

# **Biofortification**

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# Our Food

**Hindu-CNN-IBN State of the Nation Survey 2006 reports**

-31% of Indians are purely vegetarian,

-9% also consume eggs (ovo-vegetarian).

-Remaining 60 % non-vegetarian (?)

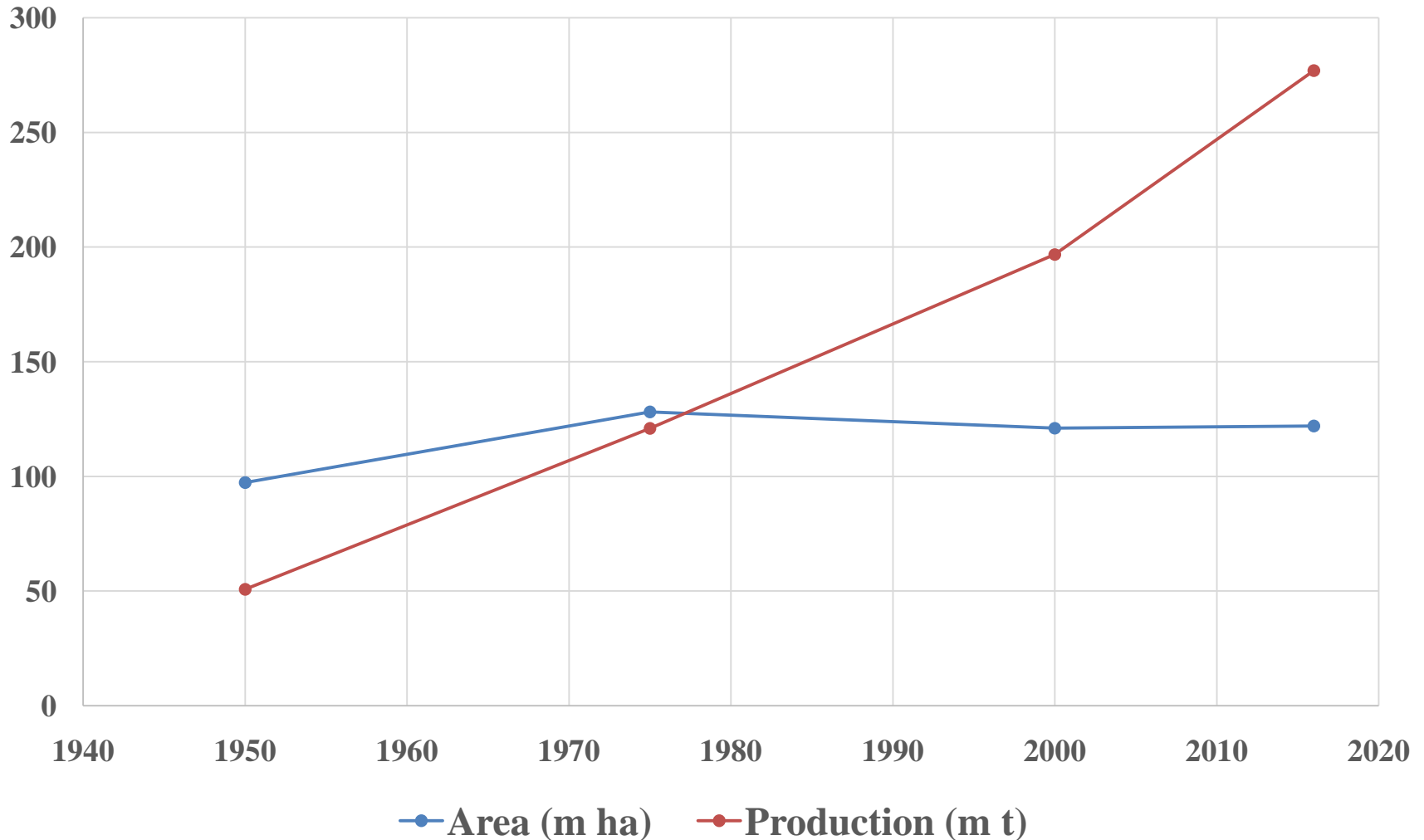
**Food Grains: Cereals, Pulses and Millets**

**Cereals:** Wheat, Rice, Maize, Barley

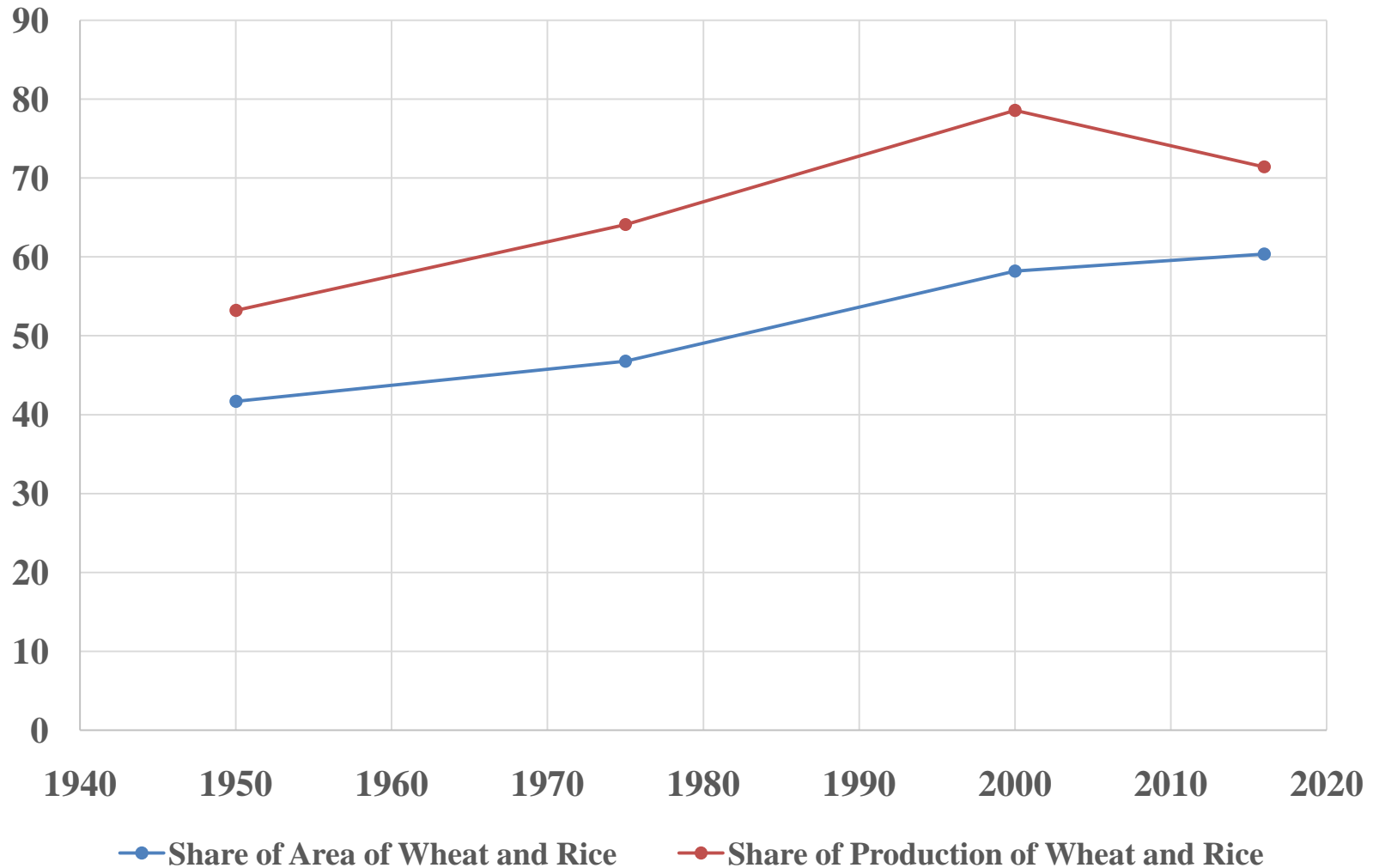
**Pulses:** Chickpea, Pigeonpea, Mungbean, Urdbean,  
Lentil and Soybean.

**Millets:** Jowar, Bajra, Ragi

# Food Grain Area and Production in India since 1950



# Share of Wheat + Rice out of total Food grain in India



# **Current situation leads to Hidden Hunger (Malnutrition)**

## **Hidden Hunger**

- People who suffer from it may not even be aware of it.
- Has no visible warning signs.
- Women and Children of poor families are main victims

## **Consequences**

- Persistent lack of vitamins and minerals.
- Mental impairment
- Poor health
- Poor productivity

# Facts in the developing world due to Malnutrition

- 3.5 billion people are iron deficient.
- Due to Zinc deficiency, stunting, mental impairment of children, Diarrhea in children and Skin lesions are observed.
- Vitamin A deficiency leads to the blindness of 5 lac children yearly, affects immune system, intestines and lungs.

# Options ?

## ➤ **Fortification of Food**

- expensive
- consumption of processed food
- issue of adulteration

## ➤ **Use of medicines (multivitamins)**

- expensive
- problem of monitoring for quality of medicine

## ➤ **Diversification of the diet**

- expensive
- Unaffordable for many

## ➤ **Biofortification**

# What is Biofortification?

Biofortification is the development of nutrient-dense staple crops using the best conventional breeding practices and modern biotechnology, without sacrificing agronomic performance and important consumer-preferred traits i.e., Iron, zinc, calcium, pro-vitamin A carotenoids, folate, amino acids, prebiotics, etc.

*“Agriculture based sustainable approach to combat malnutrition and related health issues”*



# Biofortification

To improve nutritional quality of crop plant through conventional breeding methods

## Examples

1. High *Zinc* variety of wheat
2. High *Iron* rice varieties
3.  *$\beta$ -carotene* rich sweet potato variety
4. *Lysine- and tryptophan* rich maize (QPM) varieties

# Fortification

Enriched foods

## Examples

1. Iodized Salt
2. Fe in Flour
3. Floride in toothpaste

# Initiation of HarvestPlus



Robin D. Graham  
Professor  
Dept. of Plant Sci  
University of Adelaide



Ross M. Welch  
Plant Physiologist  
USDA-ARS  
Cornell University



Howarth E. Bouis  
Program Director  
HarvestPlus  
IFPRI





World Food Prize 2016 is awarded to Laureate Dr. Howarth "Howdy" Bouis, for his pioneering work in addressing the global problem of micronutrient deficiencies, known as hidden hunger, through biofortification.

# Biofortification-HarvestPlus (Target crops)

**Target crops** are the main calorie source in developing countries and by adding micronutrients & enhancing their nutritional value – HarvestPlus provides the link between Agriculture and Health

- Wheat in India and Pakistan.
- Rice in India and Bangladesh,
- Pearl millet in India,
- Beans in DR Congo and Rwanda,
- Cassava in DR Congo and Nigeria,
- Maize in Nigeria and Zambia,
- Sweet potato in Mozambique and Uganda,

# Biofortified varieties released by ICAR

|                     |   |
|---------------------|---|
| <b>Rice</b>         | CR Dhan 310 (protein rich variety)<br>DRR Dhan 45 (zinc rich variety)   |
| <b>Wheat</b>        | WB 02 (zinc & iron rich variety)<br>HPBW 01 (iron & zinc rich variety)  |
| <b>Maize</b>        | Pusa Vivek QPM9 Improved (provitamin-A, lysine & tryptophan rich hybrid)<br>Pusa HM4 Improved (lysine & tryptophan rich hybrid)<br>Pusa HM8 Improved (lysine & tryptophan rich hybrid)<br>Pusa HM9 Improved (lysine & tryptophan rich hybrid) |
| <b>Pearl millet</b> | ICTP 8203 (Dhanshakti)-iron & zinc rich variety<br>DHBH 211(iron & zinc rich hybrid)<br>HHB 299 (iron & zinc rich hybrid)<br>AHB 1200 (iron rich hybrid)<br><i>RHB 233, RHB 234, HHB 311, AHB 1269 (Identified in 2018)</i>                   |

# Biofortified varieties released by ICAR

|                     |  |
|---------------------|--|
| <b>Lentil</b>       | Pusa Ageti Masoor (iron rich variety)  |
| <b>Mustard</b>      | Pusa Mustard 30 (low erucic acid variety)<br>Pusa Double Zero Mustard 31 (low erucic acid & low glucosinolate variety) |
| <b>Cauliflower</b>  | Pusa Beta Kesari 1 ( $\beta$ -carotene rich variety)   |
| <b>Sweet Potato</b> | Bhu Sona ( $\beta$ -carotene rich variety)<br>Bhu Krishna (anthocyanin rich variety)                                   |
| <b>Pomegranate</b>  | Solapur Lal (iron, zinc & vitamin-C rich variety)  |

**Thank You**