



# Biofortification and School Meals

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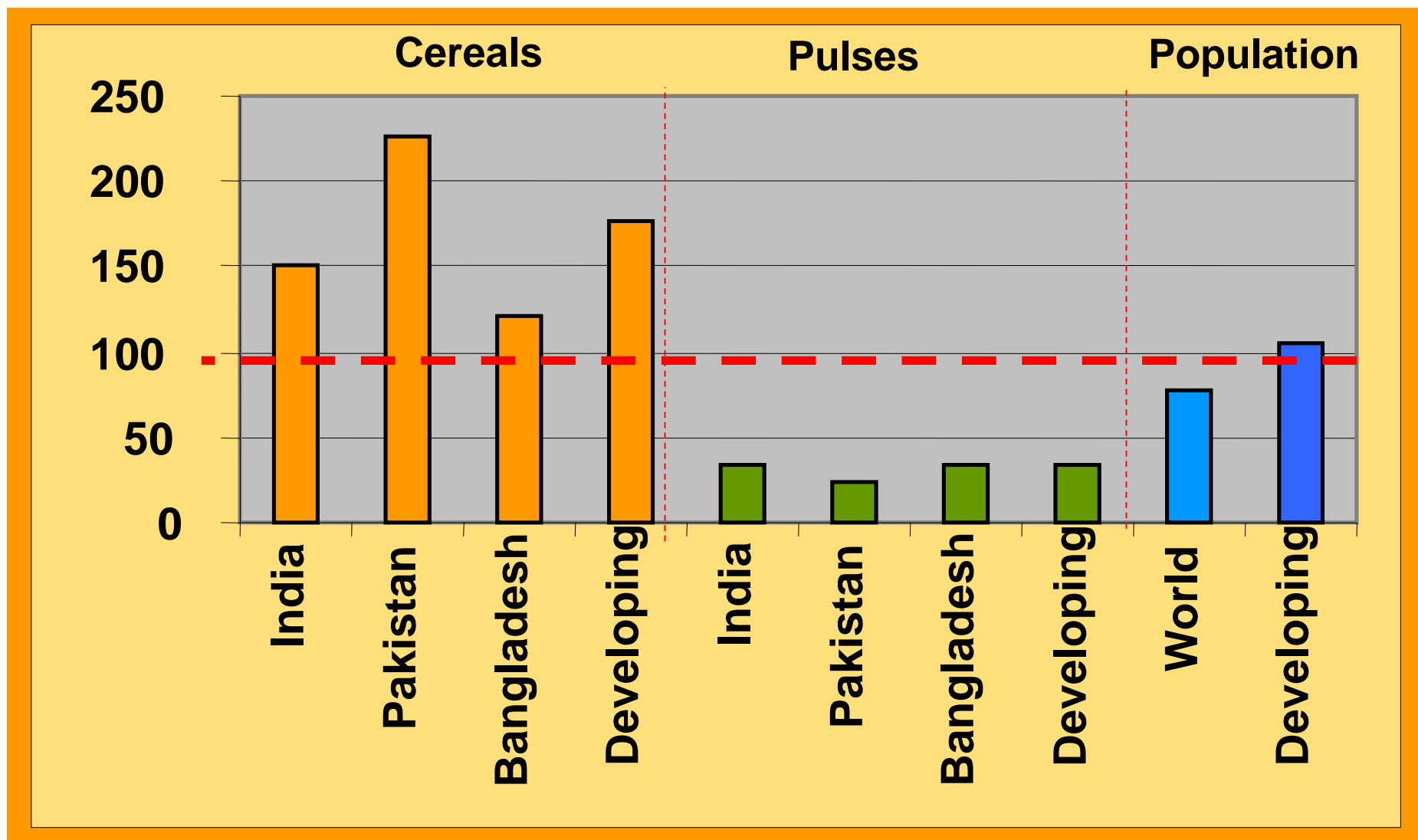


Why are Mineral  
and Vitamin  
Deficiencies Such  
A Significant  
Public Health  
Problem?



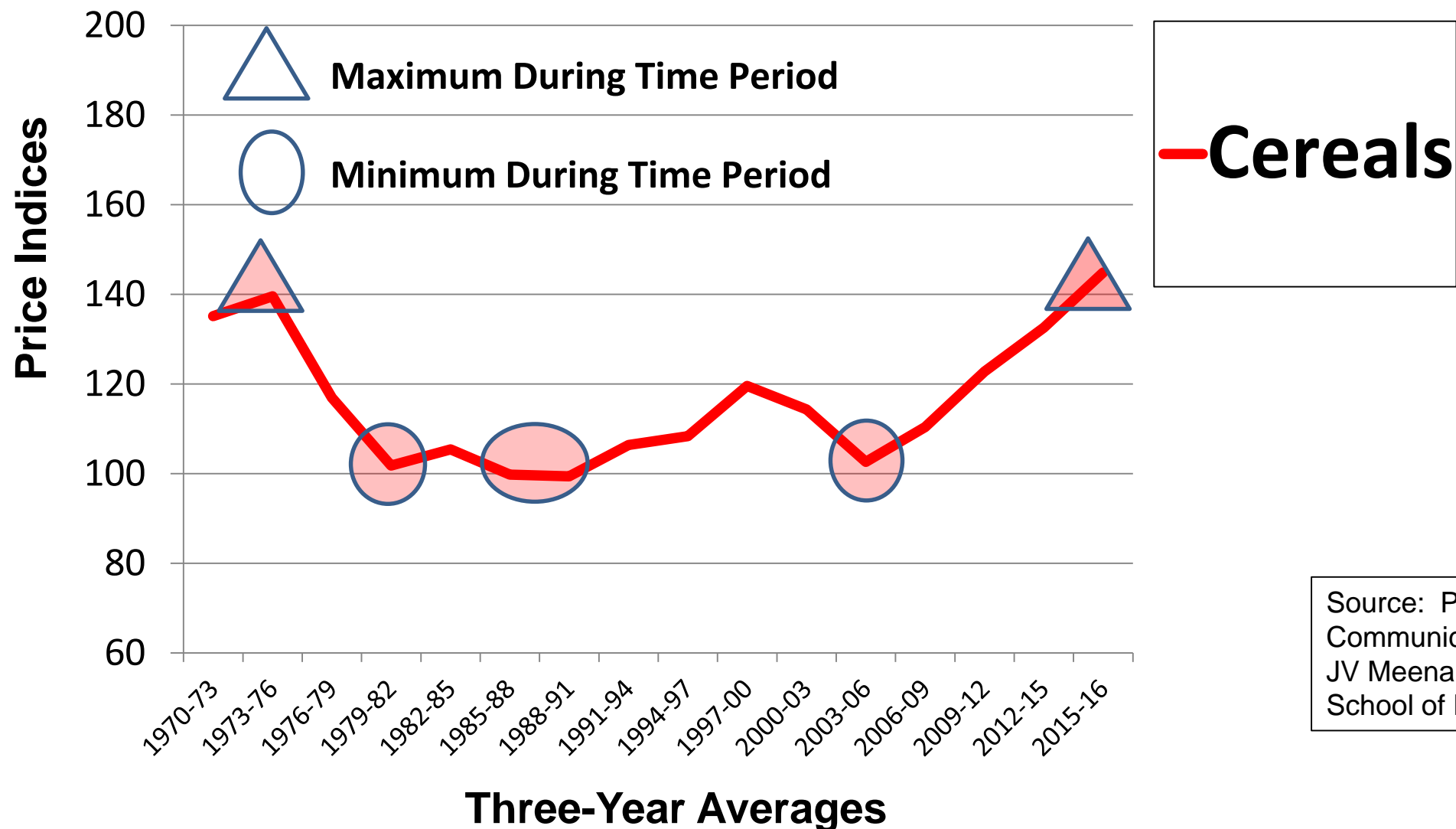


## Percent Changes in Cereal and Pulse Production and in Population Between 1965 and 1999

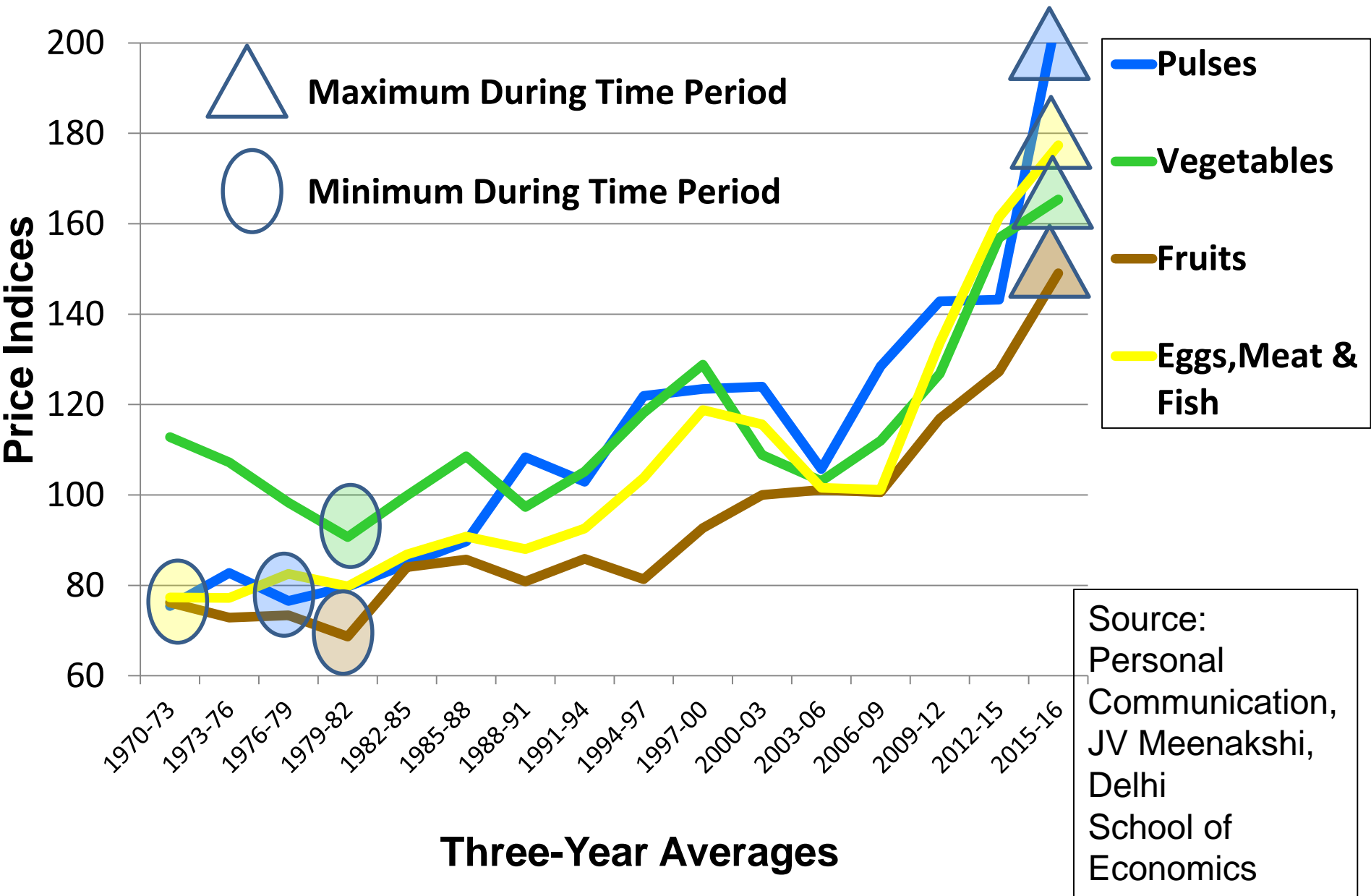




# Price Indices By Food Group for India, 1970-2016, Deflated by Non-Food Price Index

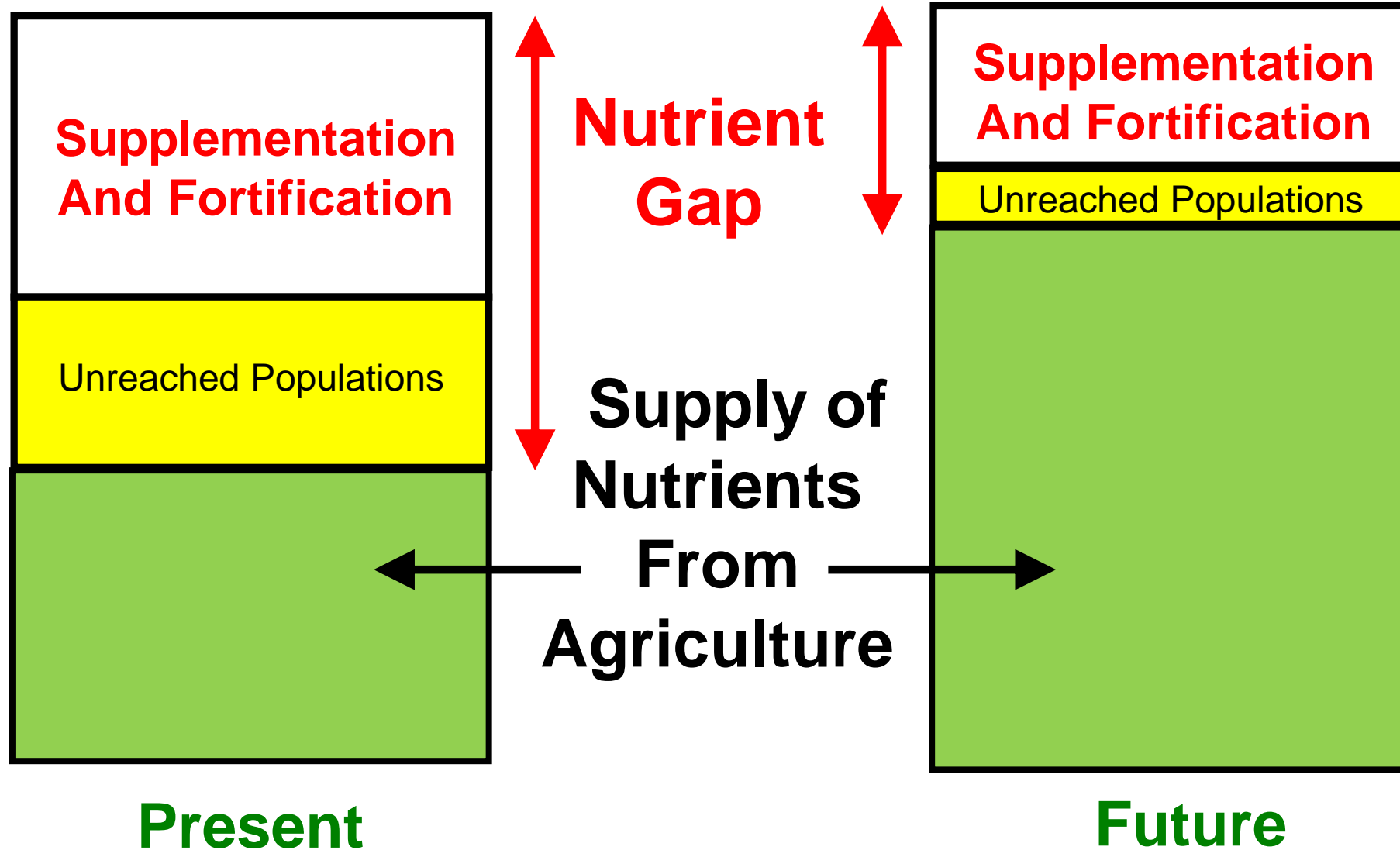


**Figure 2. Price Indices By Food Group for India, 1970-2016, Deflated by Non-Food Price Index**





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





## Per Capita Energy Intakes per Day for Jessore, Bangladesh

	Lower Income	Middle Income	Higher Income
Food Staples	1816	1848	1876
Non-Staple Plant Food	339	427	474
Fish and Animal Foods	47	59	92
All Food Groups	2201	2334	2442



# 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









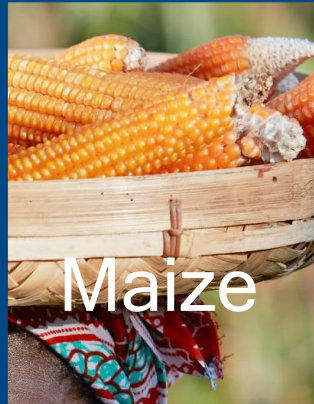
# Biofortified Crops - Reaching over 30 Million



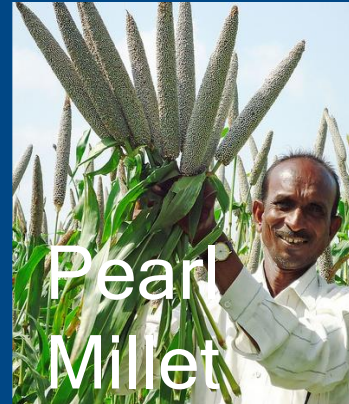
Rice



Wheat



Maize



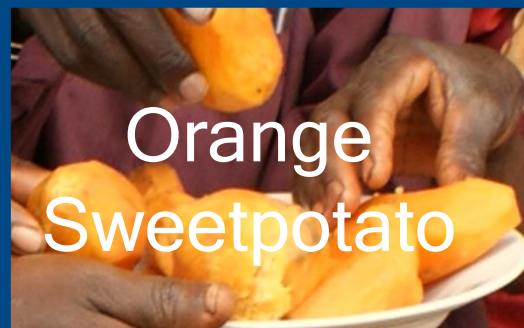
Pearl  
Millet



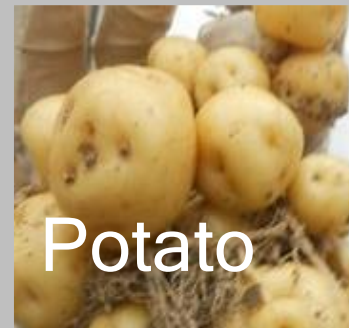
Sorghum



Cassava



Orange  
Sweetpotato



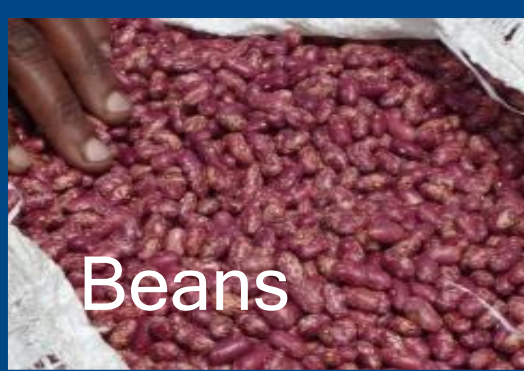
Potato



Banana  
Plantain



Lentil



Beans



Cowpea





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## Cost-effective: Central, One Time Investment

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# Biofortification is Climate-Smart

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- Biofortified crops piggyback on crop varieties that are bred for desirable attributes which include resistance to climate change effects such as tolerance to heat, drought, flooding

## Examples:



Heat and drought  
tolerant iron beans



Drought tolerant  
vitamin A maize



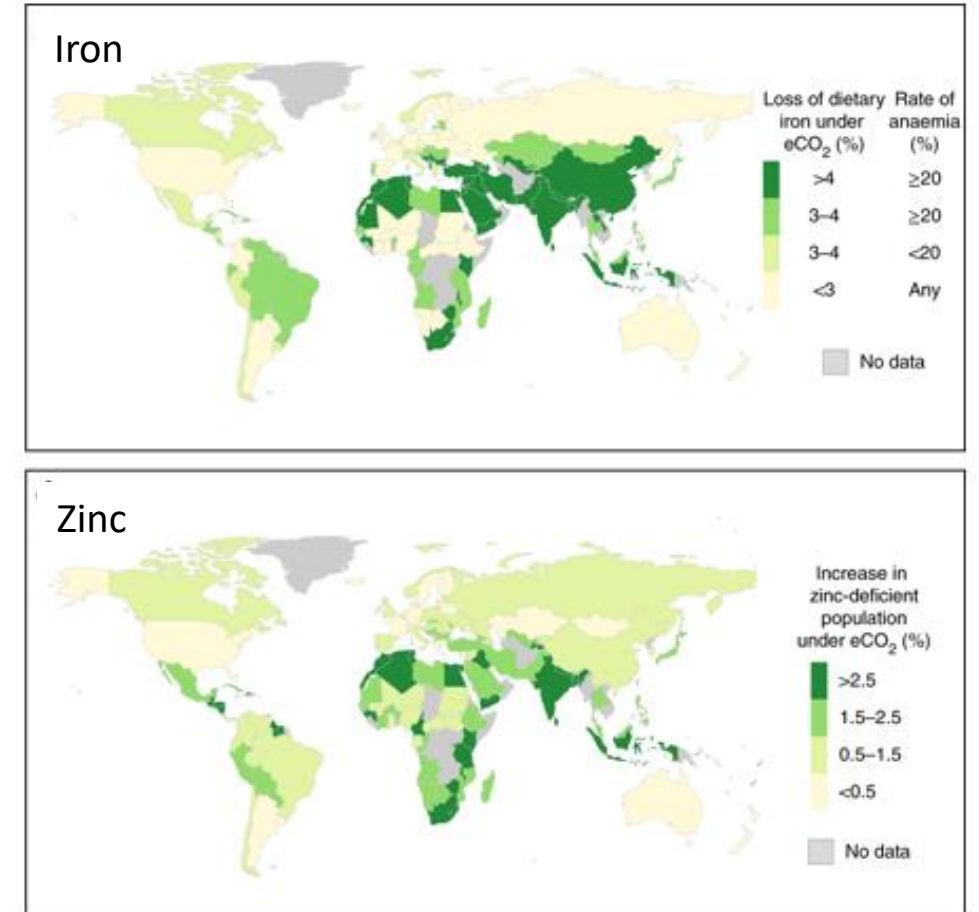
Flood/Submergence  
tolerant zinc rice





# Negative Impact of CO<sub>2</sub> Emissions on Nutritional Value

- **Rising CO<sub>2</sub> levels will likely cause plants to lose nutritional value**
  - Under rising CO<sub>2</sub> levels, many food crops have iron and zinc contents that are reduced by 3-17% compared with current conditions
  - Elevated CO<sub>2</sub> could cause an additional 175 million people to be zinc deficient
  - 1.4 billion women of childbearing age and children under 5 live in countries with greater than 20% of anemia prevalence and would lose >4% of dietary iron



Risk of inadequate nutrient intake from elevated atmospheric CO<sub>2</sub> concentrations of 550 ppm. (Smith and Myers 2018).



## Nutrition Contribution

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- Biofortified crops, as consumed, provide *an extra* 40% of estimated average requirement each day – substituting one-for-one the biofortified variety for the existing non-biofortified variety.





# Human Nutrition Efficacy Trials

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Fourteen Efficacy Trials either completed or in process

- High iron crops ✓ +
  - Meta-analysis completed for beans and pearl millet
- High vitamin A crops ✓
  - Multiple efficacy trials completed for sweetpotato, maize, and cassava
- High zinc crops
  - Bioavailability studies positive, one efficacy trial completed, others in data analysis stage

















# Functional Outcomes

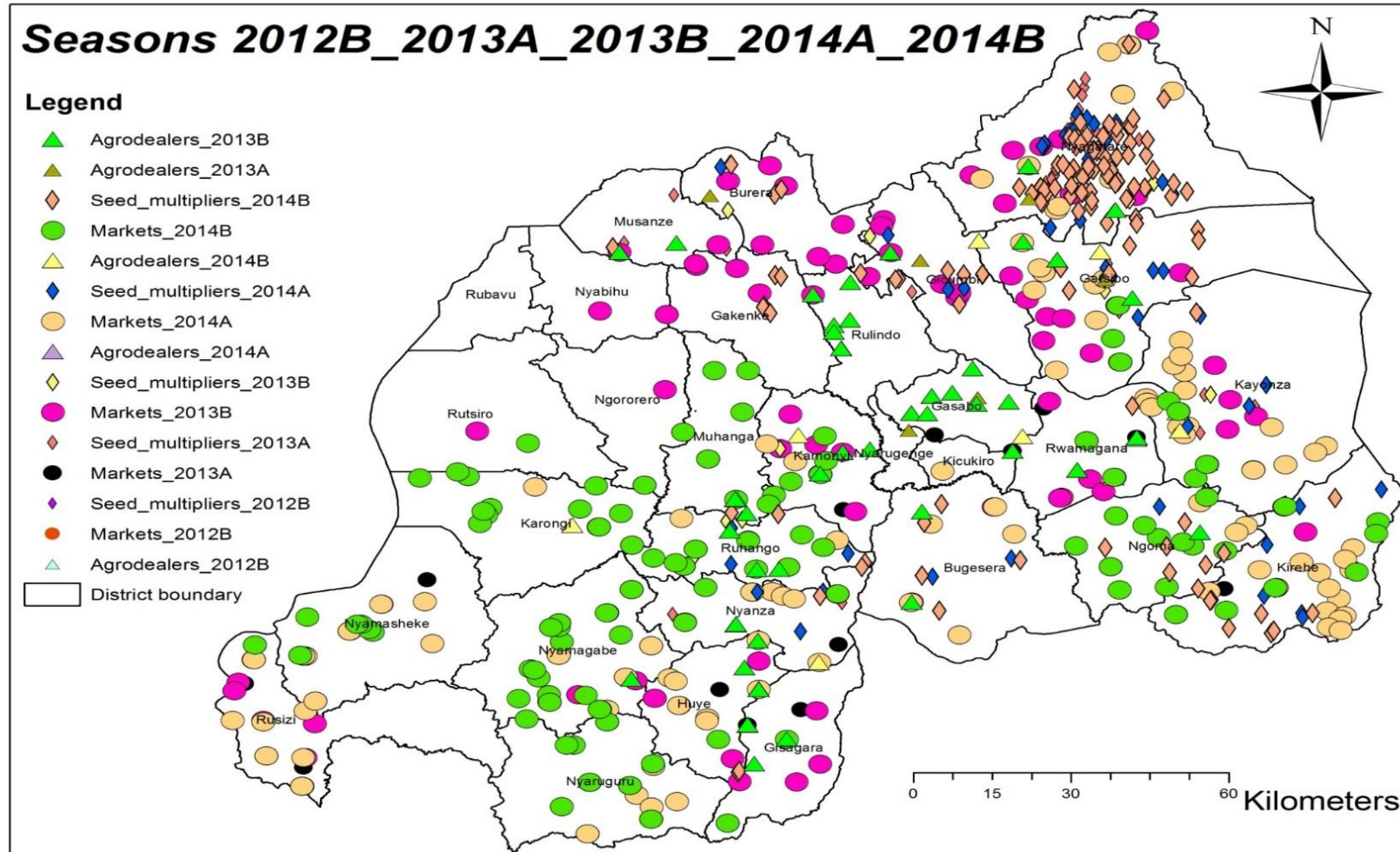
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- Efficacy trials with vitamin A, iron, and zinc biofortified crops have also shown improved functional outcomes:
  - Improved cognitive function (iron)
  - Better work performance (iron)
  - Reduced morbidity (zinc and provitamin A)
  - Better sight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



# Ten Bean Varieties Released in Rwanda

<div>  <b>AGRONOMIC PROPERTIES OF IRON BEAN</b>  </div>						
Names	Pictures	Type	Yield potential	Adaptation	Iron content	Maturity
RWV 3316		Climber	4 t/ha	High altitude	91,6ppm	110 Days
RWV 3006		Climber	3.8 t/ha	High altitude	91,7ppm	110 Days
MAC 44		Climber	3.5 t/ha	Mid to low altitude	78 ppm	87 Days
RWR 2245		Bush	2.5 t/ha	Mid to low altitude	75 ppm	87 Days
RWR 2154		Bush	2.5 t/ha	Mid to low altitude	75 ppm	87 Days
RWV 1129		Climber	3.5 t/ha	Mid to high altitude	81 ppm	110 Days
Cab2		Climber	3 t/ha	High altitude	94,8 ppm	115 Days
RWV 3317		Climber	4 t/ha	High altitude	74 ppm	110 Days
RWV 2887		Climber	3.5 t/ha	Mid to high altitude	93,7 ppm	106 Days
MAC 42		Climber	3.5 t/ha	Mid to high altitude	91 ppm	81 Days





# Results Of Nationally Representative Farm Survey

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## Rwanda 2015 Season B Bean Production

Percentage of Farmers Planting Iron Beans At Least Once	30%
Iron Beans As Percentage of Total Bean Production	16%
Yield Advantage of Climbing Iron Beans	+22%
Yield Advantage of Bush Iron Beans	+17%
Added Value of Production of Climbing Iron Beans	+\$78/hectare
Added Value of Production of Bush Iron Beans	+\$57/hectare



# Harvest Plus and Partners are Catalyzing Robust Supply Chains







# Vitmain A Sweetpotato Puree - No refrigeration

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Preservative free OFSP puree





# Vitamin A Maize Marketing in Zambia







# Vitamin A Cassava Marketing in Nigeria







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## Mainstreaming Through Key Stakeholders

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- Public agricultural research (CGIAR, NARS)
- Seed Companies (SeedCo in Africa)
- Food Companies (exploratory)
- International financial institutions (World Bank, IFAD)
- Multi-lateral agencies (World Food Program, Codex)
- National governments (Brazil, China, India)
- International NGOs (World Vision, GAIN)





# Potential of Biofortification and School Feeding

- Biofortified staple crops and food products can easily be included in school feeding programs
- School feeding programs with biofortified foods are an efficient way to improve child nutrition on a wide scale
- Children bring home important nutrition messages to the family when biofortified crops are used in school farms





# Integrating Biofortified Crops in Programs



## Zimbabwe:

- 2018: Invited by Ministry of Education and the World Food Program to 3rd Africa School Feeding Day (African Union)
  - 17 ministers, 1000 delegates
  - Served vitamin A maize to 3,000 children and headmasters
- Donated 400 metric tons maize and bean seed
  - has provided and will continue to provide free seed packs to primary schools support feeding programs





# Biofortified School Feeding Programs

## World Bank:

- **Uganda:** Multisectoral Food Security and Nutrition Program, vitamin A sweet potato in school gardens, meals, and home gardens

## World Food Program:

- **Honduras:** school meals include biofortified crops like iron beans
- **Zambia:** assessment evaluating acceptability of vitamin A maize in school children
- **Zimbabwe:** biofortification supported during African Day of School Feeding





# Further Potential

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- **Iron Pearl Millet** to be included in **India's** Integrated Child Development Services' school feeding program
- HarvestPlus is working with the government in **Malawi** to include **vitamin A maize** meal in the Child Nutrition Meal Pack





# Policy Support at the Global Level

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The twentieth **Global Child Nutrition Forum** Communique:

**“Nutrition-sensitive school feeding programmes are strong service delivery platforms to address micronutrient deficiencies through proven fortification strategies and a diversified food basket, including **biofortified**, fresh and locally produced **foods**”**



The XX Global Child Nutrition Forum

National School Meal Programs for Food and Nutrition Security and Multiple Social Benefits



## Stay Connected!

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# Questions?

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