Nutrition and the Agrobiodiversity Connect

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“All the evidence we have today shows that if we want to achieve a resilient recovery from the COVID-19 crisis, avoid future pandemics and stand a chance of delivering on the SDGs and the Paris Agreement, we have to focus on biodiversity and food.” - Open letter to G20 by EAT Advisory Board






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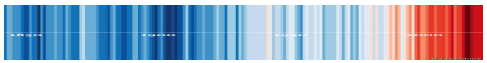
Climate Change and Indian Agriculture



- India has to feed 1.65 billion people in 2050
- Diminishing Natural Resources
- Land degradation and desertification
- Loss of Biodiversity
- Water demand for food production to increase dramatically while water resources are depleting
- Imperfect markets and information asymmetry resulting in high transaction costs for smallholder farmers.

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Climate risk remains as a huge disincentive for investments into innovative technology for smallholders.

Major risks faced by smallholder farmers:

- **Cost and availability of inputs**
- **Biotic stress (pests and diseases)**
- **Prices received for produce**
- **Market risk**
- **Storage risk – loss of quality and health risks (e.g., Aflatoxins)**
- **Climatic risk**

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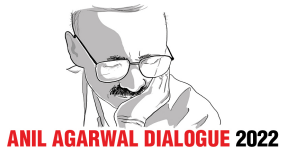
The daunting malnutrition challenge

- India shares a quarter of the global hunger burden. 4 out of 10 children in India are not meeting their full human potential because of chronic undernutrition or stunting. Stunting has consequences such as diminished learning capacity, poor school performance, reduced earnings and increased risks of chronic diseases. (UN India, 2019)
- Due to COVID19 pandemic, number of undernourished people, estimated at 690 million before the health crisis, may have increased by another132 million in 2020. (FAO, 2020)
- The data from recent NFHS-5 have revealed that nutrition indicators have not fared well in many States and UTs. (GoI, 2021)

India's success is essential to achieve the planetary goal of Zero Hunger.



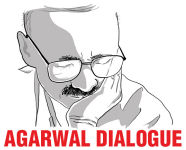
Agriculture-Nutrition nexus

Agriculture is crucial for improved nutrition:

- Source of food; delivering energy; macro- and micro-nutrients essential for growth.
- Source of income to purchase food and services integrated to maintaining nutrition
- Increased access for women and their decision making power over resources
- Impacts human and planetary health.

Source: IFPRI

Research, Policy and Programs critical to fill the gaps.



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Pathways for Climate-smart Agriculture

- Diversification (towards climate resilient and nutritious crops)
- Resource (water, nutrient, energy, etc.)- use efficiency
- Agro-ecological approaches (Regenerative agriculture)
- Use of renewable energy (Solarization)
- Enhanced research and innovation investments
- Targeted and timely delivery of information and services (Digital Ag)
- Supportive institutional architecture
- Capacity building and sensitization of stakeholders (emphasis on local self-governments)

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Research and Innovation with Nutrition focus

Enhanced investments in research and innovation

- Moving beyond productivity towards nutritional quality: research with a systems approach
- Targeting nutri-dense crops (pulses; millets)
- Bio-fortification of staple (and non-staple) crops
- Breeding crop varieties for climate-resilience, along with nutrition.

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Plant Genetic Resources for Crop Improvement

- Germplasm of landraces, and wild relatives of crops- employ traits in breeding improved varieties with nutritional qualities and biotic and abiotic stress resistance/tolerance.
- For example, Swarna Sub 1 rice variety (sub1 QTL derived from submergence tolerance FR13A landrace in Odisha); Pigeon-pea hybrid (based on CMS, developed with genes from wild pigeon peas)

ICRISAT Gene Bank: Wealth for future

- ICRISAT is the custodian of more than 1,20,000 germplasm accessions of its mandate crops from 144 countries. 90% of these accessions are conserved under long term storage; duplicate samples are also conserved at the Svalbard Global Seed Vault in Norway.
- Between 1975-2022 (January), ICRISAT Gene Bank has distributed > 843,100 samples (of its mandate crops and small millets) to users in 148 countries. It has promoted testing and release of 104 accessions directly as 137 superior varieties in 51 countries and 1019 varieties were released in 81 countries utilizing germplasm and breeding lines from ICRISAT.

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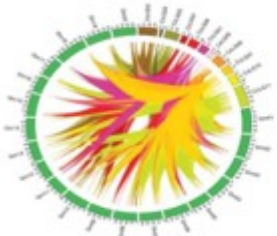
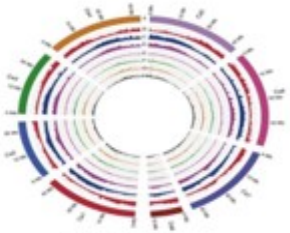
Reference Genomes for ICRISAT mandate crops

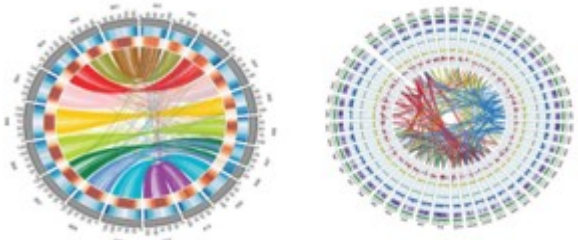


Pigeonpea
(*Nature Biotechnology 2012*)



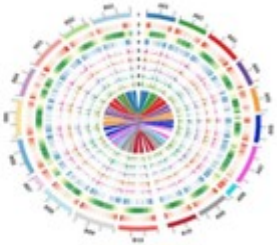
Chickpea
(*Nature Biotechnology 2013*)

Pearl millet
(*Nature Biotechnology 2017*)



Wild ancestors of groundnut
(*Nature Genetics 2016; PNAS 2016*)

Cultivated tetraploid groundnut



Subspecies *fastigiata*

Subspecies *hypogaea*

(*Nature Genetics 2019b; Nature Genetics 2019c; Mol Plant 2019*)

Courtesy: Dr Rajeev Varshney

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Few bio-fortified crop varieties to address malnutrition

High protein rice variety, CR Dhan 310, with 10.3% protein content

Zn (Zinc) rice variety, DRR Dhan 45, with 19.5 ppm Zn in polished rice

High Fe (Iron) lentil variety, Pusa Vaibhav, with 102 ppm Fe

Wheat lines having wide range of iron (23-48 ppm), Zinc (21-43 ppm) and antioxidant activity identified

Quality Protein Maize hybrid, Vivek QPM 9, with high Tryptophan and Lysine amino acids

Released by ICAR

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India's first bio-fortified Sorghum variety, *Parbhani Shakti* with significantly higher Fe and Zn than regular sorghum has been released for cultivation in Maharashtra. It offers a cost-effective & sustainable solution to address micro-nutrient deficiency.

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Importance of millets in Indian agri-food systems

- Millets have an evolutionary advantage in terms of resilience to drought, high temperature and are a solution to two major global challenges of present times- micronutrient malnutrition and climate change
- Millets, while sustaining production systems, can provide micronutrients, vitamins, antioxidants, fiber and fats that are essential for human health
- The COVID-19 pandemic reinforces the need to consume foods rich in nutrients to maintain good health and high levels of immunity.

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Halting the loss of Agrobiodiversity: Way forward

- (Strongly) Integrating agriculture policies into environments and health policies
- Context specific diversification practices
- Treating agricultural lands as ecosystems; Managing through regenerative, carbon sequestering and nature-positive or circular production systems
- Greater investment in research, practices, technologies and incentives that reward efforts of farmers for the environmental services
- Concerted and systematic efforts for collection, conservation, evaluation, and utilization of germplasms

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Halting the loss of Agrobiodiversity: Way forward

- Consumer awareness on diversity of diets that originates from sustainable agri-food systems: to promote biodiversity in diets, in farms and fields
- Preventing losses of nutrients, halting biocides and other pollutants to air, soil & water: Healthy soils promote nutrient capture and water delivery for crop growth
- Greater inclusion and recognition of farmers as key actors, with women, youth and indigenous farmers bringing their unique knowledge and capabilities
- Protecting remaining natural ecosystems from agricultural expansion and other extractive activities to secure nature's essential contribution to climate mitigation

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Thanks

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