



## **A Global Roadmap for Mainstreaming Biofortification into CGIAR Breeding Programs**

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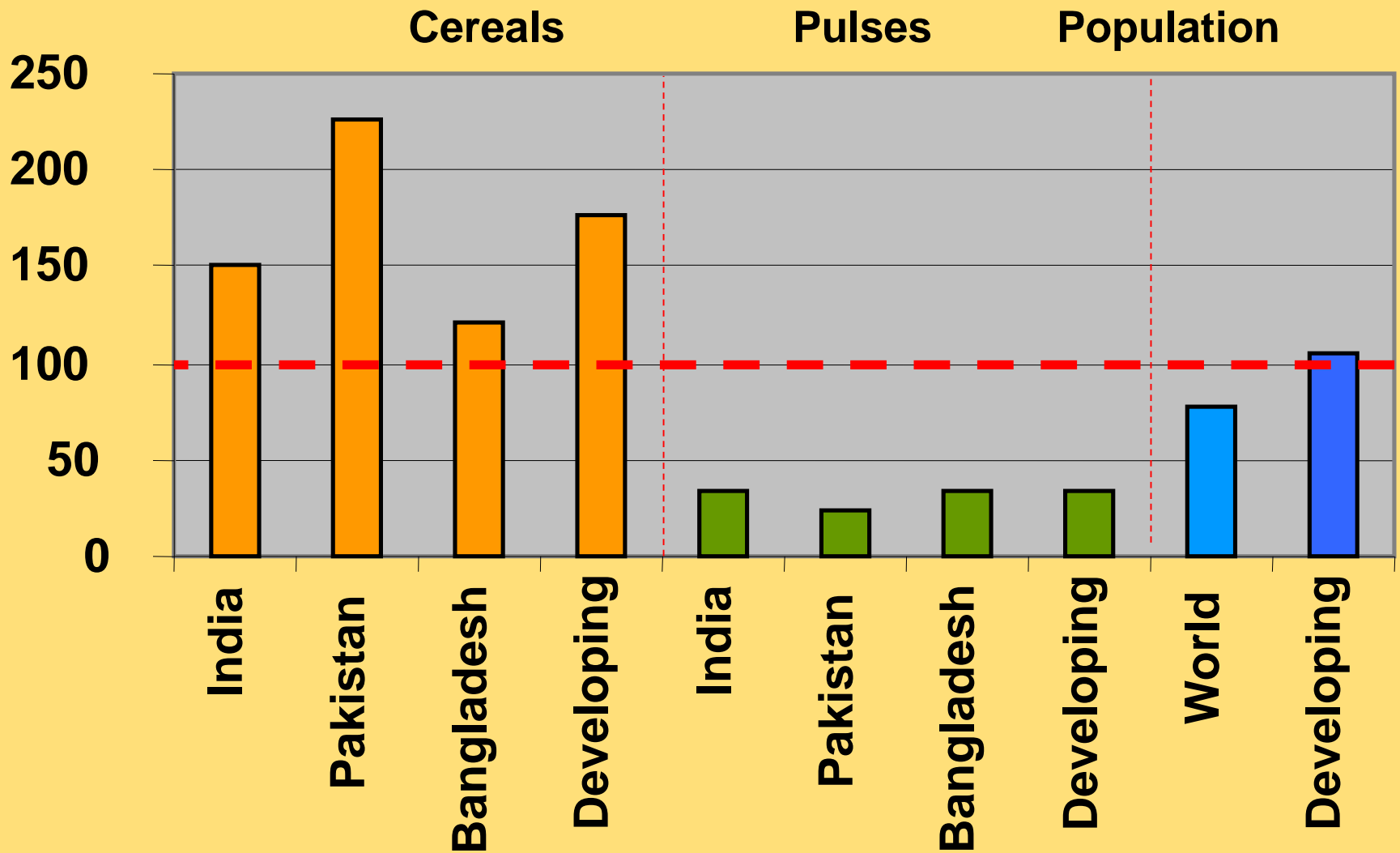




## Dietary Diversity

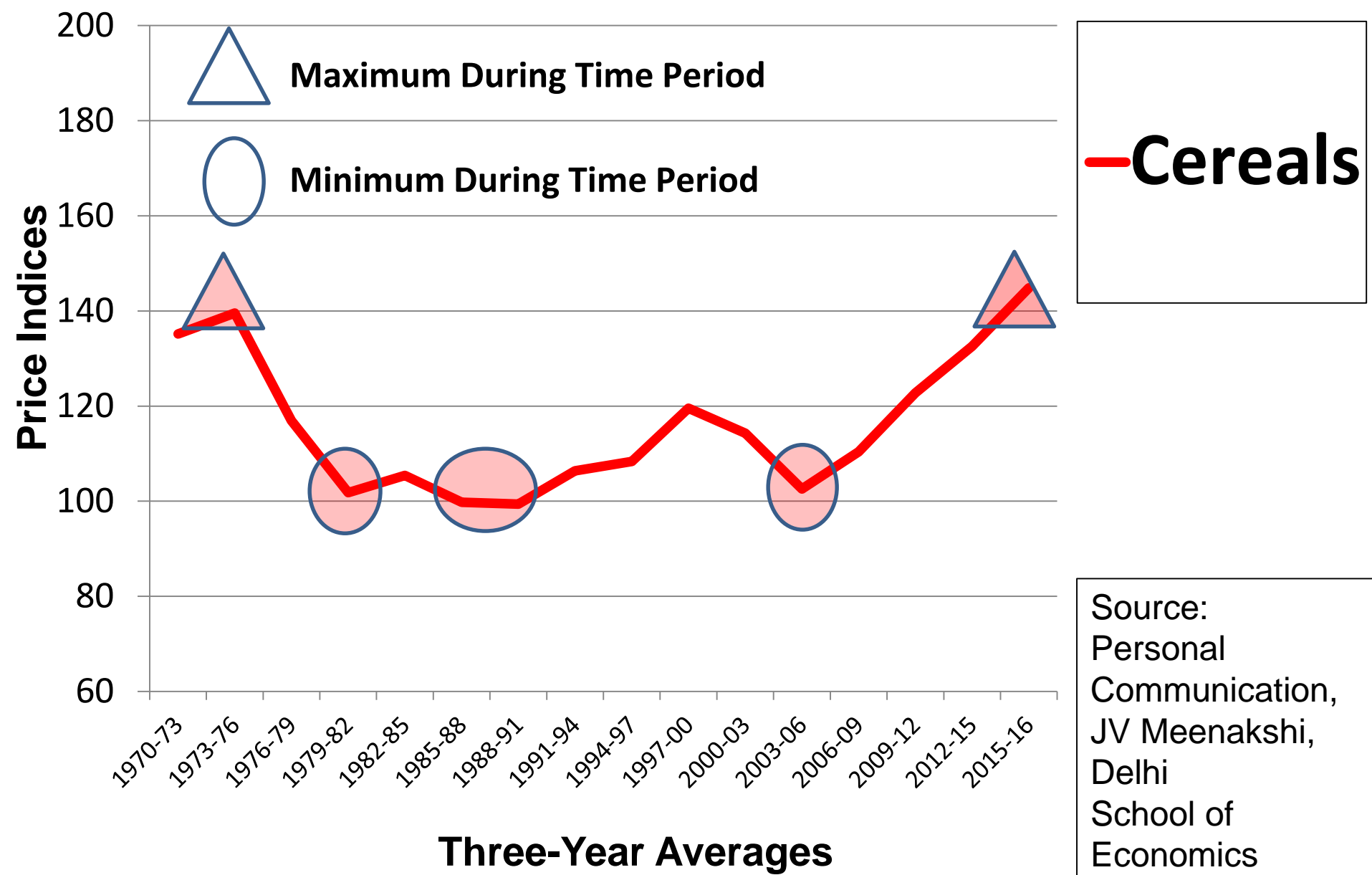
Why are Mineral and Vitamin Deficiencies Such A Significant Public Health Problem?

# Percent Changes in Cereal and Pulse Production and in Population Between 1965 and 1999

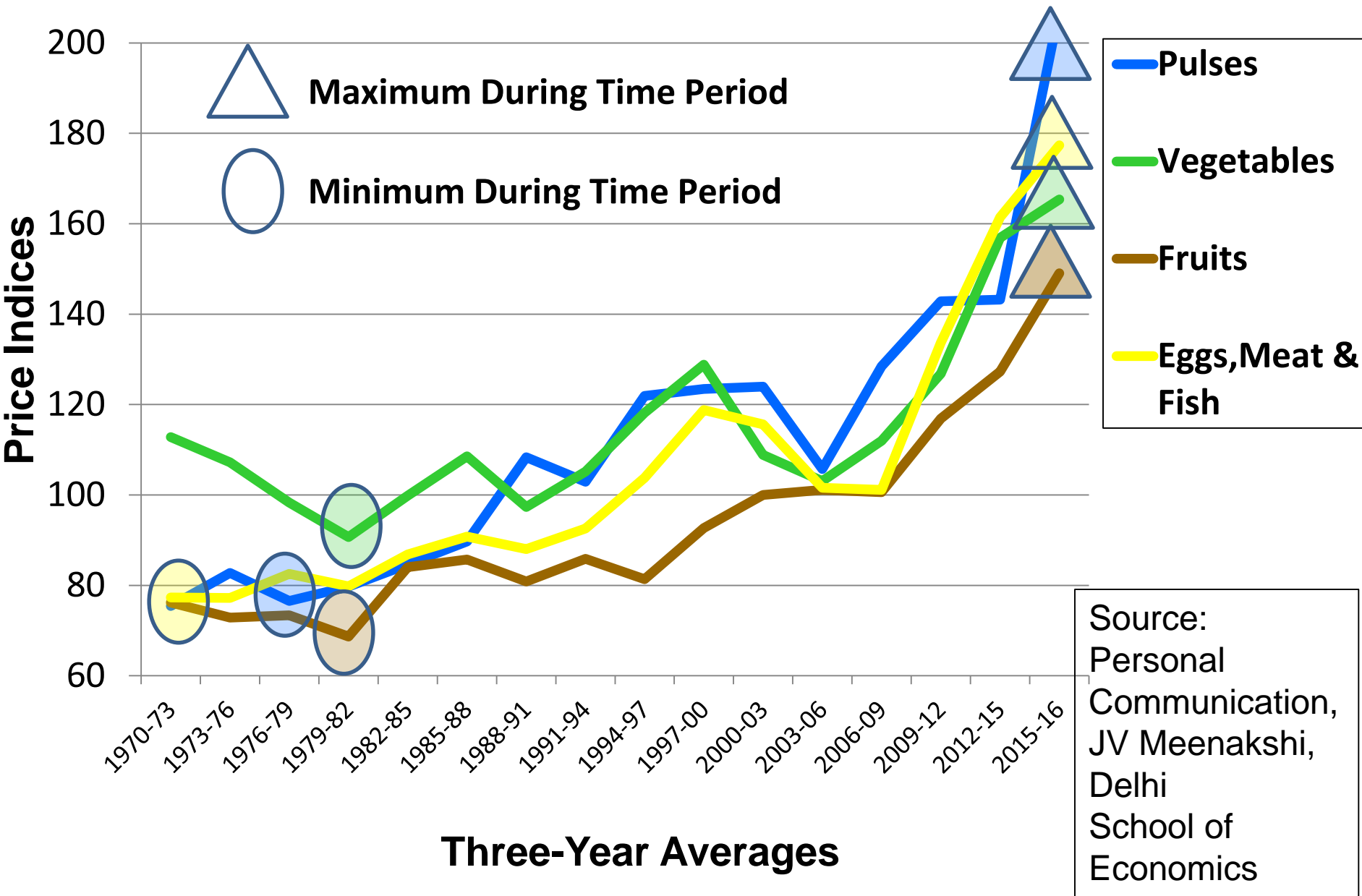




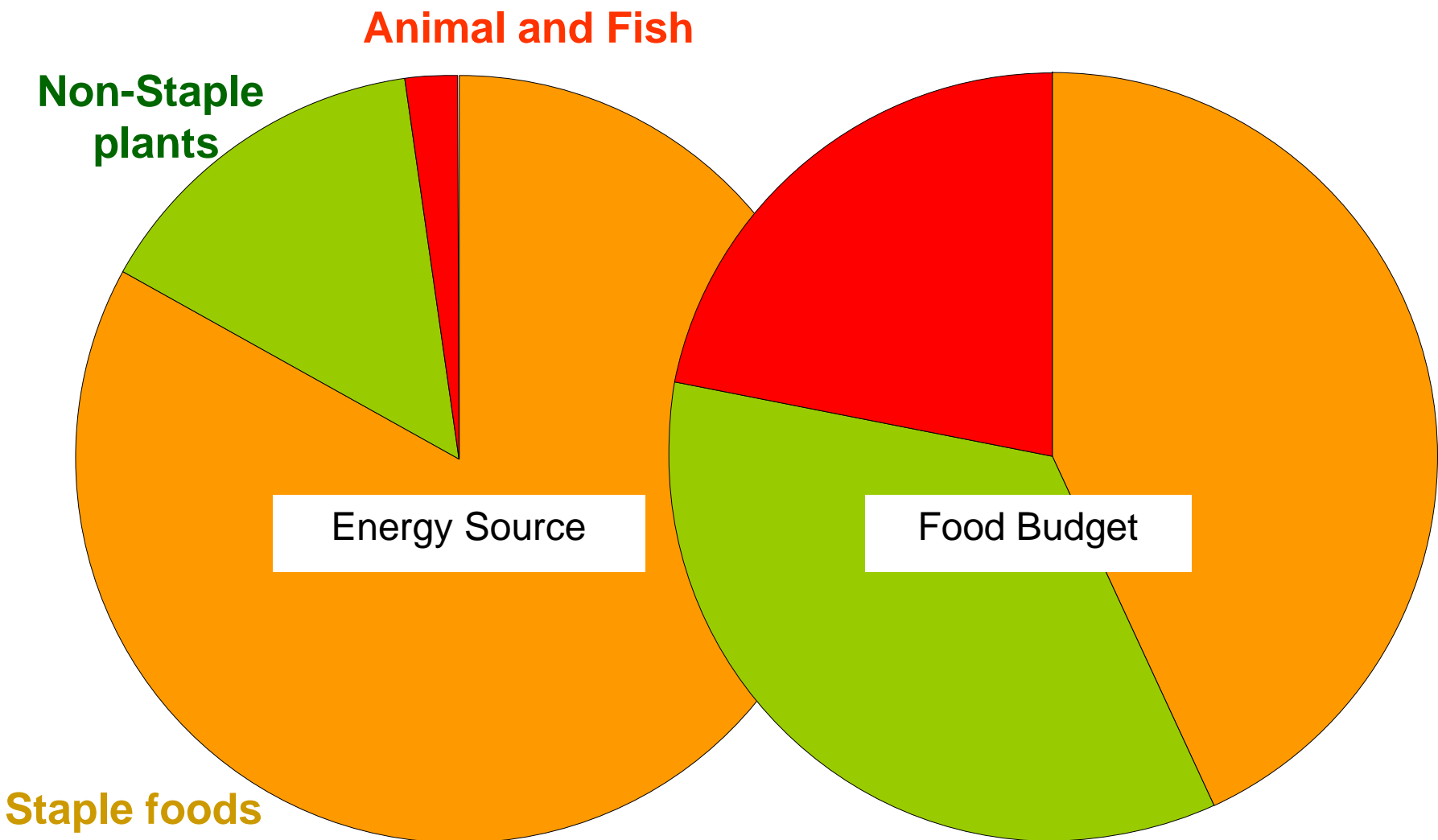
**Figure 2. Price Indices By Food Group for India, 1970-2016, Deflated by Non-Food Price Index**



**Figure 2. Price Indices By Food Group for India, 1970-2016, Deflated by Non-Food Price Index**



# Share of Energy Source & Food Budget in Rural Bangladesh





# Consequences Mineral & Vitamin Deficiencies

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## Vitamin A deficiency

- Supplements reduced child **mortality** by 23%
- 375,000 children go blind each year

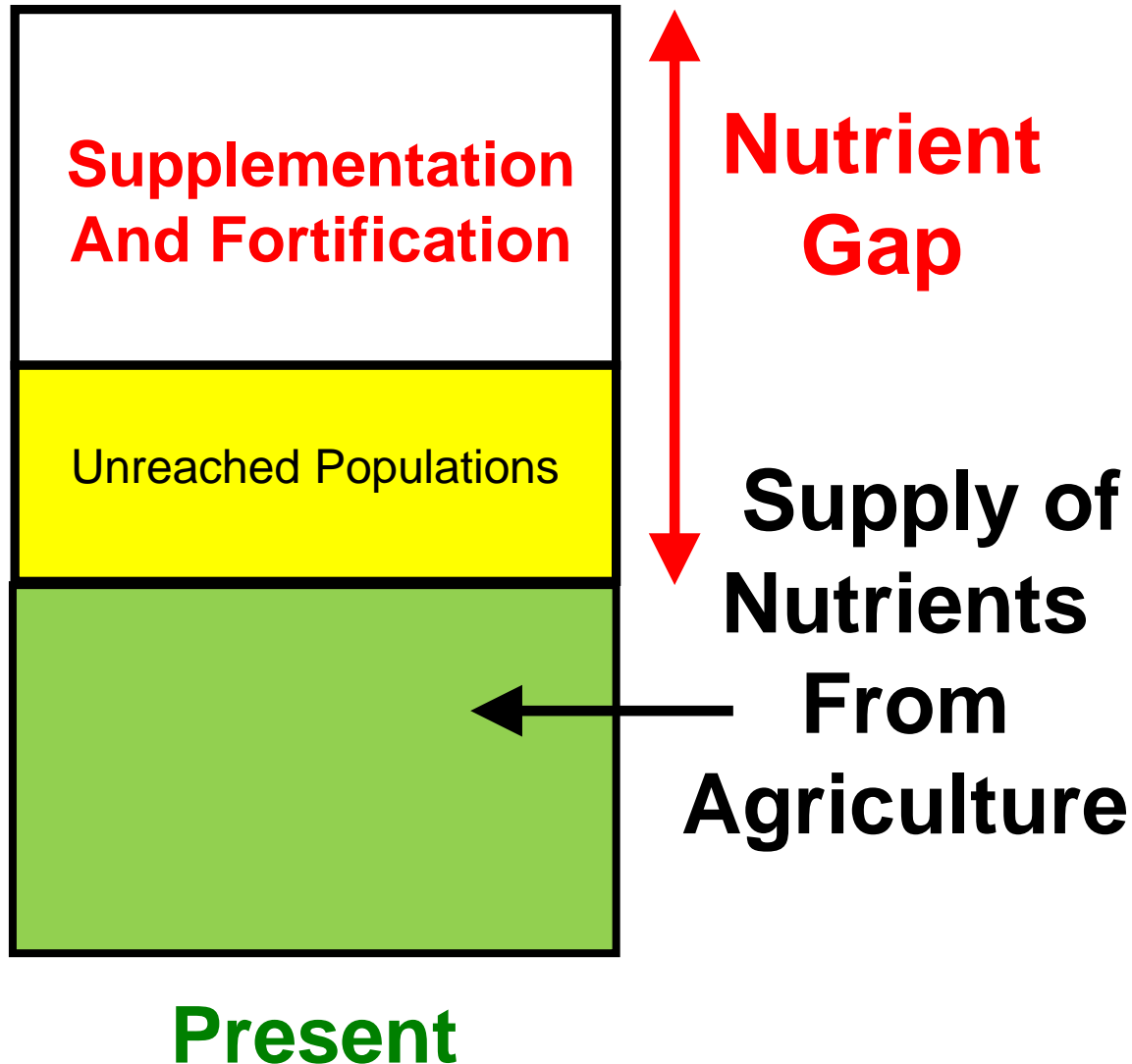
## Iron deficiency

- **Impaired cognitive abilities** that cannot be reversed
- 82% of children < 2 years in India are anemic

## Zinc deficiency

- increased **incidence/severity diarrhea/pneumonia; stunting**
- 2 billion people at risk; 450,000 deaths per year

# A Primary Role of Agriculture Is To Provide Nutrients for Healthy Populations






# Excerpt From Recent UNICEF Brochure

**8 BILLION**  
VITAMIN A CAPSULES




 each silhouette represents  
100 million capsules



Government  
of Canada

Gouvernement  
du Canada

Thanks to a donation programme financed by the Government of Canada and implemented through the Micronutrient Initiative, UNICEF has received more than 8 billion capsules since 1998, which, when combined with programme financing, have been critical to maintaining strong Vitamin A supplementation programmes.



**4 MILLION**

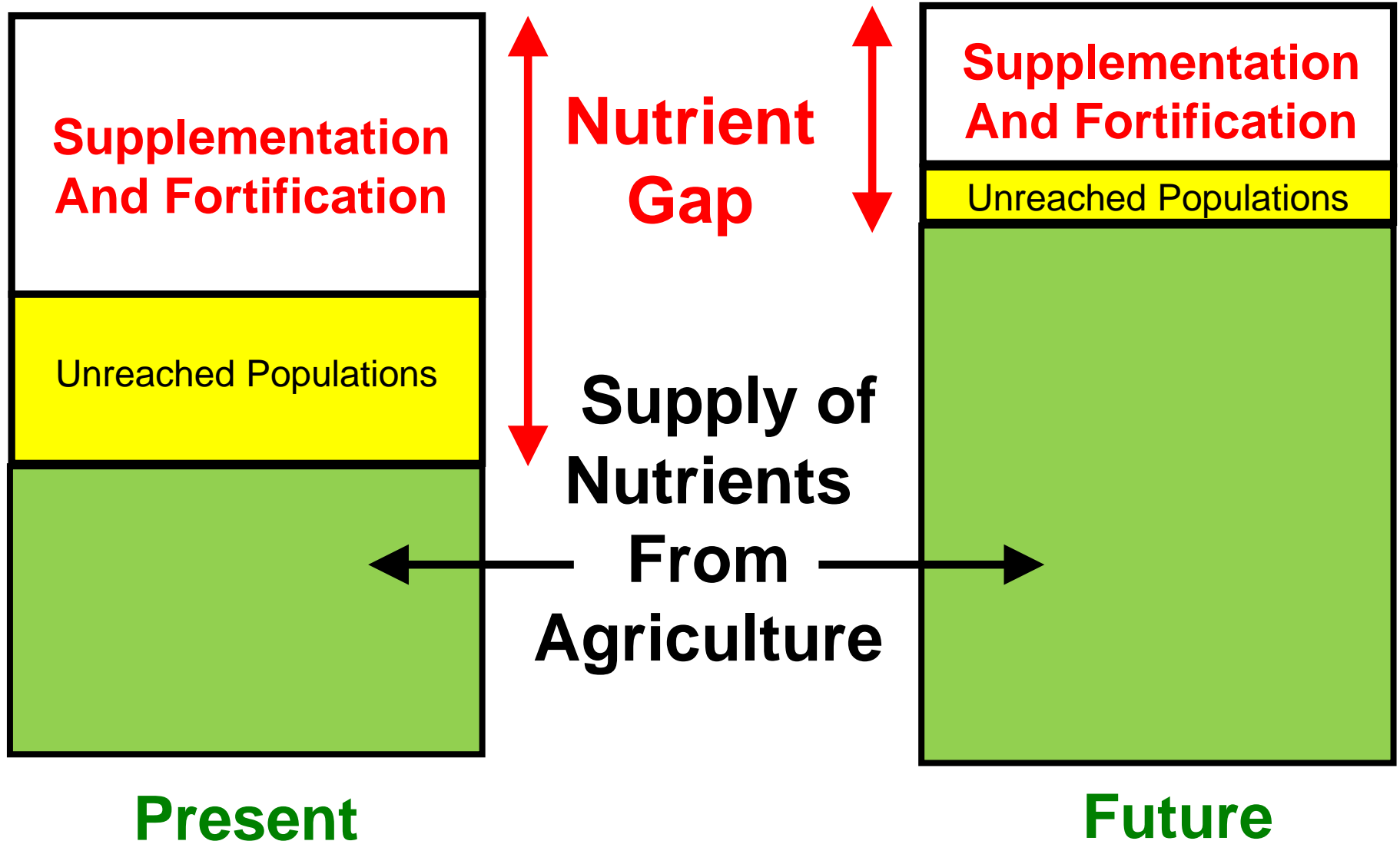
The Micronutrient Initiative estimates that more than 4 million deaths have been averted during this time.

Cost Per Vitamin A Capsule    \$US 0.50-1.25    World Bank (2007)



**Cost-effective: central one  
time investment**

# A Primary Role of Agriculture Is To Provide Nutrients for Healthy Populations





Biofortified crops released in **30 countries**

In-testing in another **30 countries**

A lush green rice field with tall stalks under a blue sky with white clouds.

Rice

A man in a white turban and shirt is shown from the waist up, sifting wheat through a circular sieve.

Wheat

A close-up shot of several ears of yellow maize (corn) with their husks partially removed.

Maize

A man in a white turban is standing in a field of tall pearl millet plants.

Pearl  
Millet

A close-up of sorghum stalks with their characteristic dense, elongated seed heads.

Sorghum

A pile of sliced cassava tubers, showing their white, starchy interior.

Cassava

A close-up of orange sweetpotato tubers, highlighting their vibrant orange color.

Orange  
Sweetpotato

A cluster of yellow potatoes, some whole and some cut, showing their smooth skin.

Potato

A woman in a colorful headscarf is standing next to a large pile of banana plantains.

Banana  
Plantain

A man wearing a red headscarf is holding a bunch of green lentils.

Lentil

A close-up of a pile of red beans, showing their characteristic kidney shape and color.

Beans

A young boy in a light-colored shirt is standing in a field of cowpea plants.

Cowpea



These crops have been conventionally bred to be rich in essential vitamins and minerals that are needed for good health.





# Functional Outcomes

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- Efficacy trials with provitamin A, iron, and zinc biofortified crops have also shown improved functional outcomes:
  - Improved cognitive function (iron)
  - Better work performance (iron)
  - Better sight adaptation to darkness (provitamin A)
  - Reduced morbidity (zinc)





# HarvestPlus Delivery Goals

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## **Globally By 2030**

- One billion people will be benefitting from biofortified nutritious foods.

## **Short-Term Goal By 2020**

- 100 million people in farm households will be growing and consuming biofortified nutritious food crops

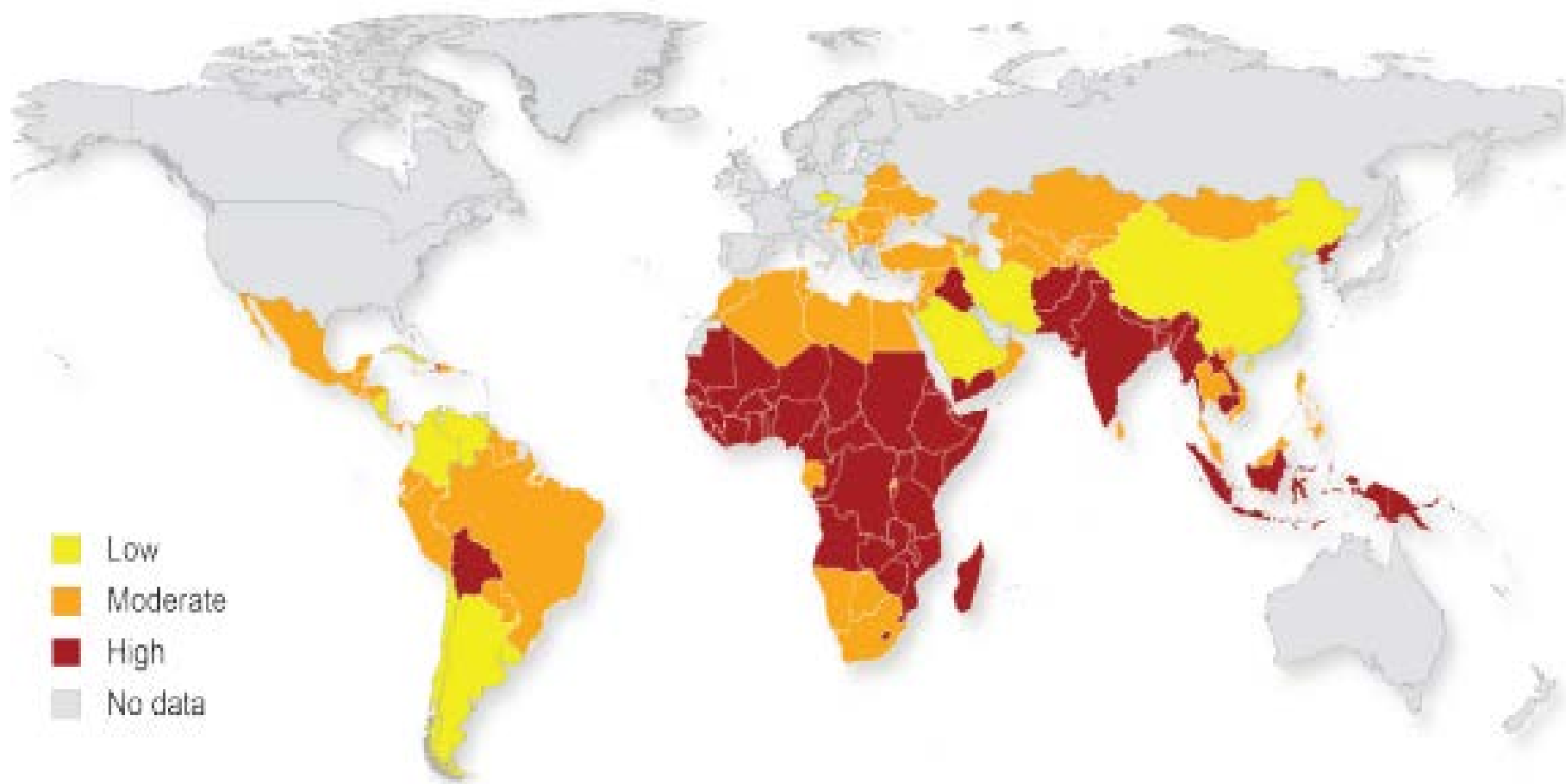
## **By the End of 2016**

- 20 million people in farm households



## Severity of Micronutrient Deficiencies: Vitamin A, Iron, and Zinc

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**Source: World Health Organization (WHO) children under 5 prevalence data**

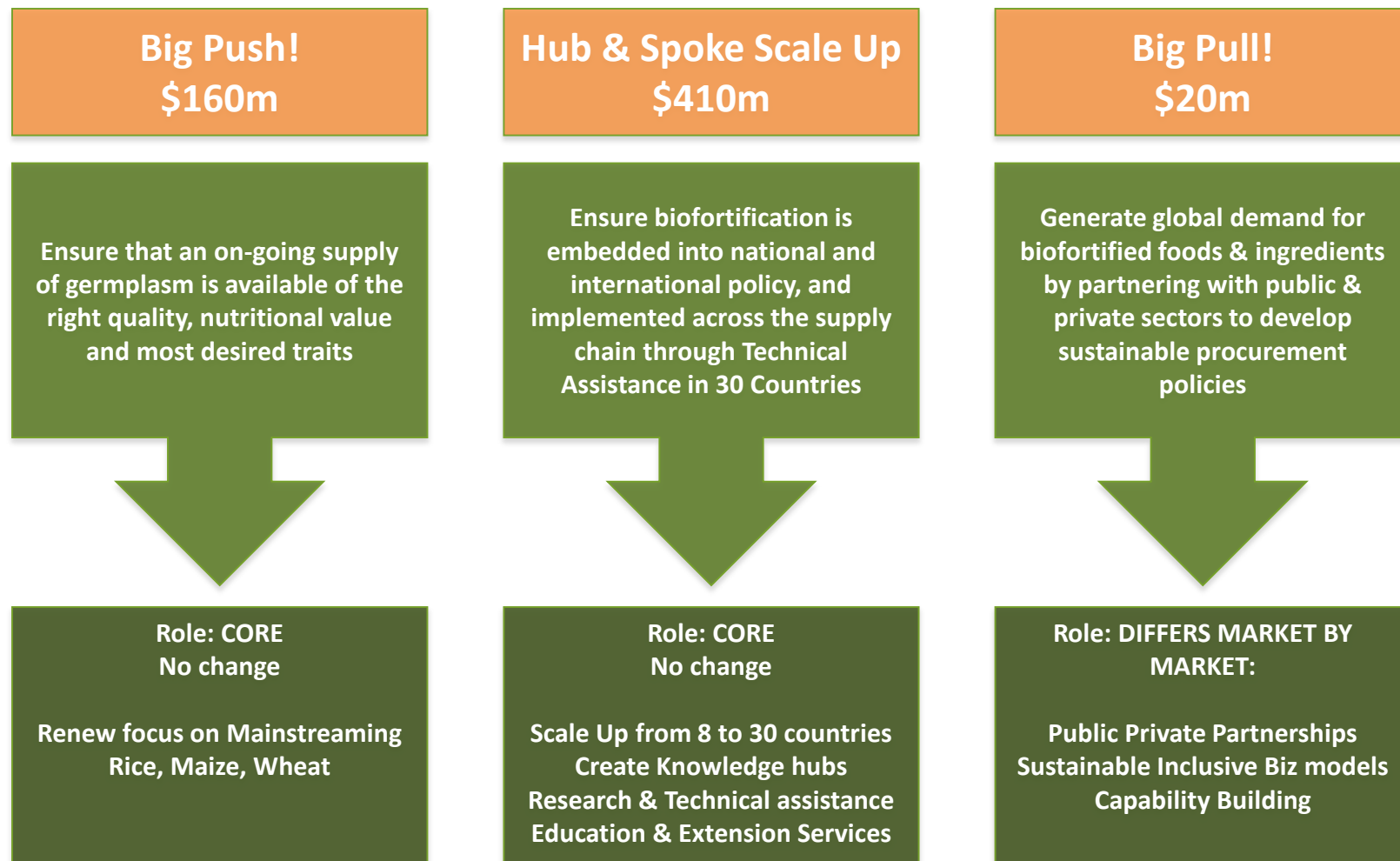
# Average Total Consumption (Million Calories Per Day)

Crop	Africa	South Asia	TOTAL
<b>Rice</b>	125,124	1,130,648	<b>2,006,869</b>
<b>Wheat</b>	107,419	987,887	<b>1,547,872</b>
<b>Maize</b>	256,286	67,481	<b>581,532</b>
<b>Cassava</b>	174,719	16,263	<b>259,271</b>
<b>Groundnut</b>	49,335	6,595	<b>227,864</b>
<b>Millet</b>	82,889	81,977	<b>167,885</b>
<b>Sorghum</b>	104,694	59,129	<b>164,842</b>
<b>Potato</b>	13,464	46,465	<b>122,764</b>
<b>Beans, dry</b>	39,258	26,384	<b>116,246</b>
<b>Barley</b>	14,771	7,037	<b>100,192</b>
<b>Plantain</b>	36,424	19	<b>92,109</b>
<b>Banana</b>	6,751	11,345	<b>57,811</b>
<b>Yam</b>	42,787	0	<b>42,966</b>
<b>Sweetpotato</b>	23,789	3,008	<b>36,478</b>
<b>Lentils</b>	603	11,589	<b>12,999</b>

Note: Total = All Developing Countries; Source = FAO, 2002-2004



# How to Get the Job Done by 2030



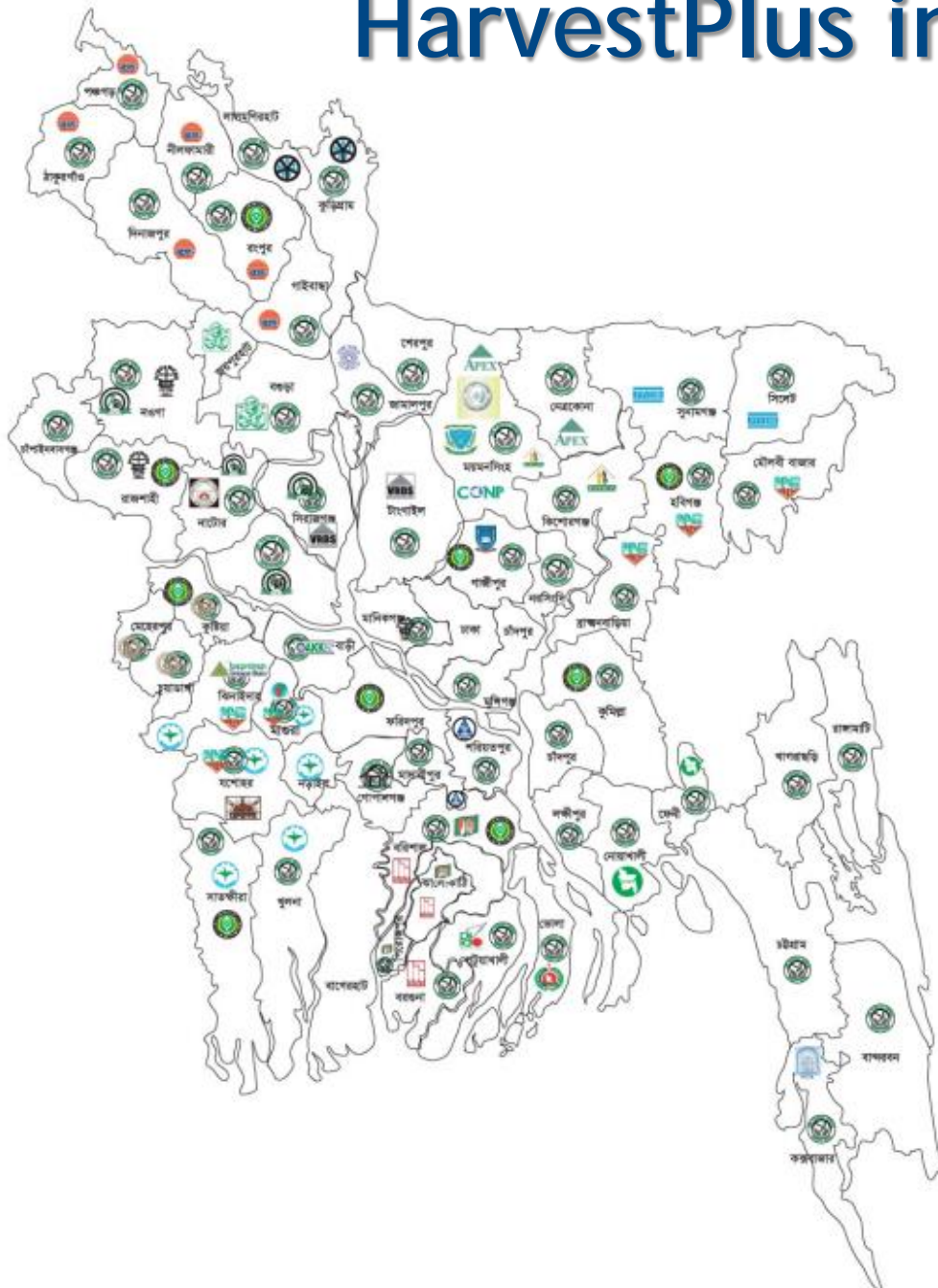


# HarvestPlus in Bangladesh

**GO- 5**

**NGO- 25**

**PS- 2 associations**  
(300 seed companies)





# Additional Crop in Cropping Pattern

Before

**Aman  
Sharna**  
(155 days)



**Fallow**  
(70 Days)



**Boro  
BRRI dhan28**  
(140 days)

Now



**Aman  
BRRI dhan62**  
(100 days)



**Mustard/ lentil/  
vegetables**  
(125-130 days)



**Boro  
BRRI dhan64/  
BRRI dhan28**  
(135- 140 days)