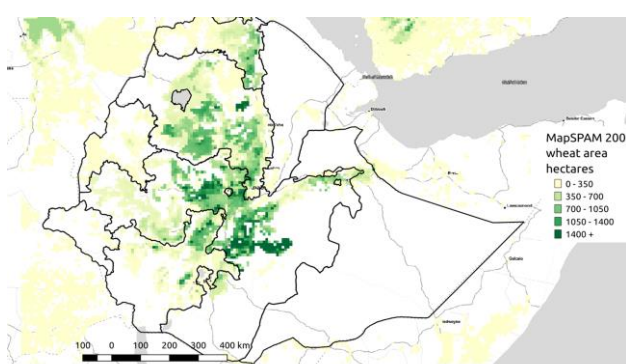


Infection dynamics:

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

- $I$ : Infection rate
- $\beta$ : 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)

Susceptible host landscape



Fungicide control



## Numerical weather prediction



3 hourly meteorological outputs on a 10x10 km resolution

CIMMYT Monthly PHOTO CONTEST  
MANDEEP RANDHAWA  
CIMMYT OFFICE, Kenya  
“CIMMYT battles of wheat”  
“CIMMYT battles of wheat”  
KALBO “Nepal, Kenya”