

# Way Forward to Meeting the Food and Nutrition Security Needs of India by 2050 - Role of Wheat

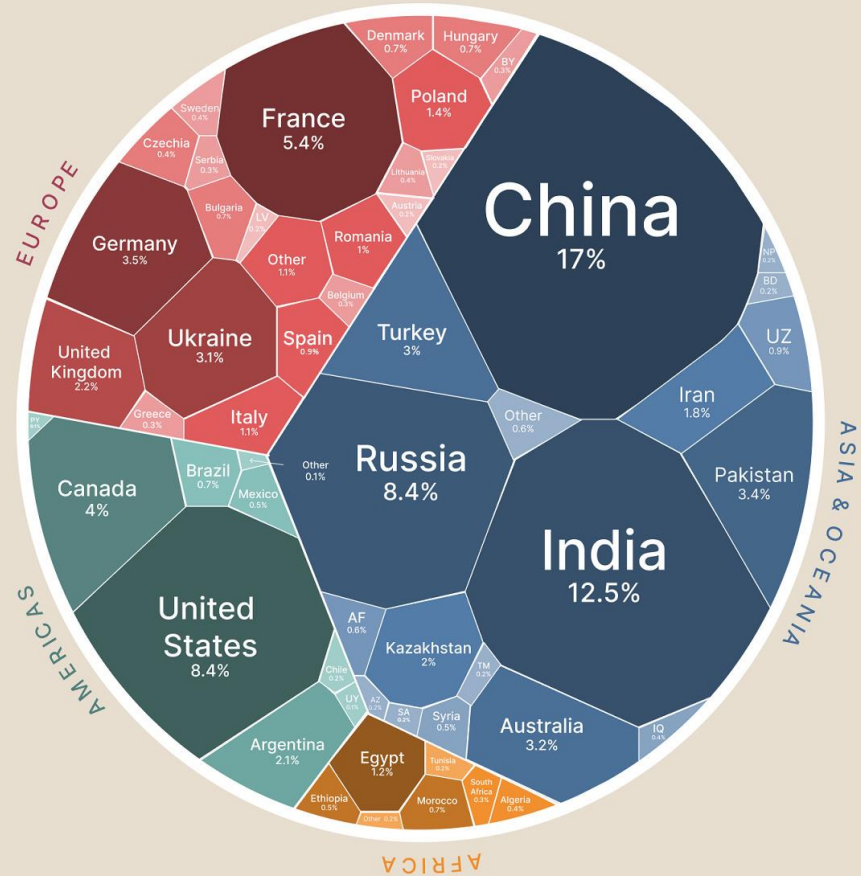
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# GLOBAL Production of WHEAT

From 2000 - 2020

This visual highlights wheat production by various continents and countries over the last twenty years.



tonnes of wheat produced by China in 2020.

**Europe**

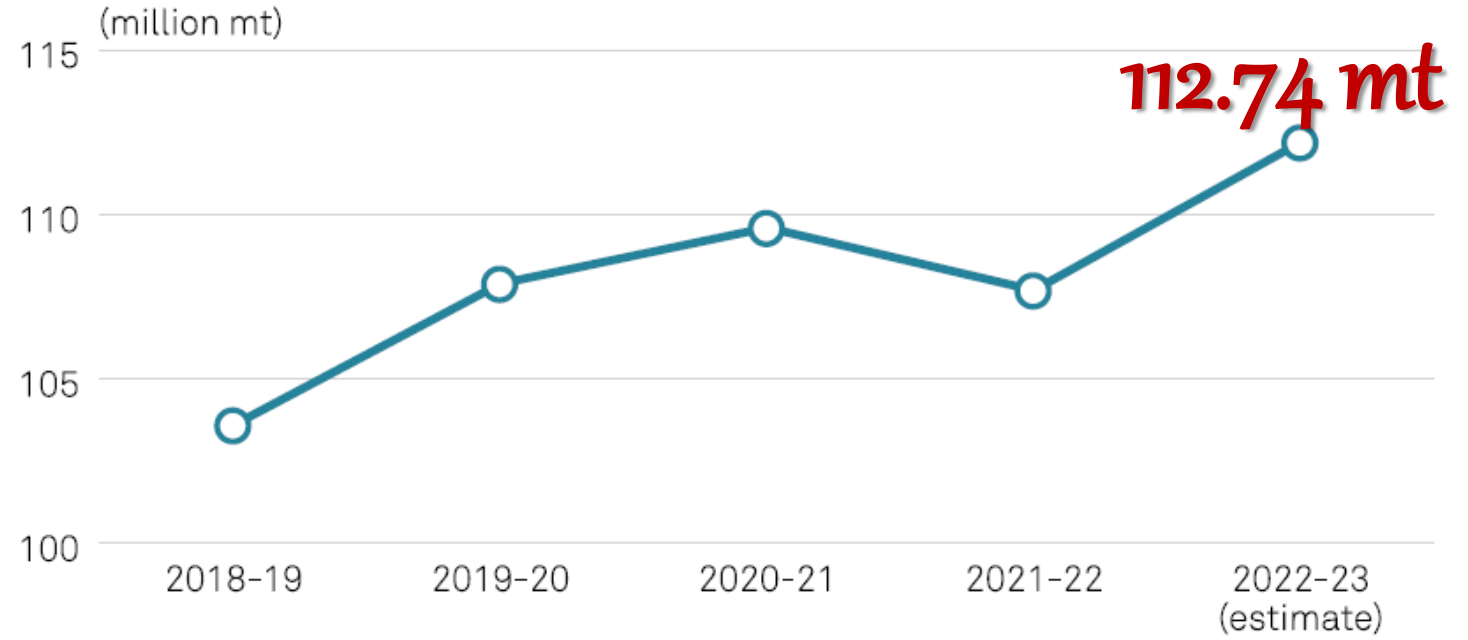
yielded >1/5<sup>th</sup> of global wheat production in 2020.

**2<sup>ND</sup> MOST**

traded grain commodity in the world second to MAIZE.

Sources: Faostat

## India's 2022-23 wheat output seen at record levels



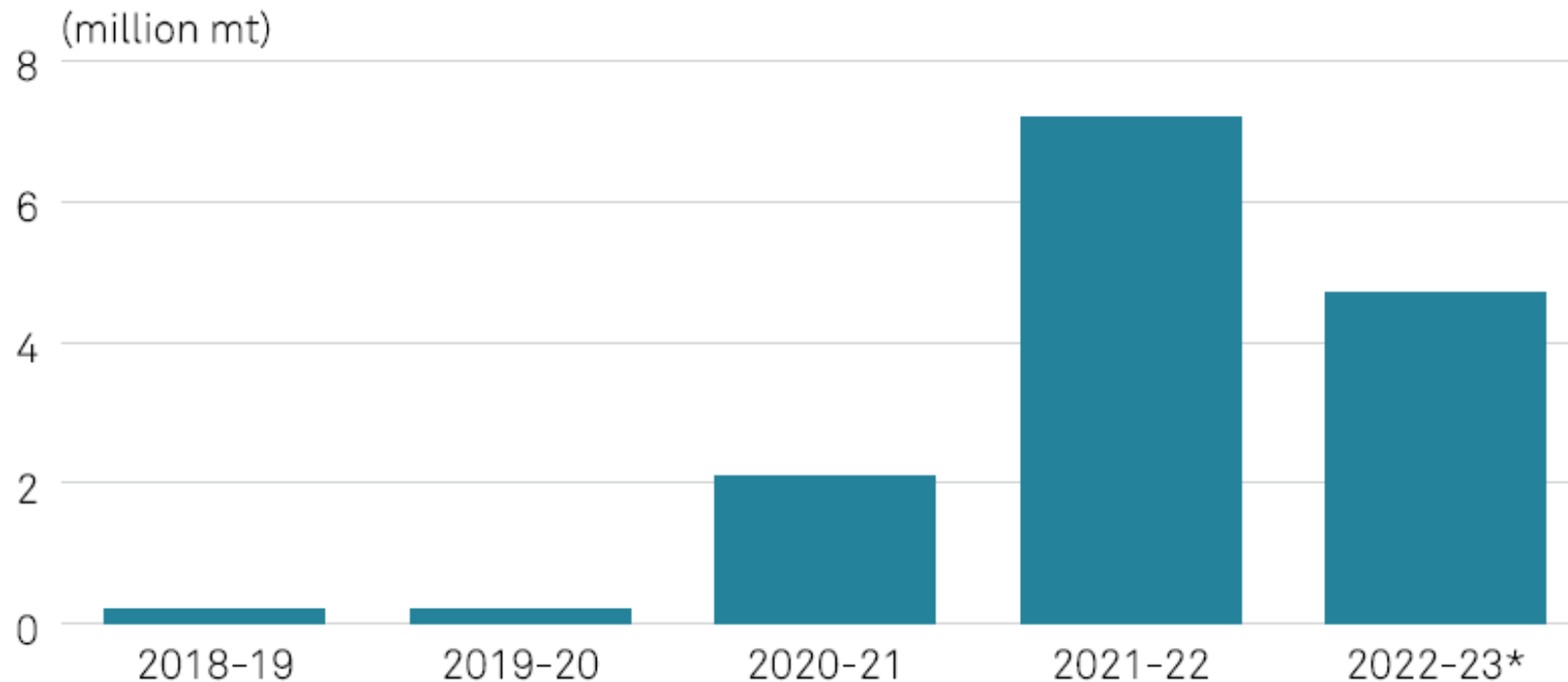
Source: Ministry of Agriculture

India has made tremendous progress, but still during 2019–21, 16.3% of the total population of India was undernourished (FAOSTAT 2021).

<https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/agriculture/021523-trade-survey-sees-indias-2022-23-wheat-crop-below-ministrys-forecast-of-record-high>

# India has emerged as an important player in international trade

## India's wheat exports in 2022-23 dip following ban

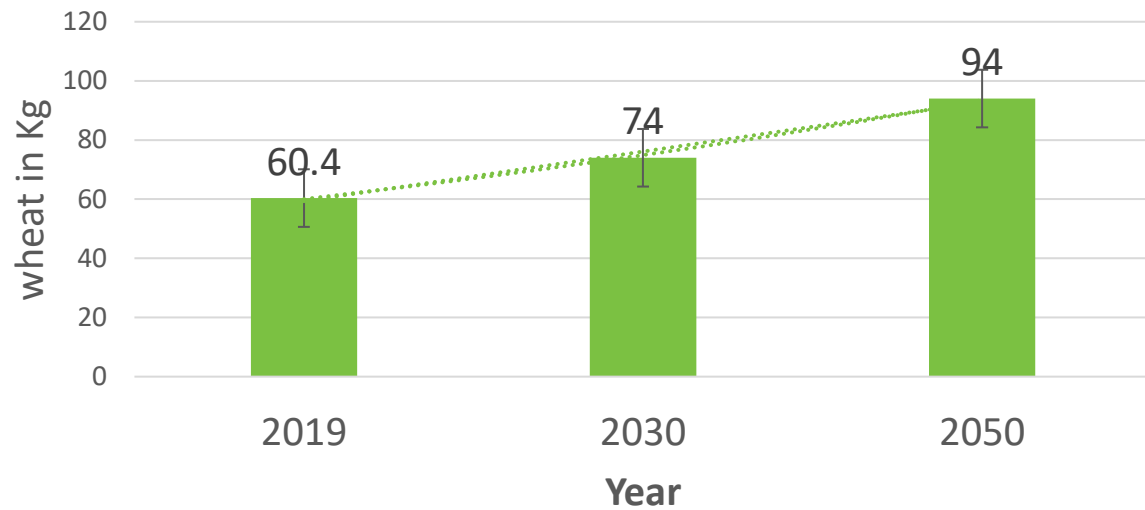


\* data for April-November

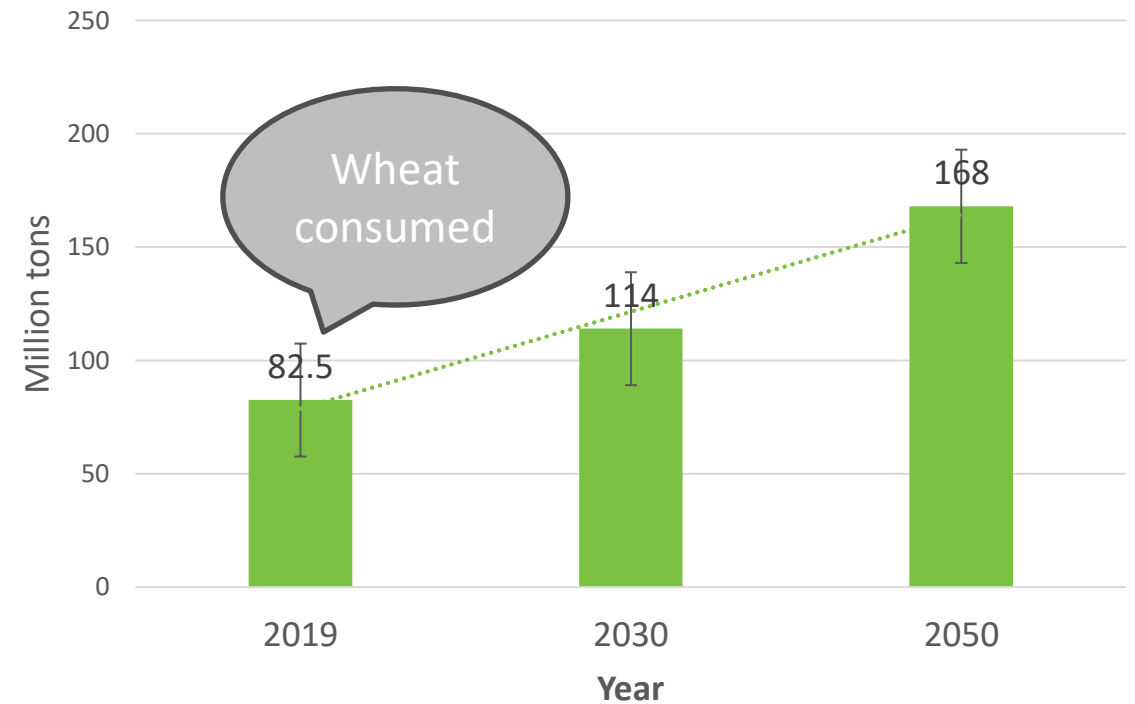
Source: Agricultural and Processed Food Products Export Development Authority

<https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/agriculture/021523-trade-survey-sees-indias-2022-23-wheat-crop-below-ministrys-forecast-of-record-high>

### Wheat consumption per capita/Kg/year in 2030 and 2050

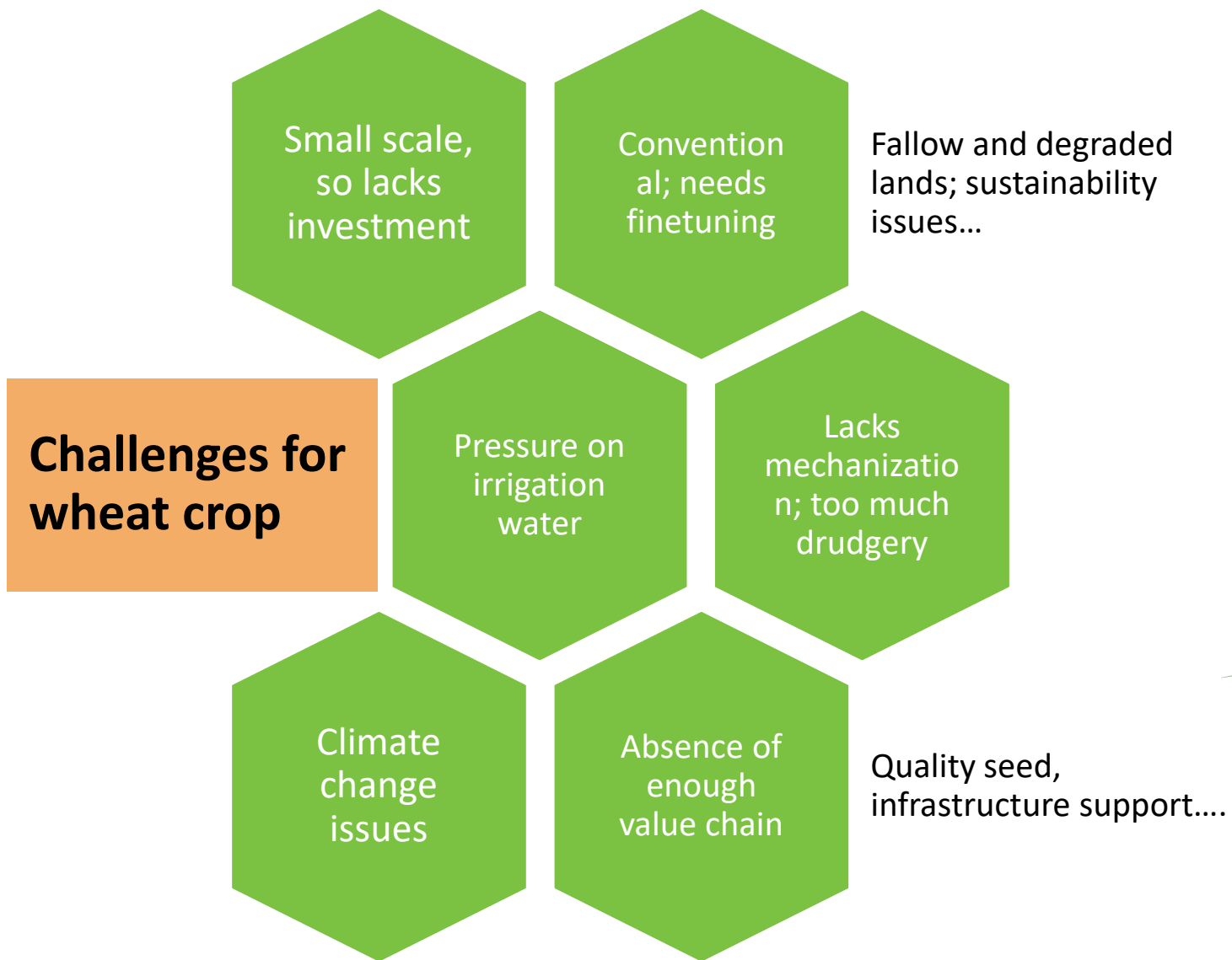


### Maximum wheat demand in 2030 and 2050, compared to 2019



India will either need to bring an extra 9–18 million ha of new land under wheat production or increase wheat yields to 4.46–5.37 t/ha, to meet the projected domestic for 2050. So, the second option is more feasible.

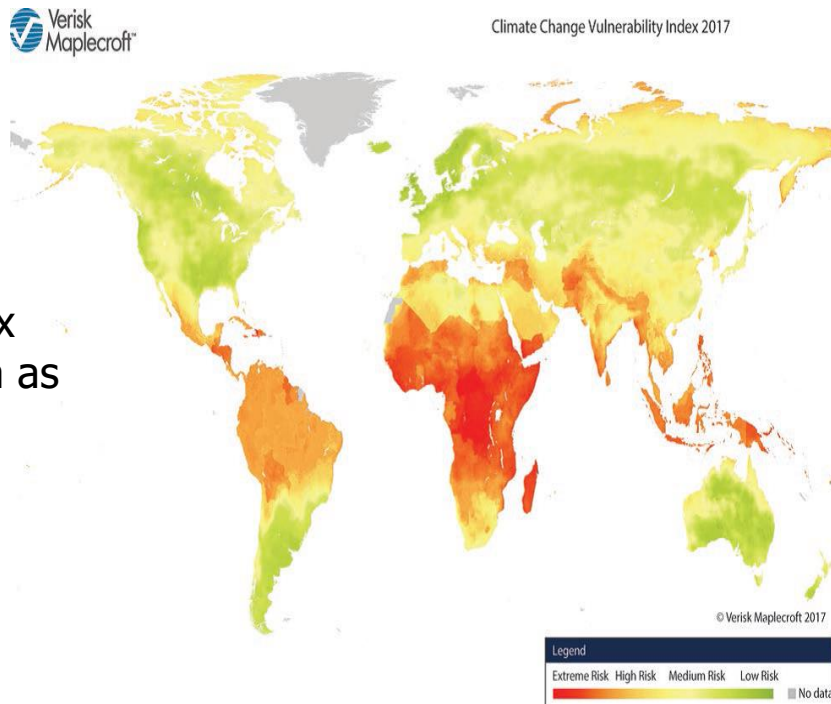
Source: Mottaleb et al., 2023



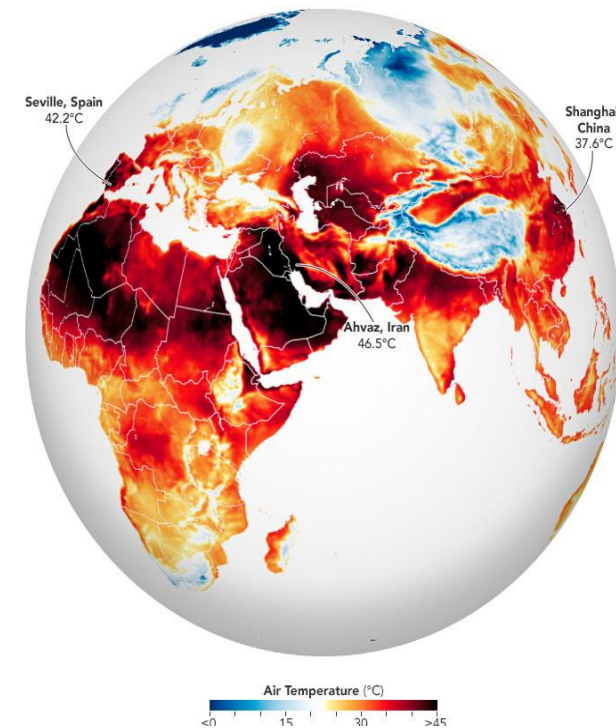
**Any other major problem may emerge any time?**



Climate change vulnerability index shows South Asia as a hotspot

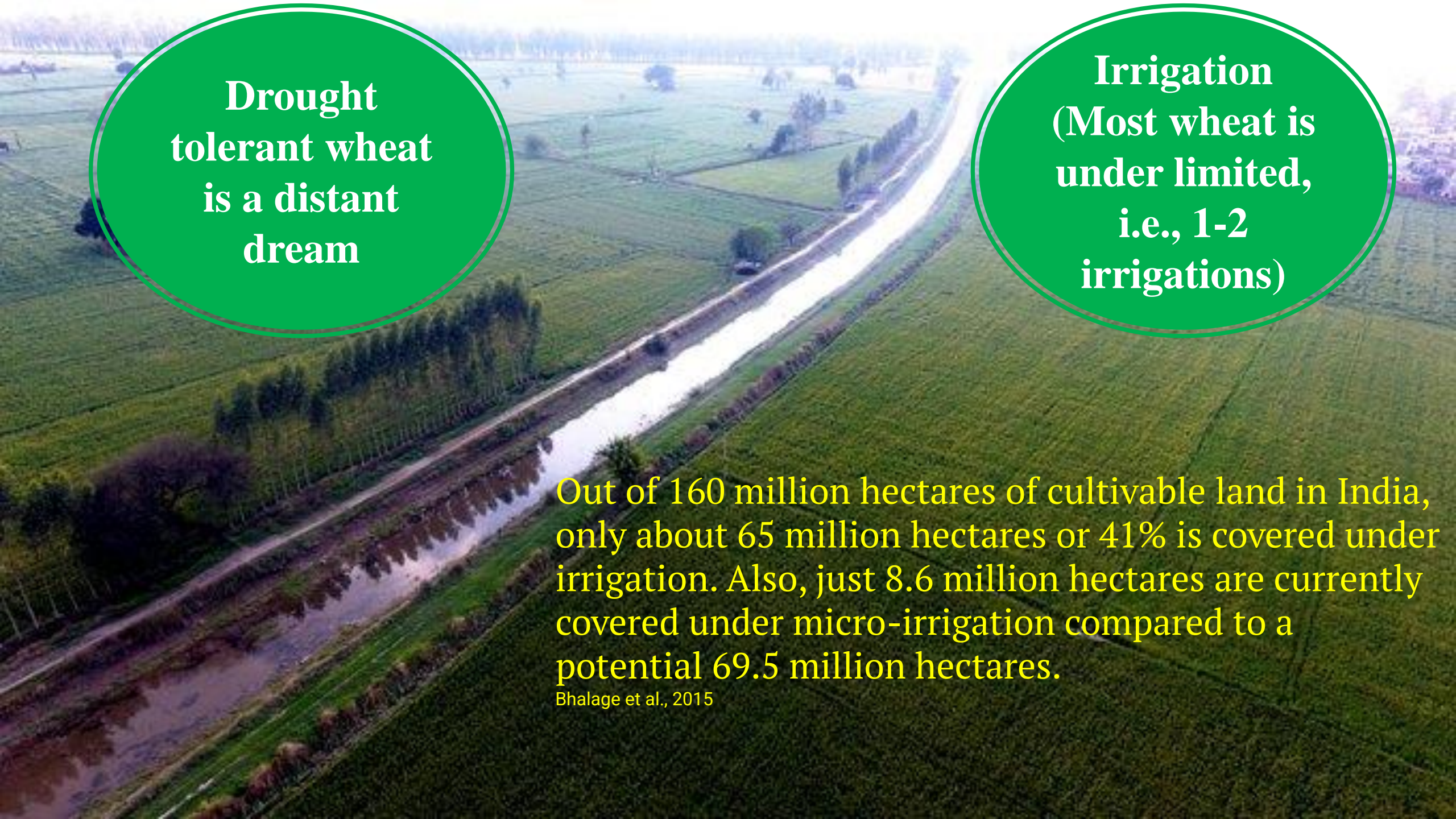


Increase in intensity and duration of extremes: March-May 2022 heat in South Asia



Can we develop 40°C wheat?  
Joshi et al., 2007

Source: Aggarwal et al., Atlas of Climate Adaptation in South Asian Agriculture (ACASA) project, BISA; Funded by BMGF.



**Drought  
tolerant wheat  
is a distant  
dream**

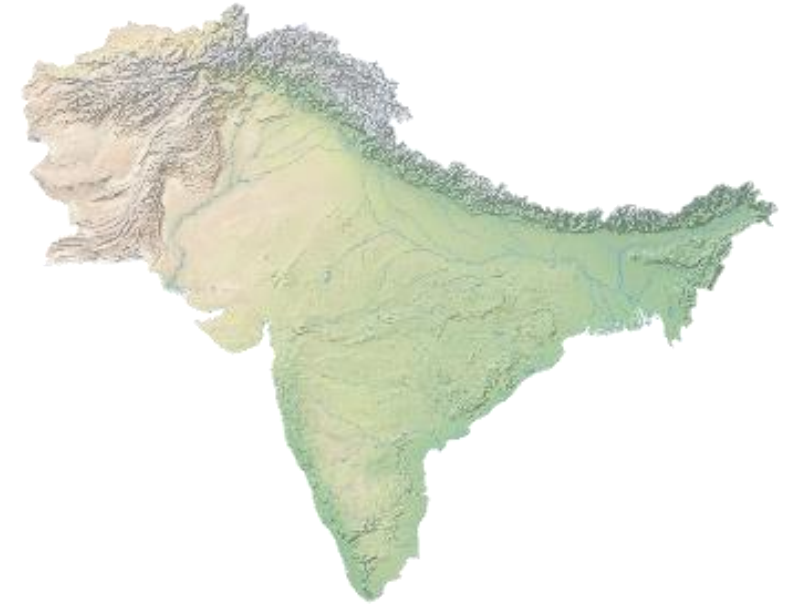
**Irrigation  
(Most wheat is  
under limited,  
i.e., 1-2  
irrigations)**

Out of 160 million hectares of cultivable land in India, only about 65 million hectares or 41% is covered under irrigation. Also, just 8.6 million hectares are currently covered under micro-irrigation compared to a potential 69.5 million hectares.

Bhalage et al., 2015



Are we capable of developing new technologies that can overcome the challenges?



Technologies need to be developed and upscaled  
Interdisciplinary, by co-learning and as soon as possible





Grain yield,  
yellow rust,  
early heat  
tolerance,  
quality; grain  
Zn

**Current Product  
Profile (priority  
traits in breeding)**

Grain yield,  
terminal heat  
tolerance, spot  
blotch, quality,  
grain Zn

Grain yield,  
Drought and  
heat tolerance,  
quality, grain Zn

**Traits that have been  
included recently**

Wheat  
Blast  
2016

Early heat  
tolerance  
2015

This needs  
upscaling

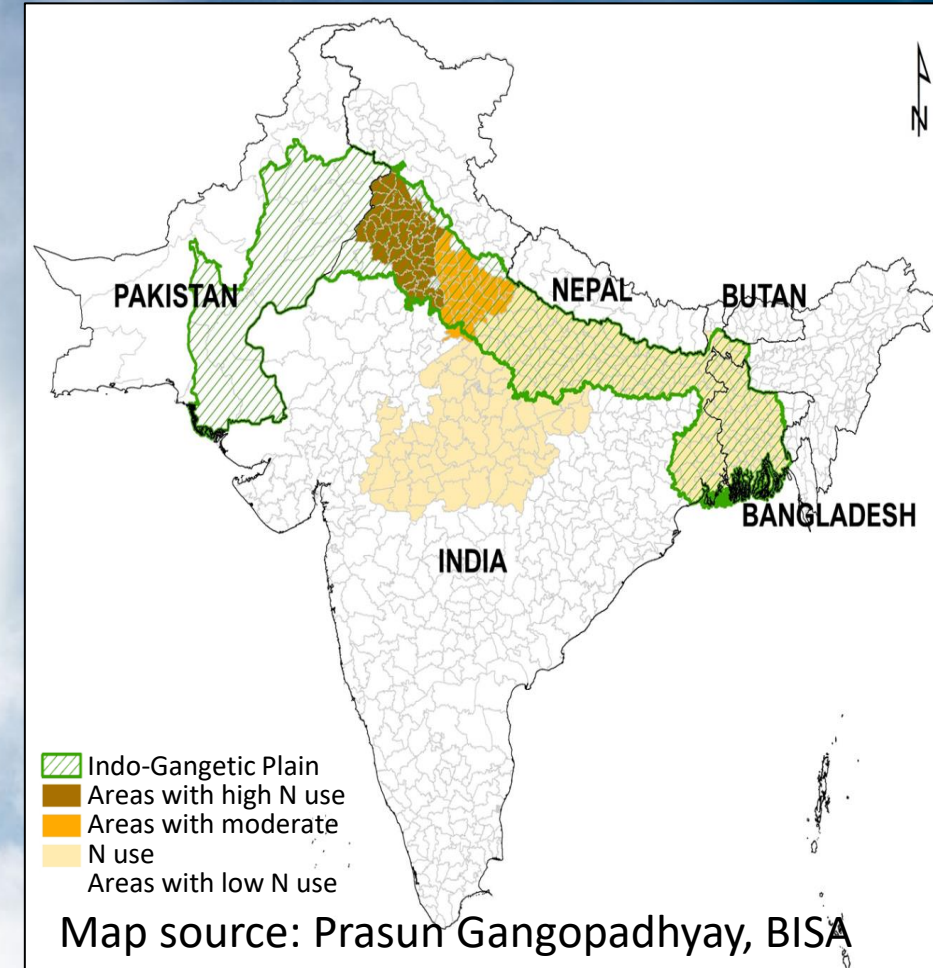
BNI  
2021

# Traits that will need greater attention

Fusarium

Preharvest  
sprouting

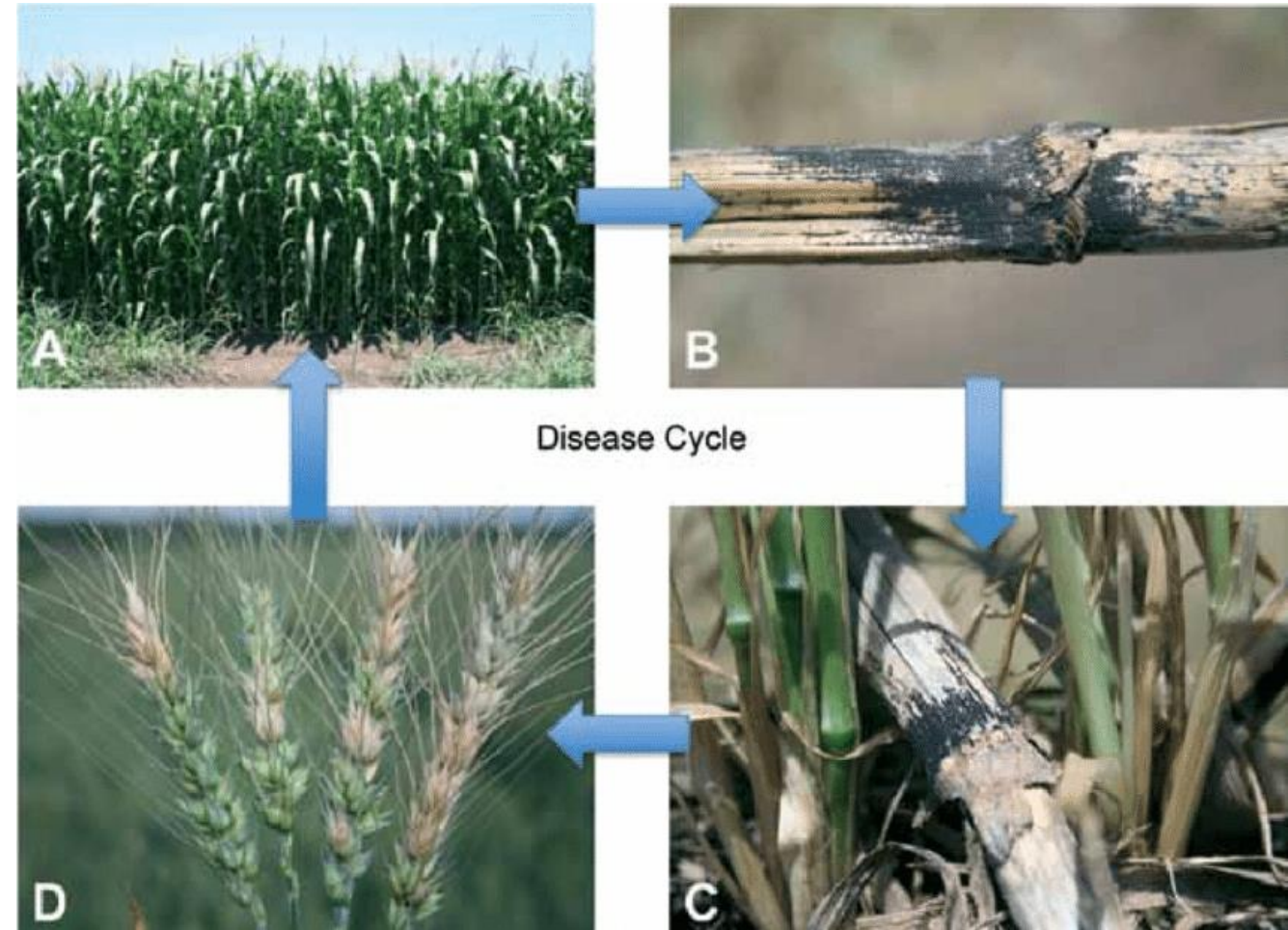
Heat  
tolerance




***Fusarium graminearum* is the most important causal agent of head blight in wheat & stalk and ear rot in maize. So may increase in maize-wheat cropping system**

Maize acts as the alternative host.

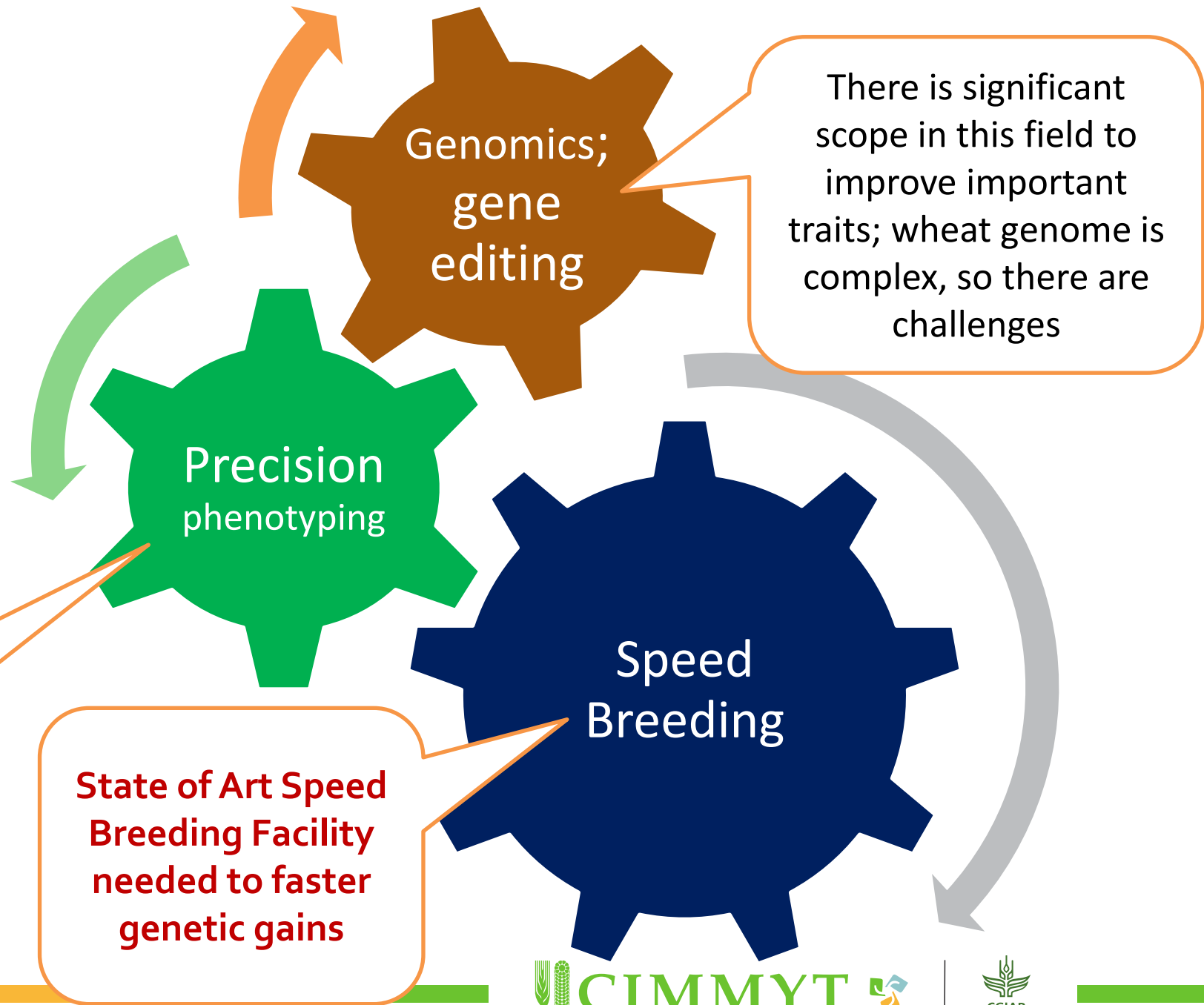
- A. Symptomless maize infected endophytically by *F. graminearum*.
- B. Old maize stalk with abundant perithecia of *F. graminearum*.
- C. Infested maize stalk in the following wheat crop.
- D. *Fusarium* head blight of wheat.



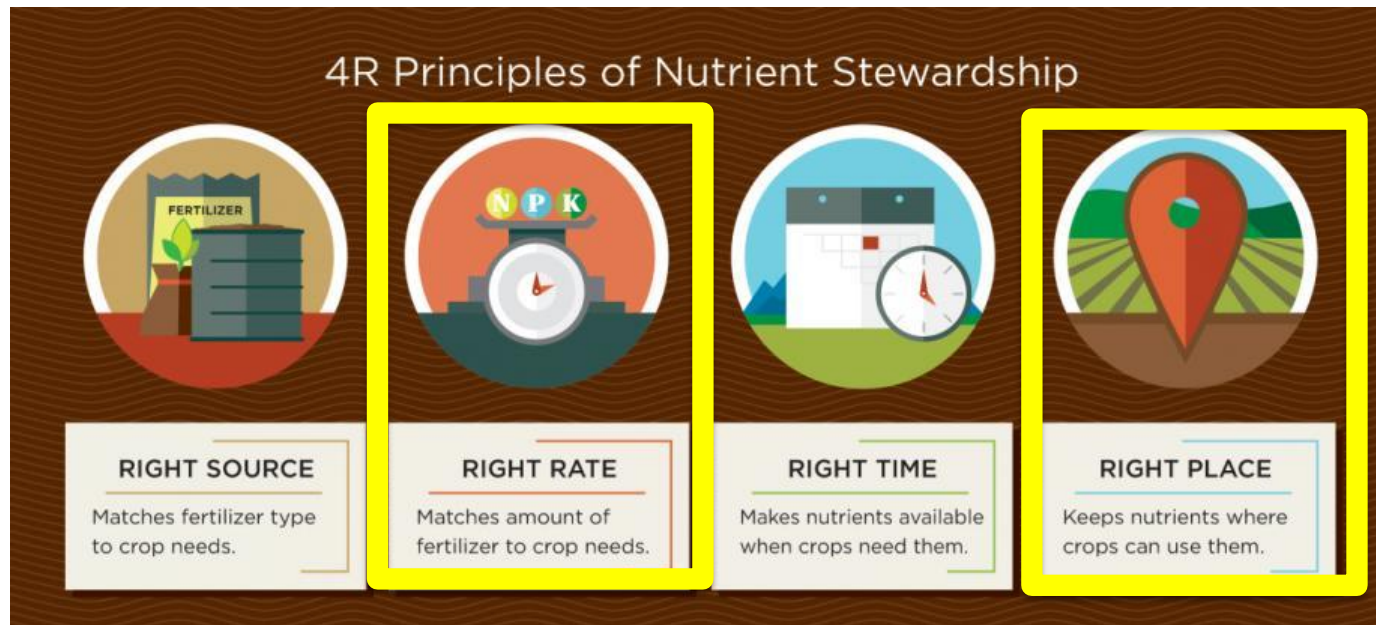


**There will be much more focus in quality due to variable consumer demand & prospect of export**

**Investment in Science is necessary in both public and private sectors; PPP will play a major role.**



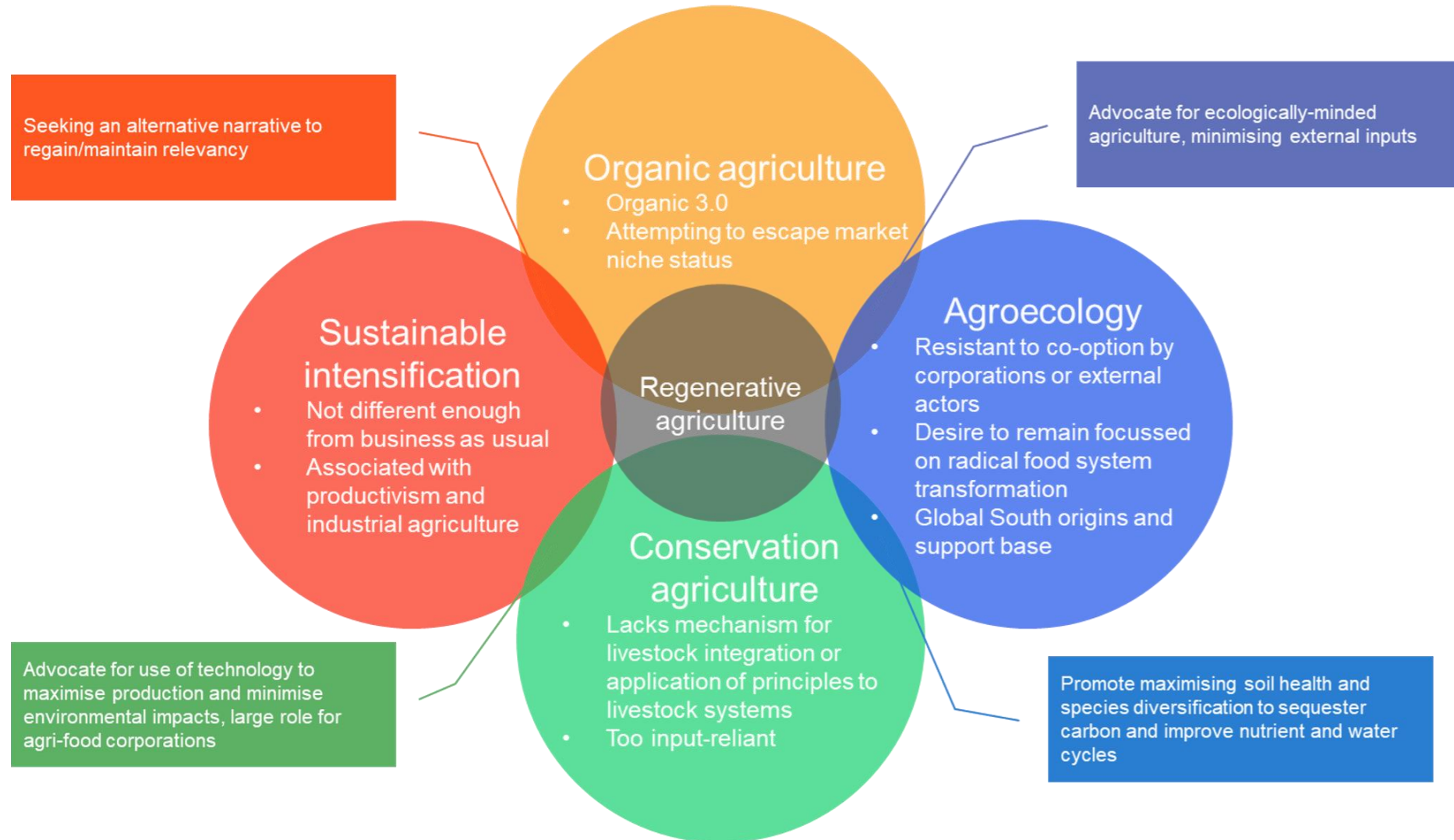
We need systematic mechanization for crop establishment, water, and nutrient use efficiency, and reduce post-harvest losses; Digital tools and AI-supported equipment are being developed



↑ Yield  
Profitability

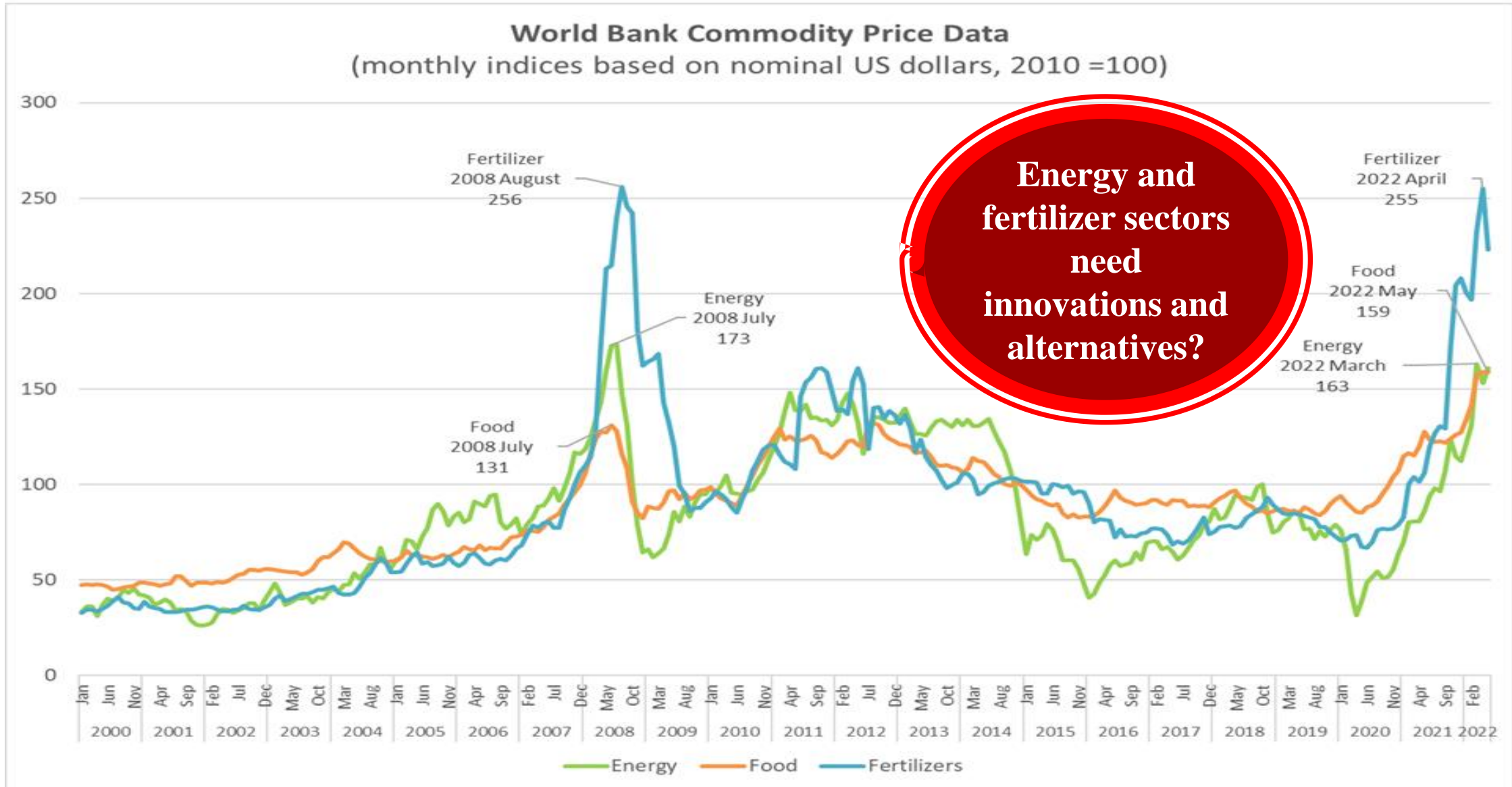
↓ GHG emissions  
Nitrate Leaching

# We will need sustainability in wheat-based cropping system



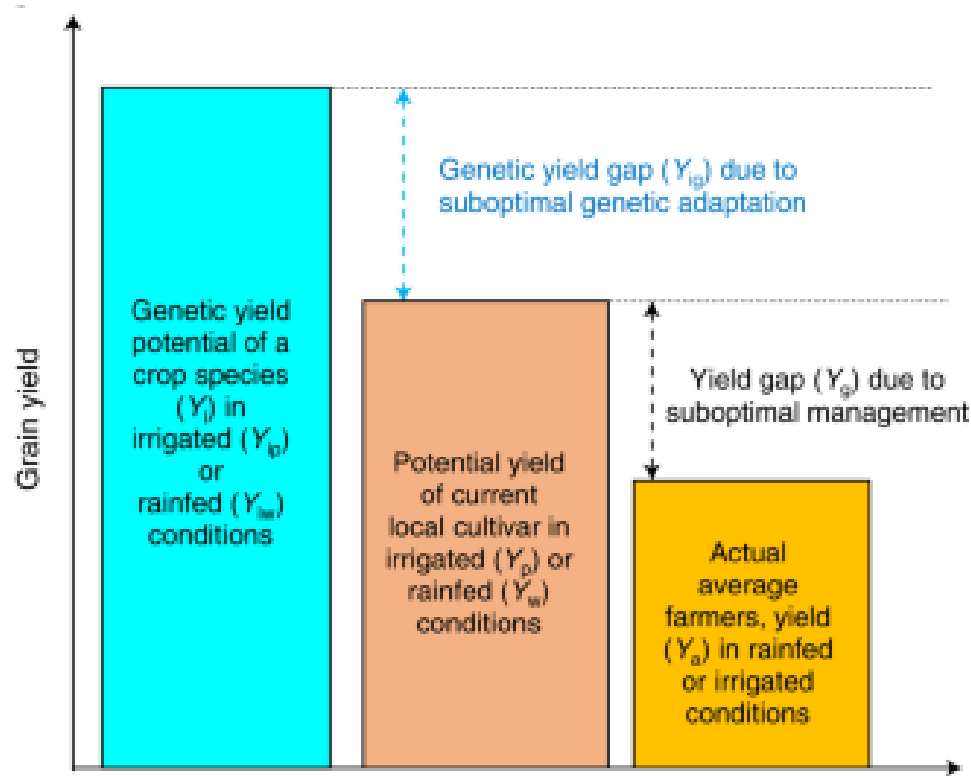
Source: Bless, A., Davila, F. & Plant, R. A genealogy of sustainable agriculture narratives: implications for the transformative potential of regenerative agriculture. *Agric Hum Values* (2023). <https://doi.org/10.1007/s10460-023-10444-4>

# Energy, food, and fertilizer are correlated (2000-2022 data)





# Innovations and their adoption can fill the yield gap



Source: Senapati et al., 2022, Nature food  
<https://www.nature.com/articles/s43016-022-00540-9>

**Yield GAP for most countries: 50 – 200%**

**G = Genetics**  
**A = Agronomy**  
**P = Policy**

**Focus and upscale where there is impact**

Source: Hans J Braun, Former Director, CIMMYT



**Many thanks  
for your  
understanding**

