



# LACC



4<sup>th</sup> ICC Latin American Cereals Conference

## **Beyond the Gluten debate: Wheat as a staple crop in the developing countries and its increasing importance**

H.-J. Braun and C. Guzman

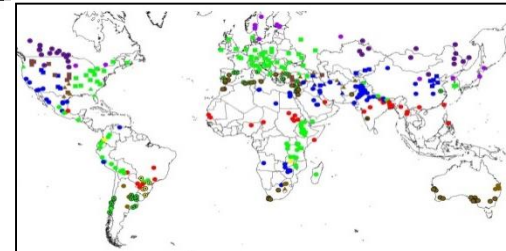
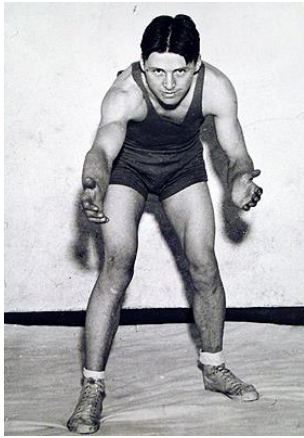
[H.J.Braun@cgiar.org](mailto:H.J.Braun@cgiar.org)

# Borlaug's Scientific Legacy





# Norman Borlaug's Scientific Legacies in Wheat



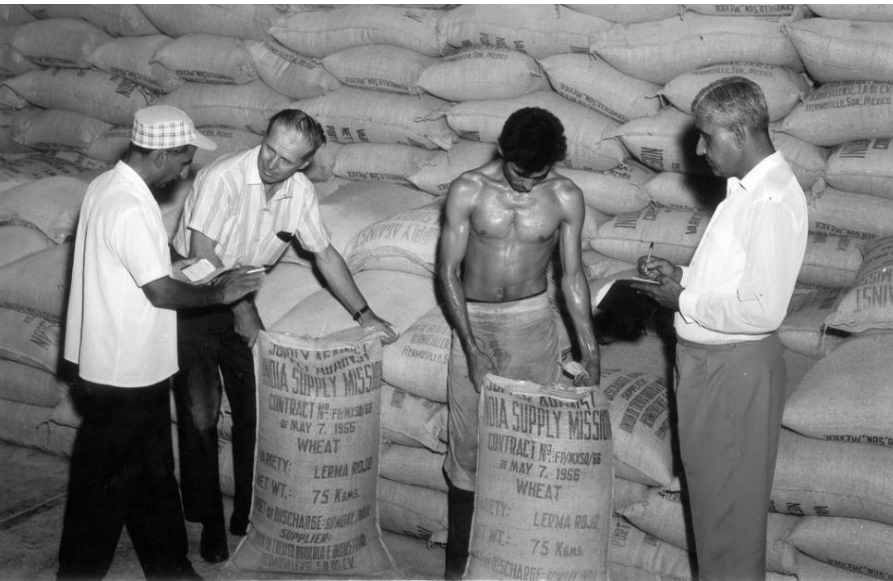
Celebrating 100 Years of  
**DR. NORMAN  
BORLAUG**



# An Outspoken Visionary

***“The seriousness or magnitude of the world food problem should not be underestimated. Recent success in expanding wheat, rice and maize production in Asian countries offers the possibility of buying 20-30 years of time.”***

**- Norman Borlaug, 1969**



**Did we use this time to  
get ready for the next  
Green Revolution?**





# The state of the World in 2017

- World hunger rising in 2016 for first time this century
- 815 million chronically undernourished – up by 38 million
- 489 million located in countries affected by conflicts
- Animal feed could feed 4 billion people
- Today more people are hungry than entire population of South Asia at beginning of Green Revolution (1970)
- Population Monster not part of public debate – 2.5 billion more people by 2050 – and none of them borne yet



[https://www.theguardian.com/global-development/2017/sep/15/alarm-bells-we-cannot-ignore-world-hunger-rising-for-first-time-this-century?CMP=Share\\_AndroidApp\\_Outlook](https://www.theguardian.com/global-development/2017/sep/15/alarm-bells-we-cannot-ignore-world-hunger-rising-for-first-time-this-century?CMP=Share_AndroidApp_Outlook)

# People dying due to hunger vs. other causes

## Deaths per year from various causes

Hunger  
and  
Malnutrition  
9 mln

HIV/AIDS  
1.78 mln

Tuberculosis  
1.34 mln

Diabetis  
1.26 mln

Road  
Accidents  
1.21 mln

Malaria  
438 mln

2008 Sichuan Earthquake  
68,000 people dead

2010 Haiti's earthquake  
84,000 people dead

2004 Indian Ocean Tsunami  
310,000 people dead

Hunger and Malnutrition kill 1.5 more people than  
AIDS, Tuberculosis, Diabetes, Road accidents,  
Malaria and all natural disasters combined

Data Source (modified): Jack Bobo, Biotechnology Advisor, US Department of State

Slide: Courtesy: M. Acevedo, DDGW, Cornell

# Wheat in the Human Diet

- Wheat has been used as food for at least 45 000 years (first evidence)
- Wheat is part of human culture and cereal (wheat / rice / maize) cultivation was basis for civilization
- Göbekli Tepe – energy dense crop frees labor



Karacamoun region, SE-Turkey  
Origin of wheat cultivation





# Are modern wheat varieties less nutritious?

- Chemical Composition of modern wheat not significant different from landraces / ancient varieties
- Minor non relevant changes in in most bioactive components i.e. quality and nutrition relevant traits
- No evidence that ancient wheats are healthier than modern wheats
- Shewry and Hey. J. Cereal Science 65: 2015 236-243



## Wheat – an ideal staple

- Important and affordable protein and calorie source
- Wheat grain easy to store at room temperature
- Wheat products can be stored for longer periods and eaten cold – convenience
- Important source for Aminoacids Micro nutrients, Vitamins, Fibre, Anti-Oxidants
- Balanced diet when mixed with legumes
- > 95% of all people





# Agri-Food Systems: Need for a more diversified diet

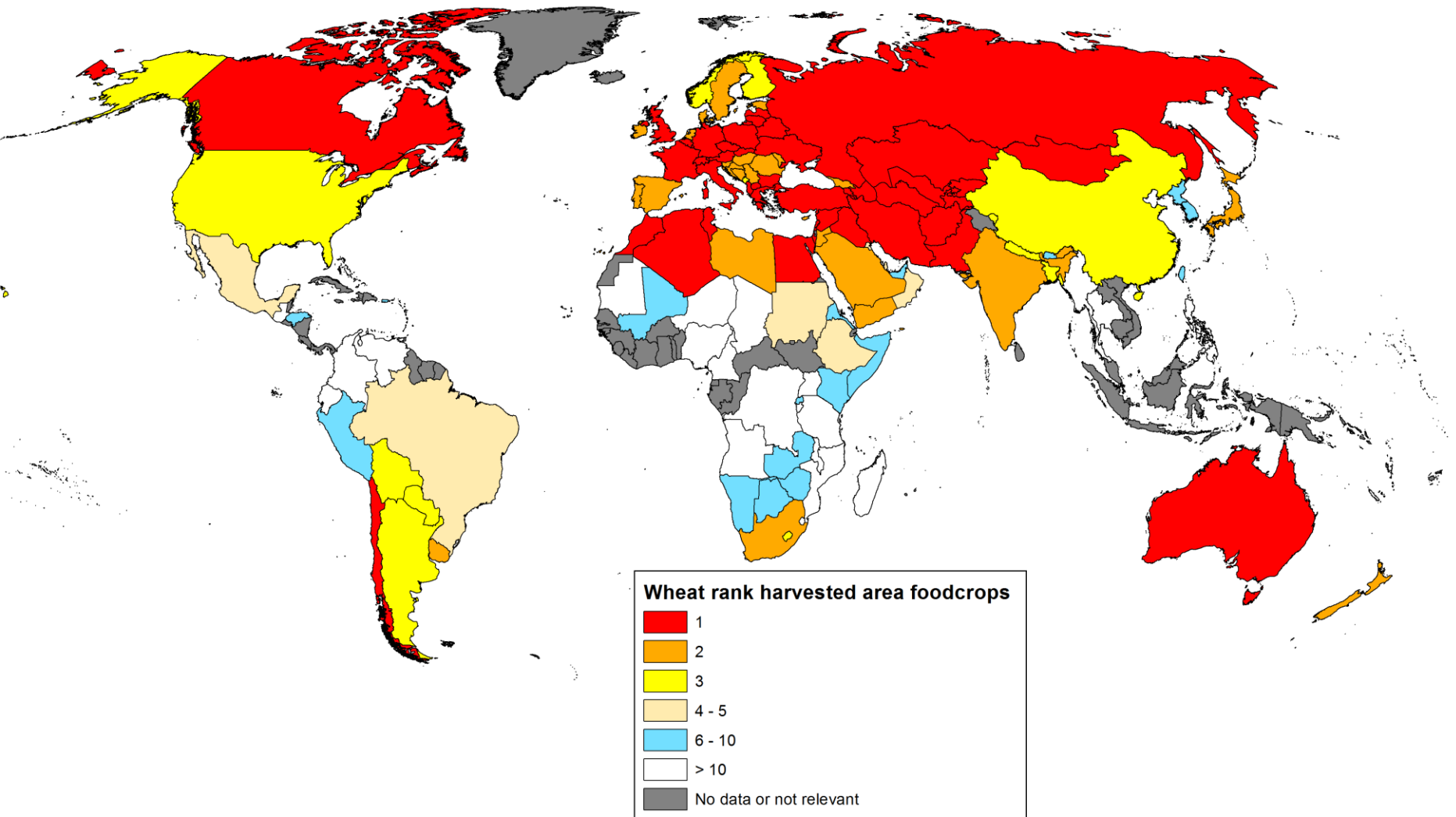
## Maize, Wheat and Rice: What the world eats and grows

44% calories      37% protein





# Wheat importance as area harvested crops



Source: FAO-Stats, 2015

# What will be future growth in world food demand?

Customary to consider out to 2050, here use 2012 to 2050.

- Population (0.96%/year) + 36 %
- Demand / increased consumption + 14 %
- Total demand +50 %  
(or average 1.5 % p.a.)
- However, projected population growth rate greater **now** (1.20% p.a.),
- **Undernourished** still substantial

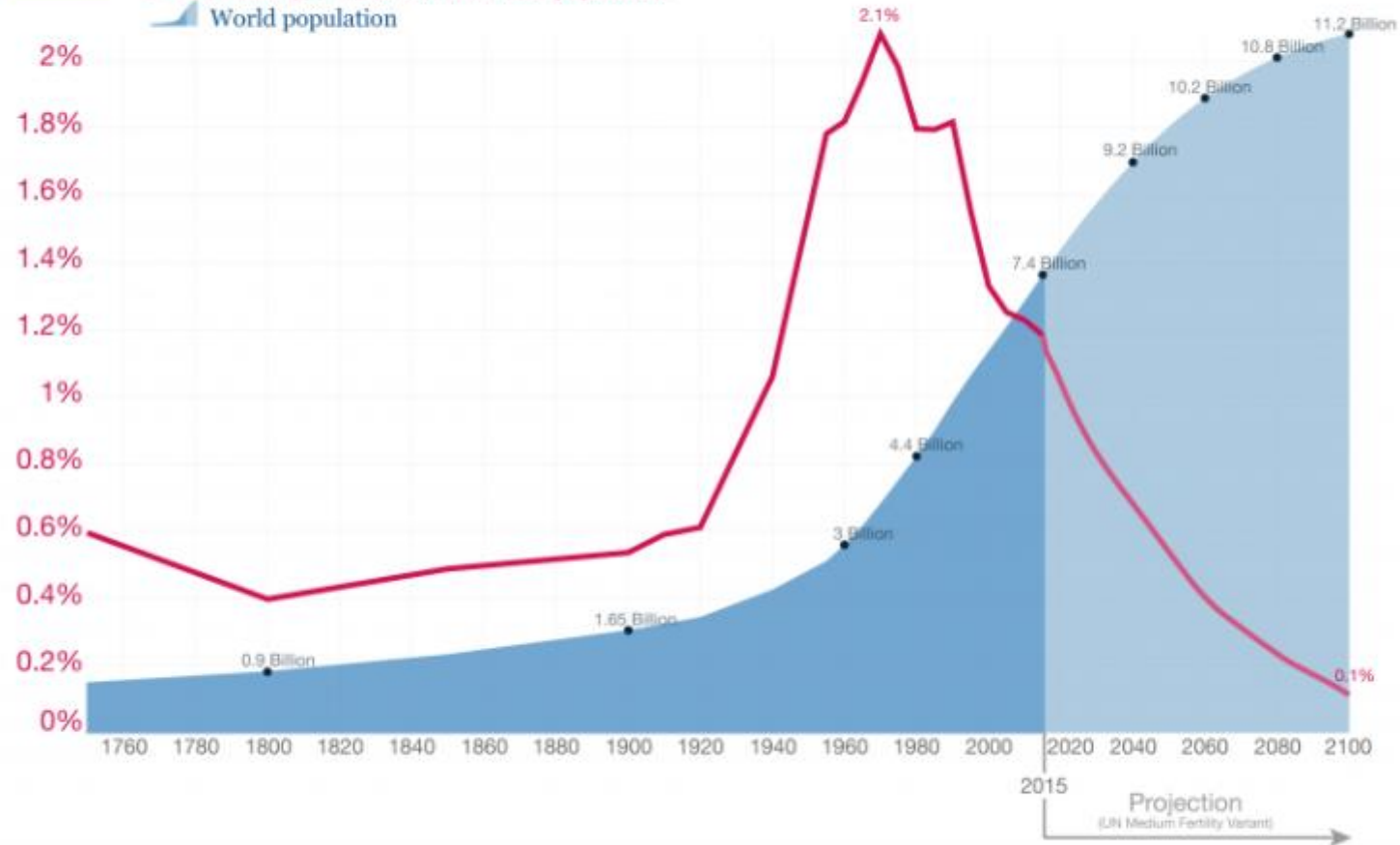
Sources: UNPopulation Assessment July 2017; Baldos and Hertel 2016; FAOStat 2016

## World population, 1750-2015 and projections until 2100<sup>3</sup>

Our World  
in Data

### World population growth, 1750-2100

Annual growth rate of the world population  
World population

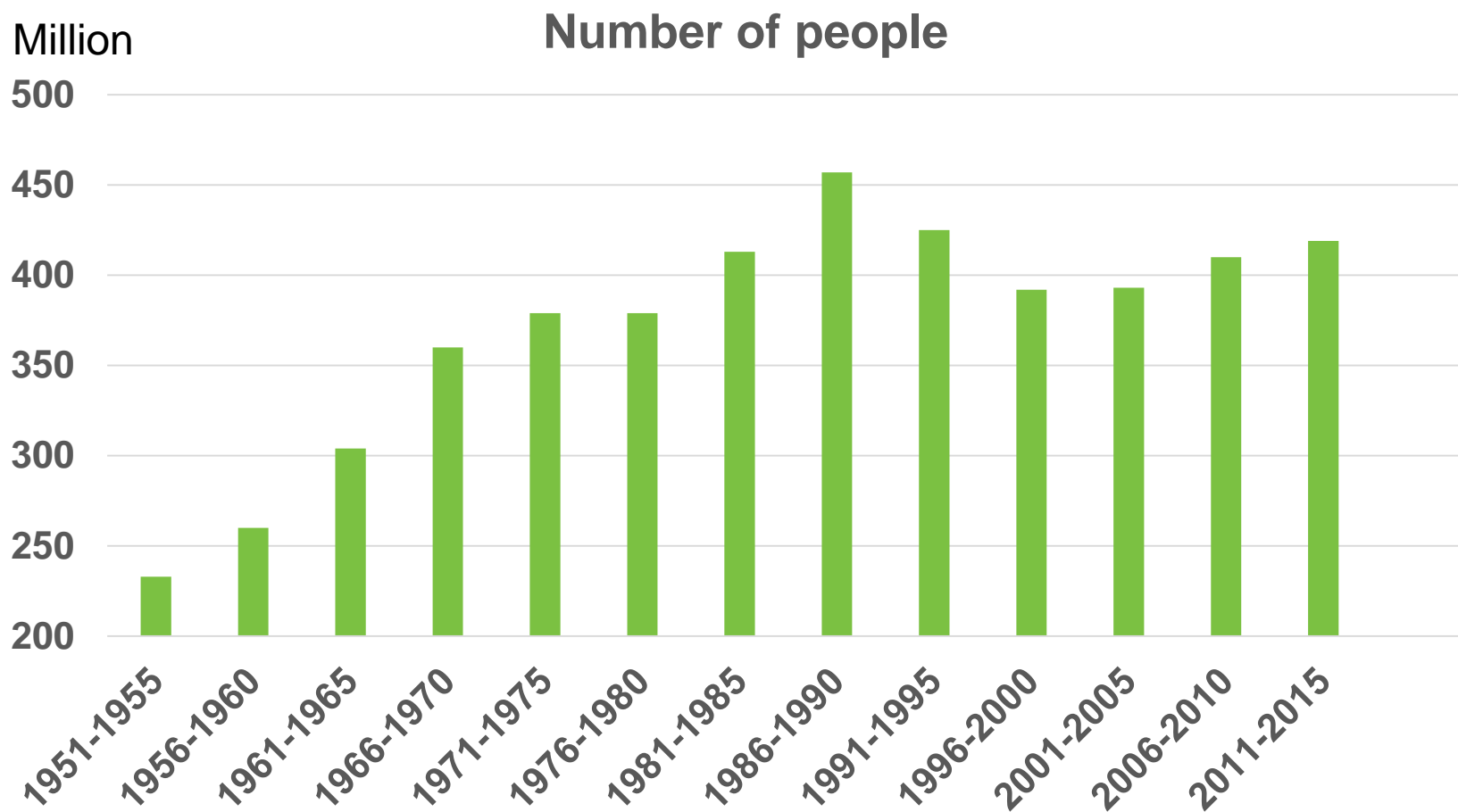


Data sources: Up to 2015 OurWorldInData series based on UN and HYDE. Projections for 2015 to 2100: UN Population Division (2015) – Medium Variant. The data visualization is taken from OurWorldInData.org. There you find the raw data and more visualizations on this topic.

Licensed under CC-BY-SA by the author Max Roser.

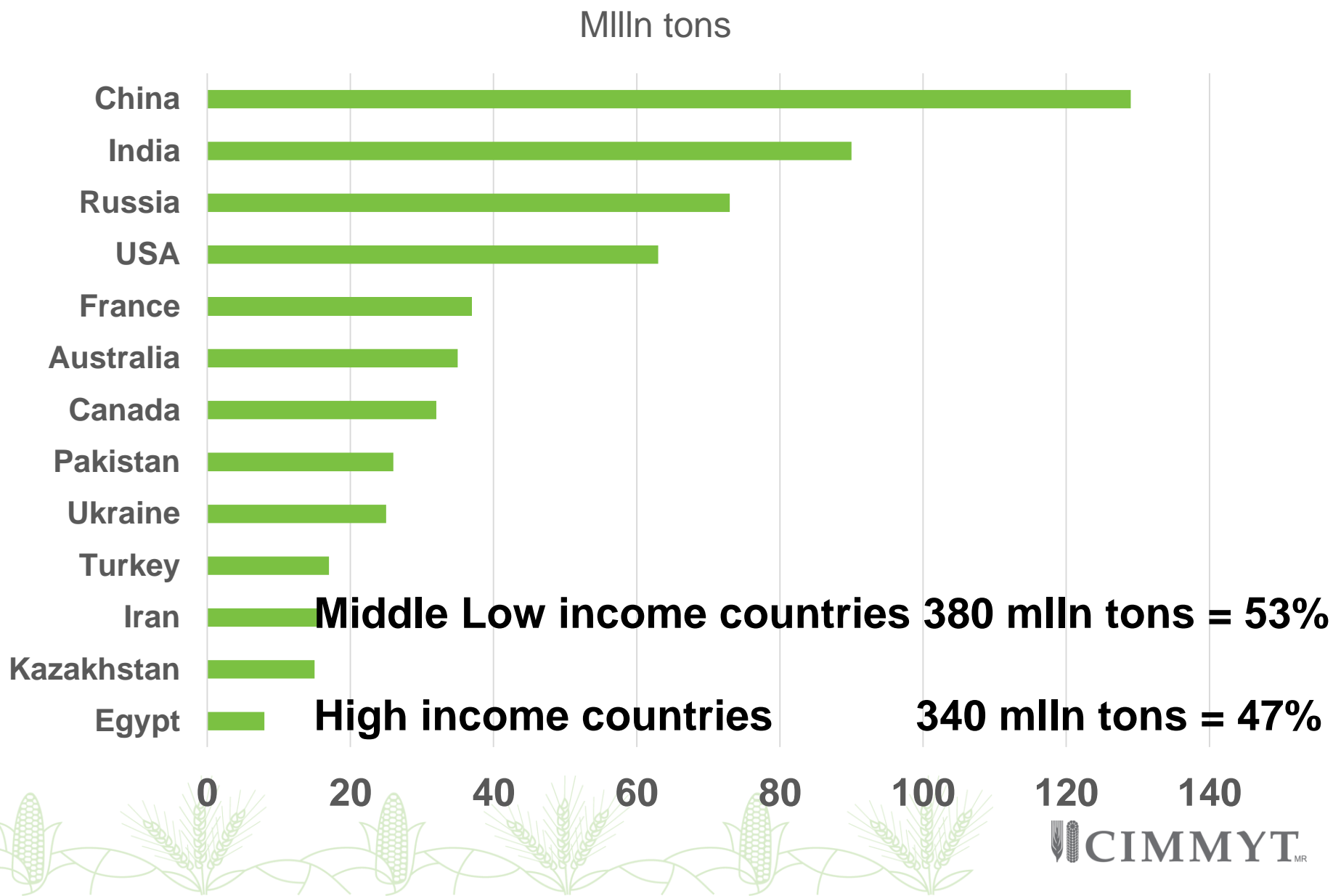


# Population growth shown as number of people for five year period since 1950

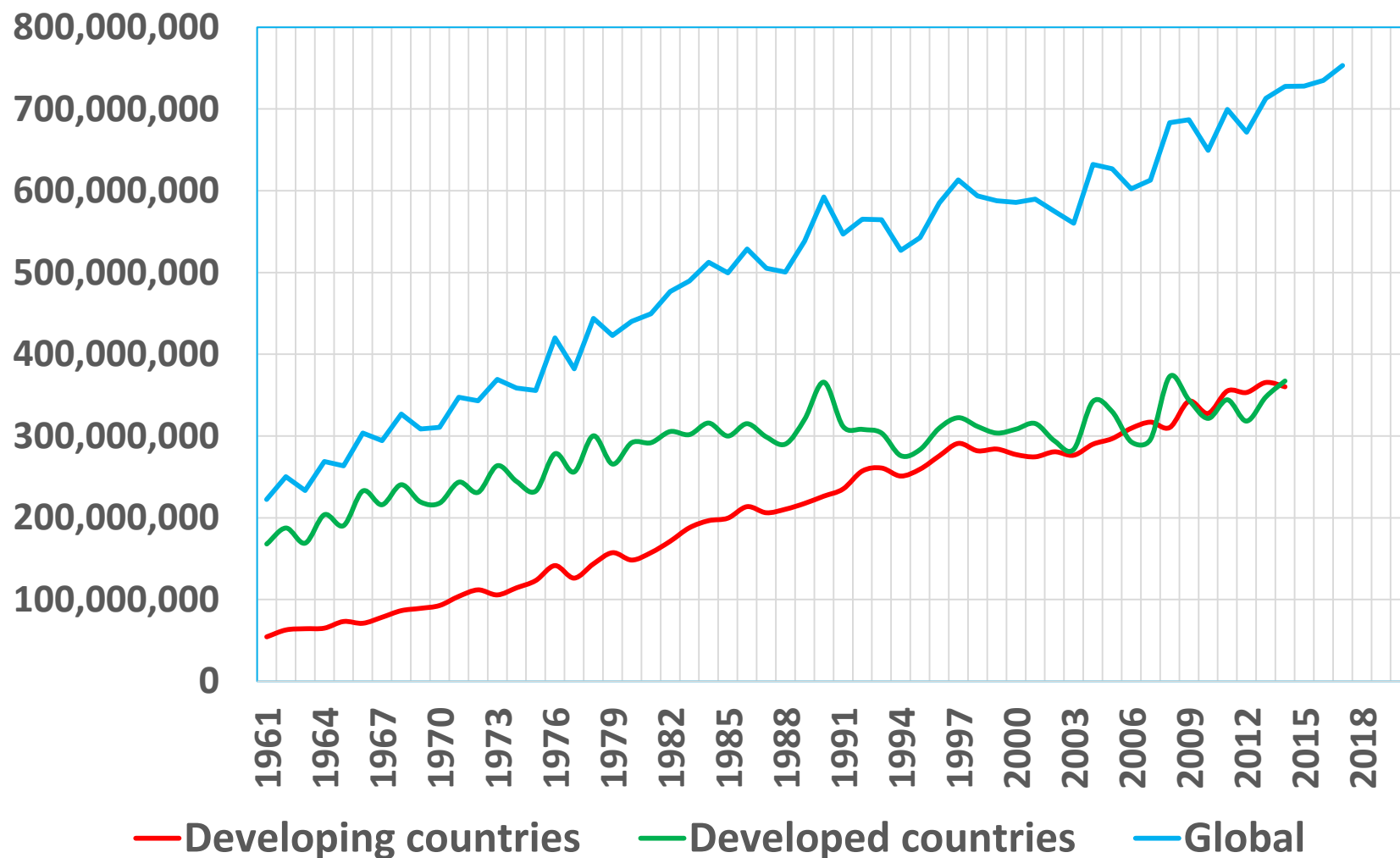


Data source: [https://en.wikipedia.org/wiki/World\\_population](https://en.wikipedia.org/wiki/World_population)

# Countries Producing more than 10 mln tons of wheat (2017)



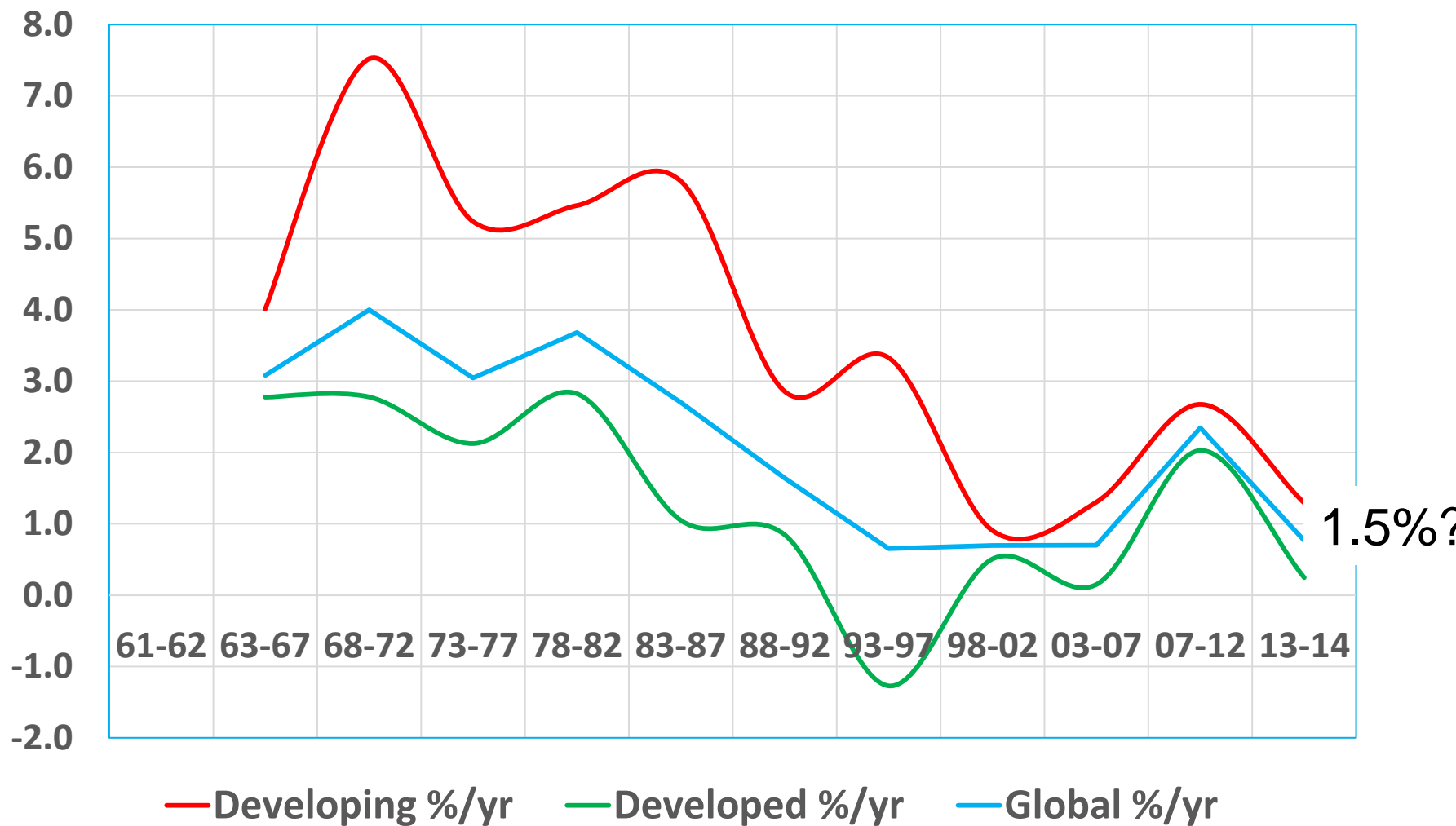
## Wheat Production 1961 to 2015: Global, in developing and developed countries (tons)



Data Source: FAO, USDA. Compiled by H.-J. Braun



Wheat Production change % compared to previous 5 year period:  
Global, in developing and developed countries (tons)



Data Source: FAO, USDA. Compiled by H.-J. Braun

# Demand growth rates; scope to lift internal cereal production in

World regions ranked by key differences:	New World	Russia Plus	Old Europe	Populous Asia	West Asia North Africa	Sub-Saharan Africa
Demand considerations (annual mean 2011-13, all annual crops as wheat energy equivalents)						
Population Increase rate 2012 (% p.a. )	1.02	0.10	0.10	1.05	1.86	2.75
Total demand increase 2012 (% p.a.) <sup>a</sup>	1.2	0.6	0.2	1.7	2.4	3.6
Supply considerations: current crop area and yield rate of change and prospects						
Crop area change 2001-2014 (% p.a. rel 2012)	1.23	1.01	-0.37	0.98	-1.86	2.51
New arable land prospects	++	++	nil	nil	nil	+++
FY growth 2001-2014 (% p.a. rel 2012)	1.51	1.80	1.05	1.73	1.57	0.96
Yield gap (% of FY)	30-50	50-75	20-40	50-100	75-300	200-400
Priorities for investment	PY increase	Yield gap closing	PY increase	Yield gap closing	Yield gap closing	Yield gap closing

- Failure will drive up prices, land clearing in SSA, and out migration
- But yield gap closing takes time and huge resources and commitment

**Africa =**

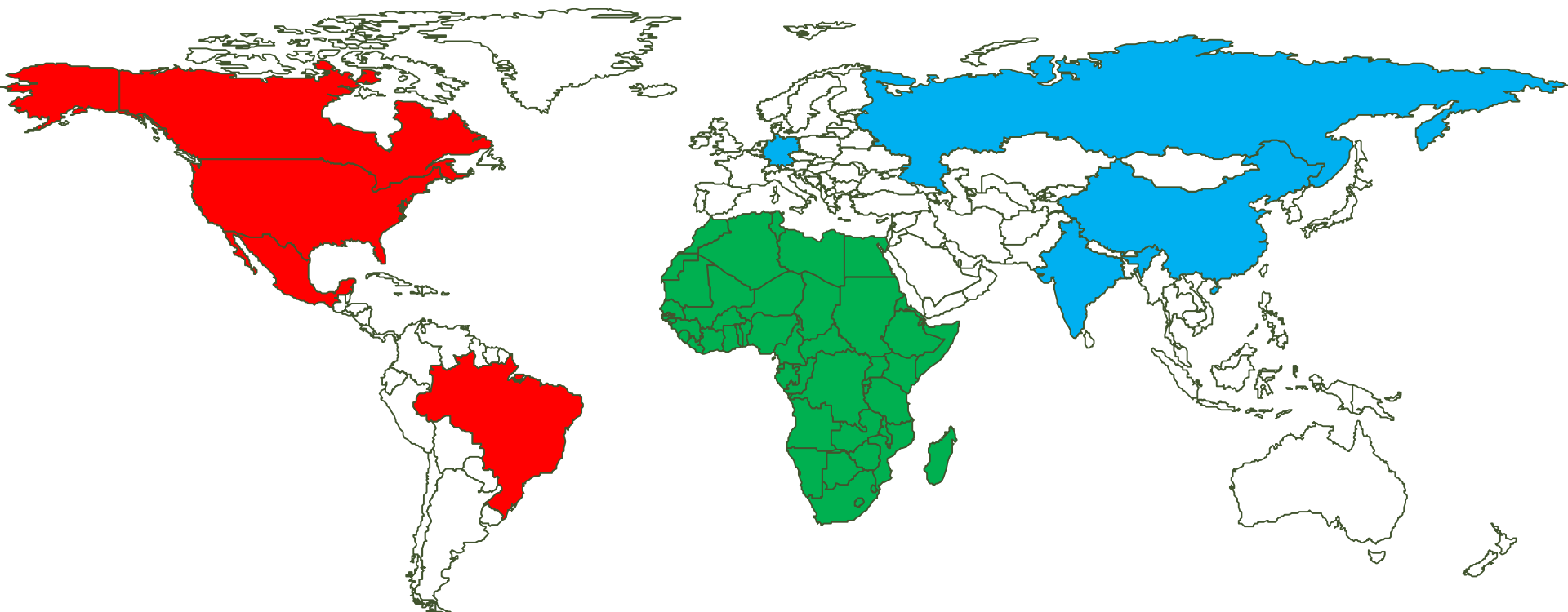
**Canada USA Mexico Brazil**

**China India Russia Germany**

**30.5 m km<sup>2</sup>**

**30.4 m km<sup>2</sup>**

**30.4 m km<sup>2</sup>**



Canada	10.0
USA	9.8
Mexico	2.0
Brazil	8.5
Total	30.4

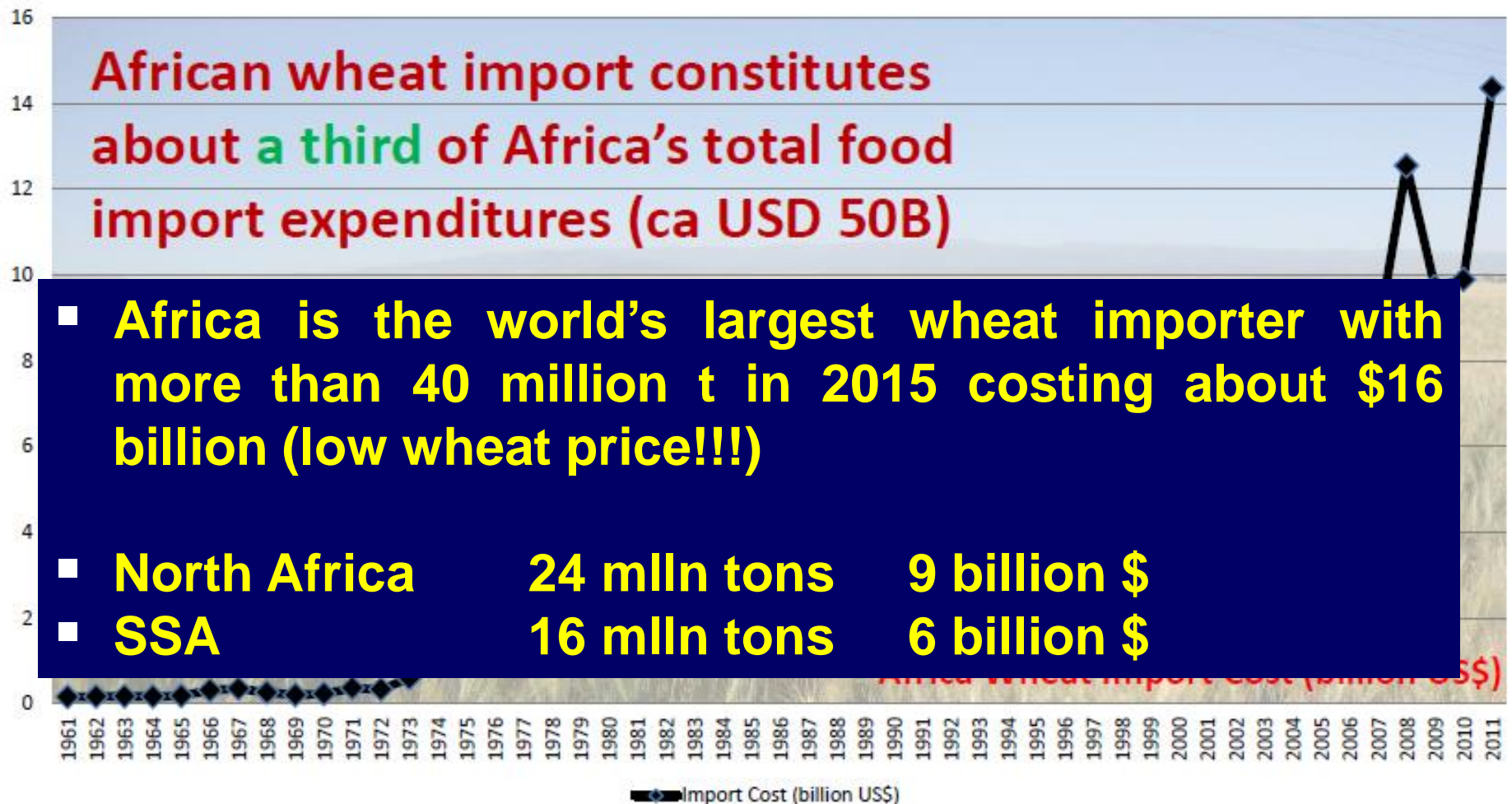
China	9.6
India	3.3
Russia	17.1
Germany	0.4
	30.4



# Rising Cost of Imports

**African wheat import constitutes about a third of Africa's total food import expenditures (ca USD 50B)**

- **Africa is the world's largest wheat importer with more than 40 million t in 2015 costing about \$16 billion (low wheat price!!!)**
- **North Africa            24 mln tons       9 billion \$**
- **SSA                        16 mln tons       6 billion \$**

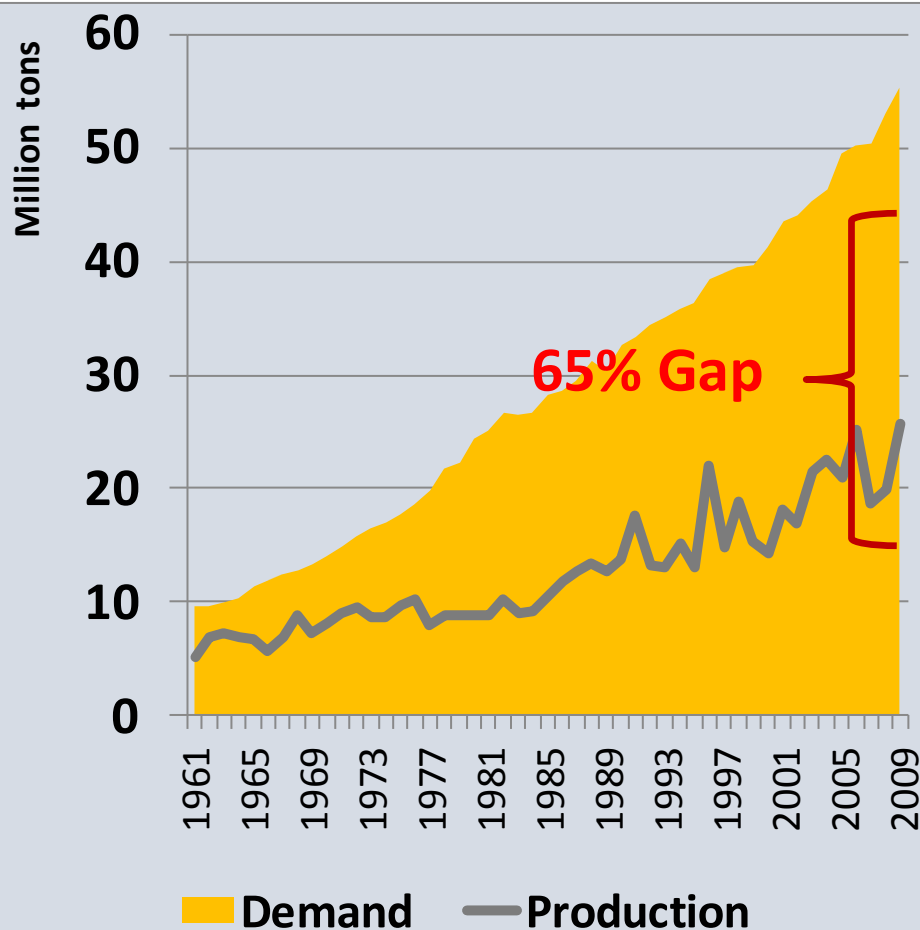


Source: FAOSTAT

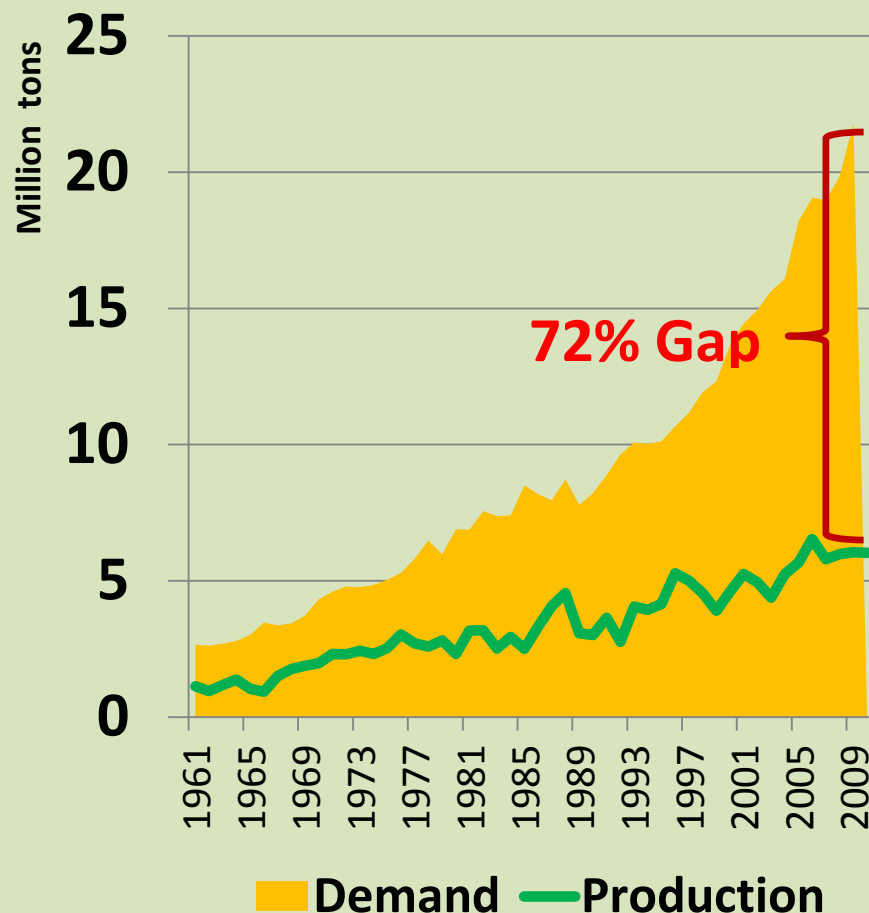


# Widening gap Demand and Supply

**All Africa**



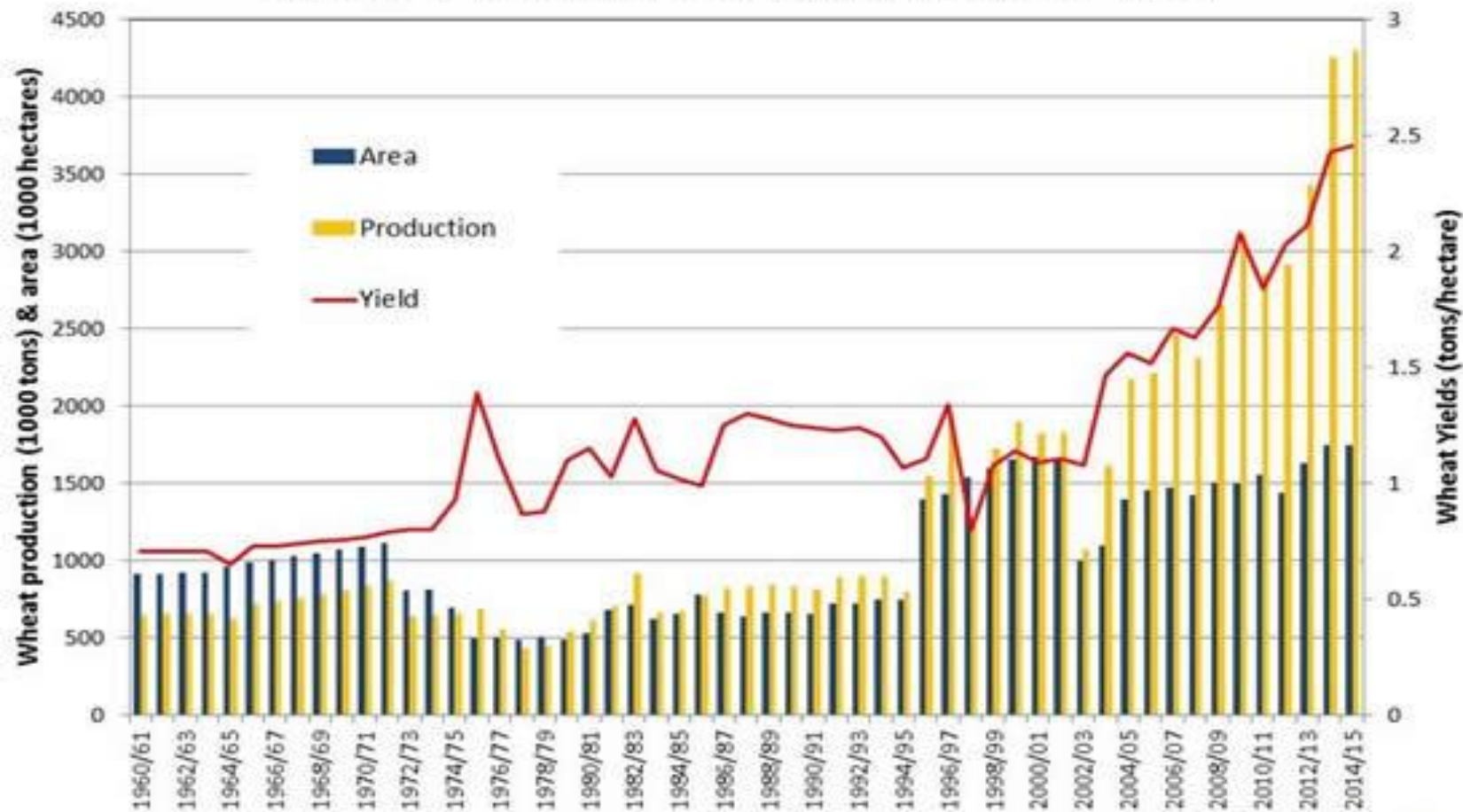
**Sub-Saharan Africa**



**African farmers produce only 44% of the wheat consumed in the continent**

# Progress : Transformation of Ethiopia wheat production (1960 – 2015)

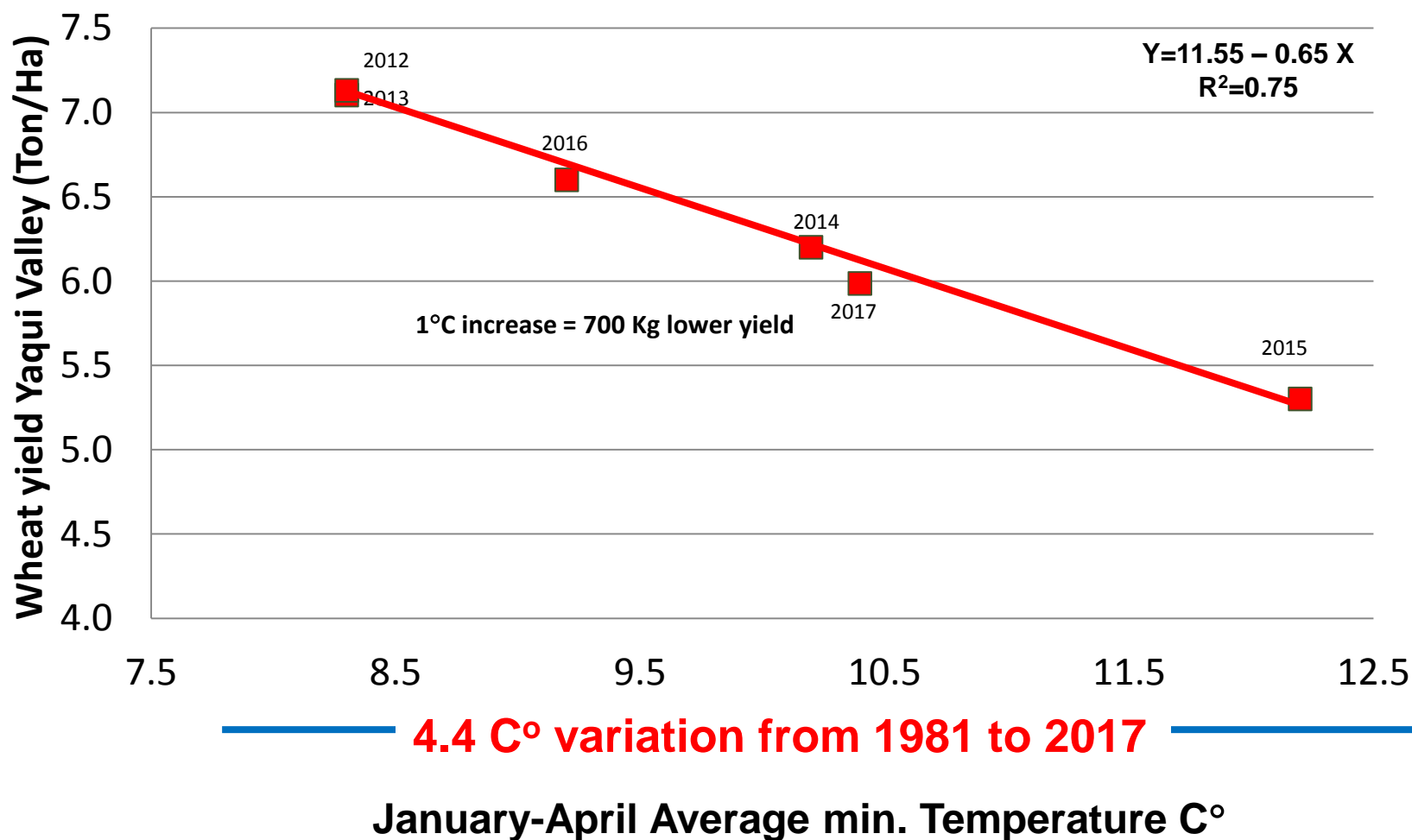
## Ethiopia Wheat Production, Area, and Yield



Source: USDA's PSD Online  
<https://apps.fas.usda.gov/psdonline/psdQuery.aspx>

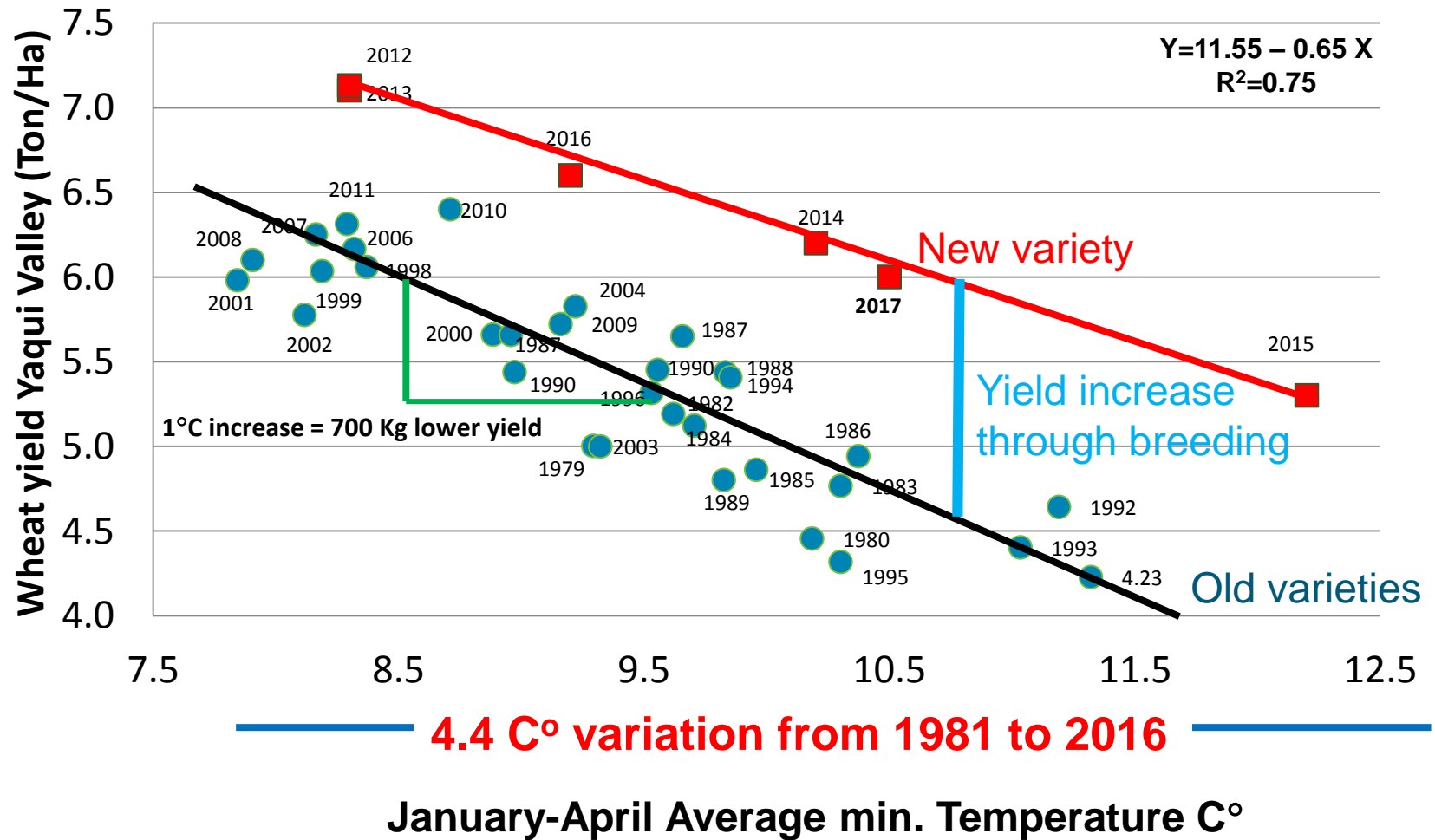


## Response of wheat to increasing night temperature



Source: H.-J. Braun and I. Ortiz-Monasterio, CIMMYT

# Adapting to Climate Change: Heat Tolerant Wheats prove their Value in Farmers' Fields in Mexico



Source: H.-J. Braun and I. Ortiz-Monasterio, CIMMYT



# **Green Revolutions – all based on N**

**1st Green Revolution – 1840 Guano NPK from Chile/Peru**

**2nd Green Revolution – 1910 Haber Bosch – N – synthesis**

**3rd Green Revolution – 1967 semi-dwarfs utilize more N**

**4th Green N Revolution needed**

**to feed 9.5 billion, with how little N can this be done**

**Agronomy x Fertilizer Formulation x Genetics x Microbes  
Root Research**



# Global N application and crop yield – 1961 – 2013

**1961     11 mt**

**2013   115 mt   of which 75% in developing  
countries -mainly Asia**

**N-application increased     10 times**

**Crop yield increased             3 times**

Source: FAO, 2015; Hirel et al., Sustainability, 2011 vol 3, 1452-1485



**More CO<sub>2</sub> and less N**

**Negative effect on quality and nutrition**



# Extreme weather events, new pest and diseases can lead to major bread basket failures



Stemrust Ug99

At time of outbreak > 90% of all wheat varieties susceptible



Wheat Blast

When it was established in Bangladesh, all varieties susceptible



- Mainstreaming Biofortification and links with Food Industry
- Vitamins / Minerals multi billion \$ business - % of daily need
- Food industry operates with standards for processed products xx ppm Zn
- CIMMYT/H+: More Zn is good (25% increase over check saves so many lives)
- Food industry and developed countries breeding programs limited interest in biofortification so far
- New areas: Some Animal Feed additives will be forbidden – high Zn wheat





**Septoria**



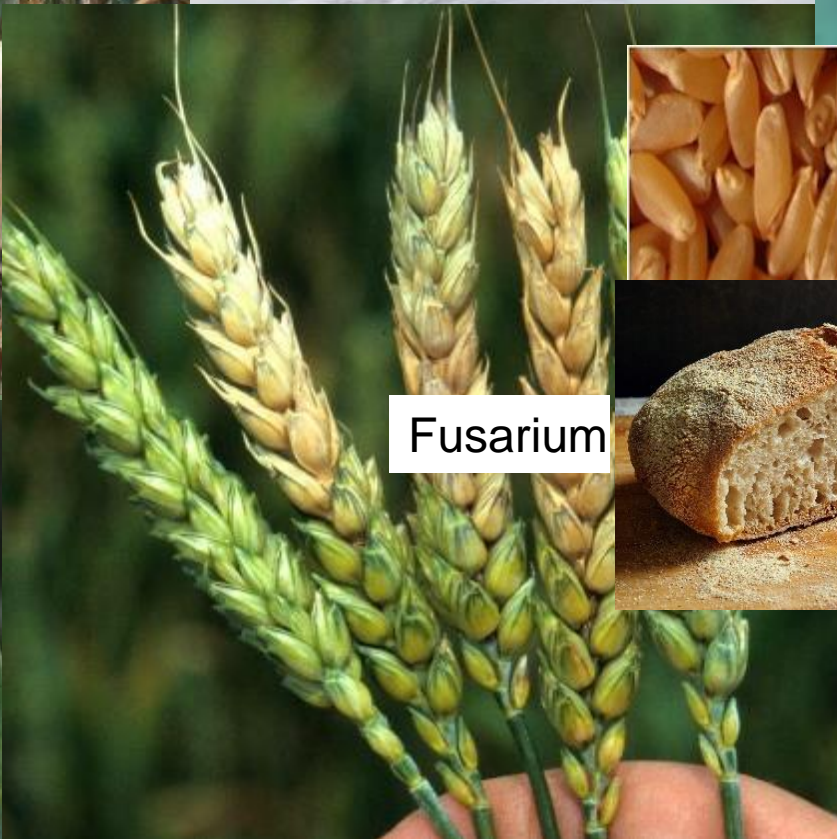
**Farmers need varieties  
(trait package) not traits**



**Processing and  
end-use quality**



**Yellow Rust**



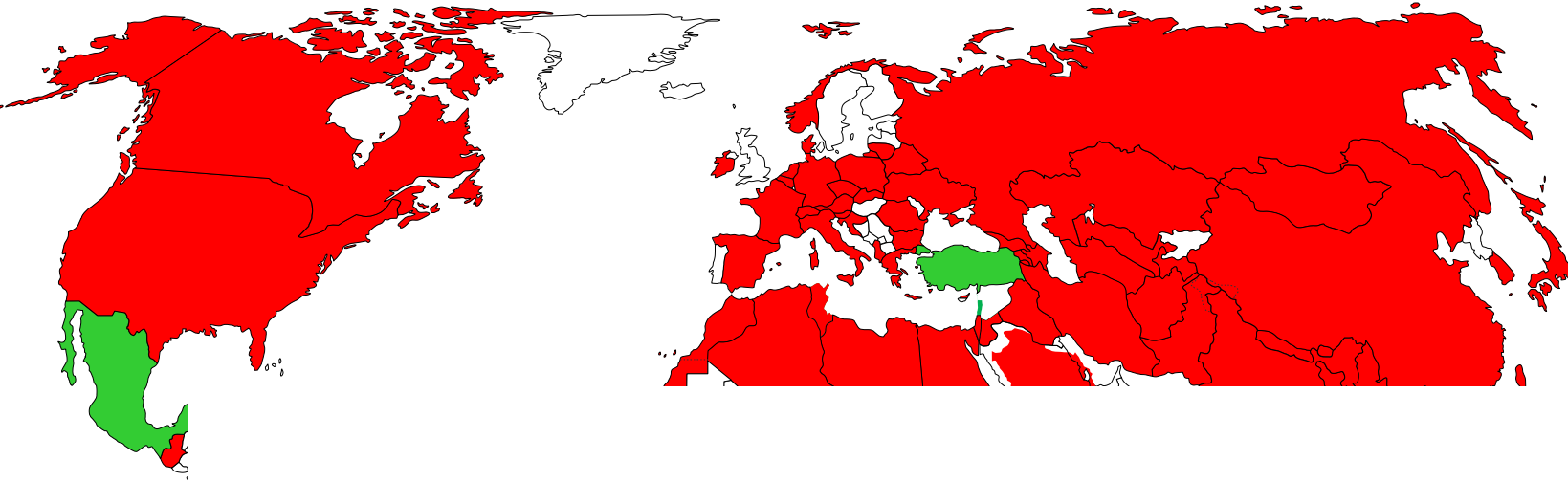
**Fusarium**



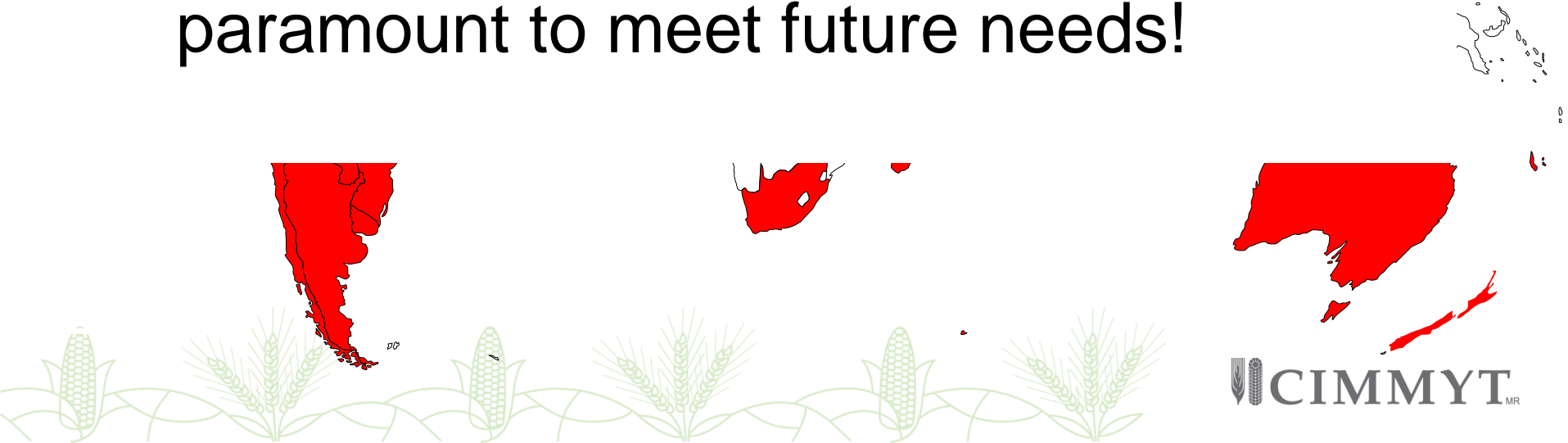
**Stem rust**



# 101 Countries receiving CIMMYT Wheat nurseries 2015/16 sent from Mexico (spring wheat) and Turkey (winter wheat)

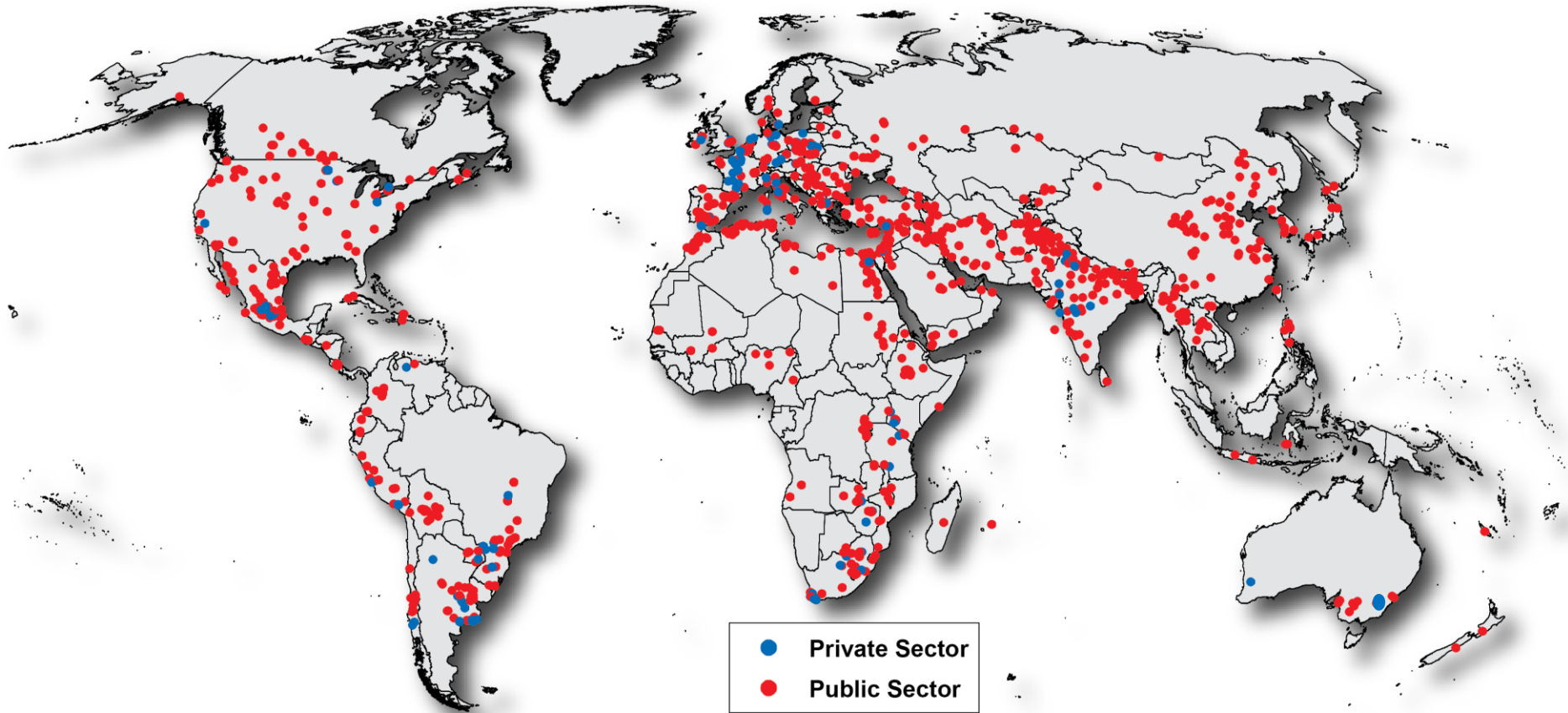


For wheat, germplasm and data sharing paramount to meet future needs!





# Private and Public sector cooperators in International Wheat Improvement Network





# Agriculture – Problem or Opportunity?

**Agriculture and Forestry account for:**

**25% GHG emissions;**

**50% Global Employment;**

**66% Total land use**

**75% Fresh water use**

**5% Global GDP – only primary production**

**30% Global GDP – if whole food system is considered**

**5% Global R&D – 70 bln US\$ - 0.9 bln US\$ in CGIAR**

**Agriculture is big business and  
Wheat will remain an important component of it**





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Thank you for your attention

