Nutrient Loss in Wheat & Rice

Why in News

Recently, researchers from various institutes under the **Indian Council of Agricultural Research (ICAR)** and Bidhan Chandra Krishi Viswavidyalaya **found depleting trends in grain density of zinc and iron in rice and wheat** cultivated in India.

- The researchers collected seeds of **rice (16 varieties)** and **wheat (18 varieties)** from the gene bank maintained at the **ICAR's Cultivar repositories.**

Indian Council of Agricultural Research

- It is an **autonomous organisation** under the **Department of Agricultural Research and Education (DARE),** Ministry of Agriculture and Farmers Welfare.
- It is the **apex body for coordinating, guiding and managing research and education in agriculture** including horticulture, fisheries and animal sciences in the entire country.
- It was **established on 16th July 1929** as a registered society under the Societies Registration Act, 1860.
- It is **headquartered at New Delhi.** With **102 ICAR institutes and 71 agricultural universities** spread across the country this is one of the largest national agricultural systems in the world.
- **Cultivar repositories** are nodal institutes that preserve and archive the old cultivars or varieties from our country.

Key Points

- **Observation:**
    - **Concentrations in Rice:**
        - Zinc and iron concentrations in grains of rice cultivars released within the **1960s were 27.1 mg/kg and 59.8 mg/kg.** This **depleted to 20.6 mg/kg and 43.1 mg/kg, respectively within the 2000s.**
    - **Concentrations in Wheat:**
        - The concentrations of zinc and iron were **33.3 mg/kg and 57.6 mg/kg in cultivars of the 1960s,** dropped to **23.5 mg/kg and 46.4 mg/kg, respectively in cultivars released during the 2010s.**
- **Reason for the Decrease:**
    - **Dilution effect**' that is caused by **decreased nutrient concentration in response to higher grain yield.**
    - This means the **rate of yield increase is not compensated by the rate of nutrient take-up by the plants.** Also, the soils supporting plants could be low in plant-available

nutrients.

- **Suggestions:**
    - Growing **newer-released (1990s and later) cultivars of rice and wheat cannot be a sustainable option** to alleviate zinc and iron malnutrition in Indian population.
        - Zinc and iron deficiency affects billions of people globally and the countries with this deficiency have diets composed mainly of rice, wheat, corn, and barley.
    - The **negative effects need to be circumvented by improving the grain ionome (that is, nutritional make-up)** while releasing cultivars in future breeding programmes.
    - There is a **need to concentrate on other options like biofortification,** where we breed food crops that are rich in micronutrients.

Biofortification

- **About:**
    - **Biofortification** is the process by which the **nutritional quality of food crops is improved** through agronomic practices, conventional plant breeding, or modern biotechnology**.**
- **Initiatives Taken by India:**
    - Recently, the Prime Minister **dedicated 17 biofortified varieties of 8 crops** to the nation. Some **examples:**
        - **Rice-** CR DHAN 315 has excess zinc.
        - **Wheat-** HI 1633 rich in protein, iron and zinc.
        - **Maize-** Hybrid varieties 1, 2 and 3 are enriched with **lysine and tryptophan.**
    - **Madhuban Gajar**, a biofortified carrot variety, is benefitting more than 150 local farmers in Junagadh, Gujarat. It has higher **β-carotene and iron** content.
    - ICAR has started **Nutri-Sensitive Agricultural Resources and Innovations (NARI) programme** for promoting family farming linking agriculture to nutrition, **nutri-smart villages** for enhancing nutritional security and **location specific nutrition garden models** are being developed to ensure access to locally available, healthy and diversified diet with adequate macro and micronutrients.
    - The production of bio-fortified crop varieties will be upscaled and **linked with government programmes** of mid-day meal**,** Anganwadi etc. to reduce **malnutrition.**
- **Importance of Biofortification:**
    - **Improved Health:**
        - Biofortified staple crops, when consumed regularly, will **generate measurable improvements in human health and nutrition.**
    - **Higher Resilience:**
        - Biofortified crops are also often **more resilient to pests, diseases, higher temperatures, drought** and provide a high yield.
    - **Greater Reach:**
        - Biofortification fills an important gap as **it provides a food-based, sustainable and low-dose alternative to iron supplementation.** It does not require behavior change, **can reach the poorest sections of the society, and supports local farmers.**
    - **Cost Effective:**
        - After the initial investment to develop the biofortified seed, it can be replicated and distributed without any reduction in the micronutrient concentration. This makes it **highly cost-effective and sustainable.**
- **Challenges for Biofortification in India:**

- **Lack of Acceptance:**
    - Lack of consumer acceptance due to color changes (e.g. golden rice) and **last mile reach of fortified food remains a big challenge.**
- **Cost:**
    - Adoption by farmers and **cost involved in the process of fortification.**
- **Slow Process:**
    - Though biofortification can be done using non-genetically-modified methods it is a **slower process than genetic modification.**

Way Forward

- Because of the prevalence of diverse food practices in the country, **biofortification will need to achieve high rates of adoption and consumption** in geographically distinct areas.
- Strategies for delivery of biofortified crops must be **tailored to the local context for each crop–nutrient pair.**
- The **government should facilitate public-private partnerships.** Private sector engagement can leverage technological solutions for scaling up food fortification initiatives, and complement the government's outreach efforts through mass awareness and education campaigns in communities.
- The lack of nutrition is not only a denial of a fundamental human right, but it is also poor economics. Biofortification is a partial solution, which must **go hand in hand with efforts to reduce poverty, food insecurity, disease, poor sanitation, social and gender inequality.**

Source: TH