



Prosperity



# Research and Innovation



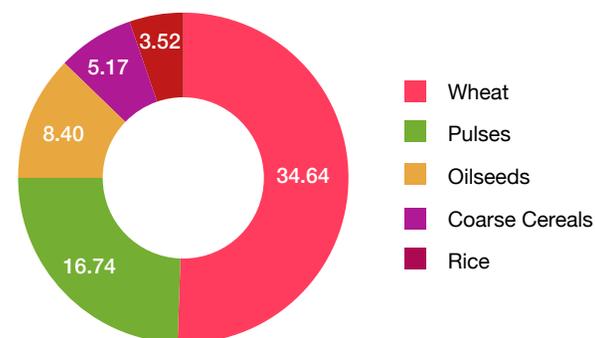
# Actionable Area

Promote research and innovations by academic institutions in the agriculture and food sectors for enhanced production and access to safe and nutritious food to contribute to a healthy society and future.

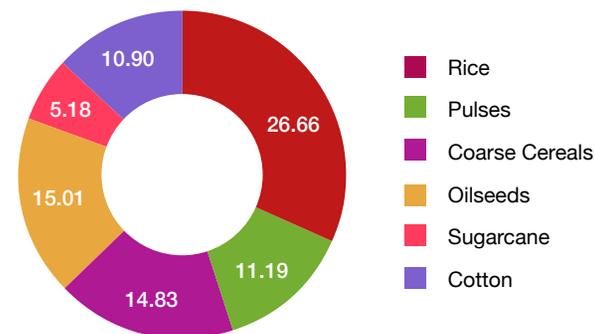
## Issue

- More than ever before, people are mindful of the food they eat, its source, safety, quality, nutrition value, and cost today. Focus on Research & Development towards pre and post-production quality management of food is therefore critical. Sustainable food systems are interconnected and represent the full agri-value chain, from pre-production and production to supply chains and consumption. Thus, R&D focus is needed in areas like genetic resource improvement, good agricultural practices, post-harvest management, food processing, packaging, and food waste management.
- There is increasing demand to develop high-yield, climate-resilient varieties of agro produce, lengthening or shortening their harvest cycles based on end-use, and introducing processable varieties. There is also a need to develop cost and energy-efficient post-harvest management technology, improve shelf life, and innovate on the packaging front. In response to consumer demand for specialty products based on “clean labels,” new ingredients, functional foods, alternative protein sources, gut health, and bioactive formulations are also gaining R&D focus. Further, traceability is gaining center stage in the changing market dynamics, and R&D focus on the production and processing side will help meet this requirement.

**Rabi area sown in 2020-21 (million hectares)**  
(as on January 29, 2021)



**Kharif area sown in 2020-21 (million hectares)**  
(as on January 31, 2020)





- The resilience of India's agriculture production has been an outcome of synergy among the scientists and researchers fraternity in the National Agricultural Research System (NARS), comprising the Indian Council of Agricultural Research (ICAR), state agricultural universities (SAUs), etc. Further, various research Institutes and centers work on the food processing side like CFTRI -Mysore, Indian Institute of Technology-Kharagpur, NIFTEM-Sonipat IIFPT-Thanjavur, etc.
- Constant technological improvements have led to a four times increase in food grain production, six times in horticultural crops, nine times in fish, and 27 times in eggs since 1951. More than 5,000 ecologically sustainable crop varieties and hundreds of animal breeds have been developed by ICAR institutions for maintaining a resilient food system. With the advancement in mobile technologies, the expanded reach of disease and pest surveillance mechanisms to farms has effectively reduced crop losses. To address malnutrition, several bio-fortified crop varieties have been released recently. Conservation of nearly one million diverse plant and animal genetic resources has maintained India's tag of a biologically diverse country. In the last decade, the compound annual growth rate of patents filed in the agricultural sector in India was 12.5% — higher than the global growth rate of 11%. This indicates the underrated strength of Indian R&D in agriculture.
- Still, agricultural R&D in India has a long way to go; to develop solutions tailored to the local needs of particular crops and agroecologies. This calls for invigorating the scientific temper, focusing on problem-solving as part of the human resources capacity, and fostering R&D funding.
- India's gross expenditure on R&D (GERD) has been consistently increasing over the years and has nearly tripled from Rs. 39,437.77 crore in 2007- 08 to Rs. 1,13,825.03 crore in 2017-18. But, it still hovers around only 0.40% of agricultural GDP while most other countries spend more than 1%. Government expenditure, almost entirely by the Central Government, is the driving force of R&D in India, in contrast to the advanced countries where the private sector is the dominant and driving force of R&D spending. There is a need for greater participation of state governments and the private sector in overall R&D expenditure in India, especially in application-oriented research and technology development.
- It's time for the agriculture and food sector to have a long-term strategy focusing on food systems within each agro-climatic region per se, instead of a generalised food production strategy. The cornerstone of success in bringing about a more vibrant agricultural sector lies in increasing agricultural R&D expenditure to at least 1% of agricultural GDP, thereby charting a trajectory of higher and inclusive growth and making the national plan of doubling farmers' income in the near future possible.
- Apart from funding, quality of research is another area of concern as many institutes do not have mandatory research goals for individual faculty, and most do not have adequate systems or infrastructure for quality research. The need for sharing knowledge between research institutions and industry has become increasingly evident in the present scenario. Through collaborative approach can also be leveraged for planning and policy decision-making.

# Status

## Government Initiatives

- India has one of the largest agricultural research systems in the world with the largest number of scientific personnel of any developing country engaged in research and education relating to agriculture and allied areas.
- The research system includes approximately 30,000 scientists and more than 1,00,000 supporting staff actively engaged in agricultural research. The present agricultural research system comprises essentially two main streams - the ICAR at the national level and agricultural universities at the state level. Although agriculture is a state subject, ICAR has established many central research institutions over the years to meet the research needs of the country. There are about 4 deemed universities, 44 national institutions, 15 national research centres, 6 national bureaux, 13 directorates/project directorates, and around 8 Agriculture Technology Application Research Institutes (ATARIs).
- 'Lab to Land' programme launched in 1979 by ICAR intends to improve the economic condition of small, marginal farmers and landless agricultural labourers by improving their access to technology. The program is supported by a network of 722 Krishi Vigyan Kendras (KVK; Agriculture Science Centres) across India which fall under the jurisdiction of one of the 11 ATARIs.
- The World Bank aided National Agricultural Technology Project (NATP) is also being implemented by the ICAR and the Department of Agriculture and Co-operation (DAC) since 1998. It aims at improving research and extension services. R&D initiatives are also supported by 15 National Research Centers under ICAR.
- While ICAR is focusing on technology innovation and dissemination, AgrilInnovate India is helping in technology commercialisation through technology transfer, incubation, contract manufacturing as well as JV and equity investments. All the technologies developed by ICAR institutions across India are commercialised by AgrilInnovate via licensing and technology transfer to relevant stakeholders across Agri-Food value chain.
- On the processing side, the Ministry of Food Processing Industries (MoFPI) has been extending financial assistance to undertake demand-driven R&D for the benefits food processing industry in terms of product and process development, efficient technologies, improved packaging, value addition, etc. Standardization of various factors like additives, coloring agents, preservatives, pesticide residues, chemical contaminants, microbiological contaminants, and naturally occurring toxic substances within permissible limits is also a focus area of R&D in processing.



- The Government of India has taken several initiatives to enhance investment in R&D as well as to promote and improve the overall research eco-system in the country. These include Uchhatar Avishkar Yojana (UAY), which promotes industry-sponsored, outcome-oriented research. 25% of the funds under UAY are contributed by the Industry. Impacting Research Innovation and Technology (IMPRINT) focuses on socially relevant research in higher educational institutions. Establishment of 9 research parks at a total cost of Rs. 775 crore, 8 of them being in the Indian Institutes of Technology (IITs) and one in the Indian Institute of Science (IISc) will propel innovation through incubation and joint research between academia and industry. Prime Minister's Research Fellows (PMRF) Scheme incentivises the most meritorious students to pursue research in the frontier areas of science & technology by offering attractive rates of a fellowship from Rs.70,000/- to Rs.80,000/- per month in addition to research grant of Rs. 2.00 lakh per year for five years.

## Vision 2030

- **Increasing R&D spending to at least 1% of GDP from agriculture, food processing and nutrition sector.**
- **Ensuring close interaction between industry, academia and research Institutes for carrying out application research meaningfully.**
- **Strengthen the scientific and technological capacity to move towards more sustainable consumption and production.**
- **Creating an ecosystem for outcome-oriented and applied research.**

# Pathways



**Lab to land scale-up operations** should be at a higher pace.

**Academic institutions should create a framework** for evaluating technology solutions developed by startups and scaling the commercialisation of the tested innovations.

**Strengthen linkages between Indian research** and academic institutions and the global academic system to help Indian scholars understand and contribute to advanced scientific developments.

**Facilitate inter-disciplinary interaction** within existing top Indian institutions and universities to expand in size and meet the diversity needed.

**Create specific allocation** of grants to encourage scientists to test their ideas commercially.

**Strengthen the curriculum** of education boards to integrate food safety and nutrition aspects for much larger dissemination to create mass awareness.

**Develop and disseminate** the post-harvest handling protocols for crops, especially export-worthy ones.

# Pathways

## POLICY



Research focus needs to be on commercially viable and need-based solutions.

—  
**Develop a collaborative framework** between the research machinery and the private sector.

—  
**Mandate academic institutions** to have a minimum number of industry-funded PhD researchers with well-defined and milestone-based focused objectives.

—  
**Make special allocations** for the upgradation of infrastructure and technical capabilities in the testing & research labs.

—  
**Offer tax concessions** to scale up private participation in research.

—  
**A mechanism should be put in place** for better convergence amongst the research institutions to reduce repetition in areas of work.

## KNOWLEDGE & RESEARCH



**Assessing the “Input use Efficiency” and “Cost of production”** with respect to various commodities is important to understand the need for developing climate resilient varieties or shifting cropping patterns.

—  
**Focus research on co-product** and by-product utilisation for minimising food losses and waste.

—  
**Regulatory research which are relevant** to the information on the adopted international standards and prepares us future-ready.

—  
**Indigenously developed processing facilities that can work** for traditional produces of the Indian subcontinent.

—  
**Research in traceability** to ensure sustainable growth of crops.