

**GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
LOK SABHA
ADMITTED/UNSTARRED QUESTION No. 5645
TO BE ANSWERED ON 06-04-2022**

Application of Biotechnology in Agriculture

5645. SHRI BHARTRUHARI MAHTAB:

Will the Minister of SCIENCE AND TECHNOLOGY विज्ञान और प्रौद्योगिकी मंत्री be pleased to state:

- (a) whether the Government has been supporting application of biotechnology tool in the areas of Agriculture and allied sectors and if so, the details of research and development activities conducted in genetic improvement of wheat and rice in the country;
- (b) the present status of commercial cultivation of Genetically Modified (GM) wheat and rice in the country along with the details thereof;
- (c) whether the Government has conducted assessment of the Genetically Modified(GM) crops for commercial cultivation on a case to case basis and if so, the details and outcome thereof particularly in confined field trials, food and feed safety studies; and
- (d) whether the studies conducted on such trials conforms the safety tests guidelines for the Safety Assessment of Foods Derived from Genetically Engineered Plants, 2008 and if so, the details thereof?

**ANSWER
MINISTER OF STATE (INDEPENDENT CHARGE) OF
SCIENCE AND TECHNOLOGY AND EARTH SCIENCES
(DR. JITENDER SINGH)**

विज्ञान और प्रौद्योगिकी तथा पृथ्वी विज्ञान के राज्य मंत्री (स्वतंत्र प्रभार)
(डॉ. जितेन्द्र सिंह)

- a)** Yes Sir, the Government of India has been supporting application of biotechnology tool in the areas of agriculture and allied sectors through extra mural research grants provided by the Department of Biotechnology, Department Agriculture Research and Education/ India Council of Agriculture Research, National Agriculture Sciences Fund (NASF) and Science and Engineering Research Board (SERB). The Government of India through its various agencies is supporting ninety eight (98) projects for improvement of rice (72) and wheat (26).
- b)** No, Sir. The Government of India has not approved commercial cultivation of genetically Modified (GM) rice and wheat in the country.

c & d) Yes Sir, the Government of India has received applications for the commercial release of food crops GM mustard and Bt-brinjal under the Genetic Engineering Appraisal Committee (GEAC) as per provisions of the rules for the manufacture, use/import/export and storage of hazardous microorganisms/ genetically engineered organisms or cells, 1989 of the Environment Protection Act (1986).

The Government of India through GEAC has received feedback from multiple stakeholders for these crops. GEAC has advised the developer to conduct additional studies for the assessment of impact on environment and health.

Annexure-i

Details of ongoing R&D projects supported in genetic improvement of Rice and wheat:

A) Department of Biotechnology

S.No.	File no. & title	Institution
1.	Marker Assisted Breeding for Developing Early Maturing versions of Popular Rice Varieties of Tamil Nadu	Agricultural College and Research Institute, TANU, Coimbatore
2.	Improvement of Biscuit Making Quality of Indian Wheats Utilizing Molecular Approach - IInd Phase	Indian Institute of Wheat and Barley Research formerly Directorate Of Wheat Research, Karnal, Haryana
3.	Development of high yielding gall midge resistant rice varieties through marker assisted pyramiding of multiple gall midge resistance genes	Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, India
4.	"Development of rice varieties for kerala with pyramided genes for Resistance to BLB by marker assisted selection"	Kerala Agricultural University, Thiruvananthapuram Rajiv Gandhi centre for Biotechnology, Thiruvananthapuram
5.	Marker aided incorporation of major genes conferring resistance to blast disease into genetic background of high altitude temperate rice (<i>Oryzasativa L.</i>)	Sher –e-Kashmir University of Science and Technology, Khudwani
6.	Marker Assisted Improvement Of Rice Variety Pusa 44 For Phosphorus Use Efficiency	Indian Agricultural Research Institute Pusa, New Delhi - 110012
7.	Development of GA-sensitive semi-dwarf high yielding climate resilient wheat utilizing Marker assisted background selection	Punjab Agricultral University, Ferozepur Road, Near Ludhiana
8.	Development of semi-dwarf blast and bacterial blight resistant version of Ranbir Basmati by marker assisted backcross breeding	Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu CSK Himachal Pradesh Agricultural University
9.	Incorporation of biotic stress resistance gene(s) in the genetic background of Pusa Basmati 1509 through marker assisted backcross breeding	Indian Agricultural Research Institute, New Delhi
10.	Marker-assisted introgression of yield-enhancing genes to increase yield potential in rice	Indian institute of rice research formerly called Directorate of Rice Research, Hyderabad Central Rice Research Institute, Cuttack
11.	De Novo Genome Sequencing of Karnal Bunt (<i>TilletiaIndica</i>) Pathogen of Wheat: Characterization of Pathogenecity Genes/Proteins for Development of Diagnostics	G. B. Pant University of Agriculture & Technology, Pantnagar

12.	Generation and comparative analysis of salinity responsive miRNAs and miRNA-mediated pathways of halophyte (<i>Oryzacoartata</i>) and a tolerant glycophyte (<i>Oryzasativa</i> cv Nonabokra)	National Research Centre on Plant Biotechnology, PUSA, New Delhi
13.	Engineering The Nodulation Signaling Pathway In Rice Plant To Promote Rhizobial Infection And Nitrogen-Fixing Symbiosis.	The Energy and Resources Institute, Darbari Seth Block, India Habitat Centre, New Delhi
14.	Development of chromosomal segmental substitution lines for 5U chromosome of <i>Ae. triuncialis</i> for transfer and mapping of multiple disease resistance and grain softness in elite wheat background	Punjab Agricultural University, Ludhiana
15.	Understanding the role of TAL effectors of <i>Xanthomonasoryzaepv. oryzae</i> in modulating rice innate immune response to cause bacterial blight.	Indian Agricultural Research Institute Delhi, New Delhi
16.	Genome-wide mapping of QTLs controlling healthy amylose starch variation in wheat	National Agri - Food Biotechnology Institute, Sector-81, Knowledge City, Mohali
17.	Maintenance, Characterization and Use of EMS Mutants of Upland Variety Nagina 22 for Functional Genomics in Rice – Phase II	Indian Agricultural Research Institute, Hill Side Road, Pusa, New Delhi, National Research Centre on Plant Biotechnology (NRCPB), Pusa Campus, New Delh Tamil Nadu Agriculture University, Coimbatore - 641003 University of Agricultural Sciences (UAS), Bangalore Indian Institute of Rice Research (IIRR) formerly DRR, Rajendranagar, Hyderabad Central Rice Research Institute (CRRI), Cuttack, Odisha

18.	“Functional Characterization of Genetic and Epigenetic Regulatory Networks Involved in the Reproductive Development in Rice”	<p>University of Delhi South Campus, New Delhi</p> <p>University of Delhi South Campus (UDSC), New Delhi</p> <p>Indian Institute of Science (IISc), Bangalore</p> <p>Osmania University, Hyderabad</p> <p>Indian Institute of Science Education and Research, Trivandrum.</p> <p>National Centre for Biological Sciences, GKVK Campus, Bellary Road, Bangalore</p>
19.	Marker Assisted Pyramiding Of Apr And Seedling Resistance Genes For Durable Rust Resistance In Wheat (<i>Triticum Aestivum</i> L.)	<p>G.B. Pant University of Agriculture & Technology, Pantnagar.</p> <p>Indian Agricultural Research Institute, Wellington</p> <p>Indian Agricultural Research Institute, New Delhi</p>
20.	Development of high yielding water and labour saving rice varieties for dry direct seeded aerobic conditions utilizing recent discoveries on traits, QTLs, genes and genomic technologies	<p>International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru</p> <p>Central Rice Research Institute (CRRI), Cuttack, Odisha</p>
21.	Characterization, Race Profiling and Genetic Analysis of Wheat Powdery Mildew Pathogen (<i>Blumeria graminis</i> f. sp. <i>tritici</i> (DC) Speer (Syn. <i>Erysiphe graminis</i> DC f. sp. <i>tritici</i>) in India.	<p>Indian Agricultural Research Institute, Coonoor Tamilnadu.</p> <p>Directorate of Wheat Research, Karnal, Shimla</p> <p>Indian Agricultural Research Institute, Himachal Pradesh</p>
22.	Pyramiding of Rust Resistance Genes into High Grain Quality Wheat Lines Developed Through Marker-assisted Selection	<p>PAU, Ludhiana – 141004 Punjab.</p> <p>GBPUA&T, Pantnagar</p> <p>PAU, Ludhiana</p> <p>ARI, Pune</p>

		BHU, Varanasi CCSU, Meerut
23.	Marker-Assisted Breeding and Mapping of QTLs for Drought Tolerance in Wheat.	ICAR-Indian Institute of Wheat and Barley Research, Karnal, Indian Agricultural Research Institute, PUSA complex, New Delhi Ch. Charan Singh University, Meerut
24.	From QTL to Variety: Genomics-Assisted Introgression and Field Evaluation of Rice Varieties with Genes/QTLs for Yield under Drought, Flood and Salt stress.	National Research Centre On Plant Biotechnology, Pusa, New Delhi,
25.	Gene discovery for reproductive stage salt-tolerance in rice	National Research Centre On Plant Biotechnology, New Delhi
26.	Molecular cloning and characterization of Xa38 loci conferring resistance to bacterial blight (BB) disease in rice and identification of novel and superior alleles.	Punjab Agricultural University Ludhiana
27.	Site-Directed Mutagenesis of Low-Affinity Nitrate Transporter Gene for Improving Nitrogen Uptake Efficiency in Aerobic Rice	Indian Agricultural Research Institute, New Delhi
28.	Introgression Breeding for Transfer of Aphid (Rhopalosiphum Padi L.) Resistance from Aegilops tauschii, the D Genome Donor of Wheat	Punjab Agricultural University, Ludhiana
29.	Editing rice genes through CRISPR/Cas9 technology for enhanced and durable blast resistance in rice.	Indian Agricultural Research Institute, Pusa Campus, New Delhi International Centre for Genetic Engineering & Biotechnology
30.	Mainstreaming rice landraces diversity in varietal development through genome-wide association studies: A model for large-scale utilization of gene bank collections of rice.	IARI, New Delhi
31.	Germplasm Characterization and Trait Discovery in Wheat using Genomics Approaches and its Integration for Improving Climate Resilience, Productivity and Nutritional quality	National Bureau of Plant Genetic Resources, New Delhi
32.	Development of superior haplotype based near isogenic lines(Haplo-NILs) for enhanced genetic gain in rice	International Rice Research Institute (IRRI), South Asia Regional Centre (SARC), Varanasi and IRRI-India

33.	CRISPR/Cas9 based editing of OsERF12 gene for potential improvement of growth and yield of indica rice	National Institute of Plant Genome Research
34.	CRISPR/Cas9 mediated genome engineering of disease susceptibility genes in rice for sheath blight disease resistance	Tamil Nadu Agricultural University, Coimbatore -3
35.	Genomics-assisted breeding for development of Dry-DSR ready Basmati rice varieties	Indian Agricultural Research Institute Punjab Agricultural University
36.	Functional delineation of exon-spliced and exon-containing isoforms of NRT1.5 gene of bread wheat (<i>Triticum aestivum</i> L.) in context with root-to-shoot nitrate transport	National Institute for Plant Biotechnology
37.	BT/PR39021/AGIII/103/1226/2020 Increasing Iron Levels in Rice Grains Through Altering the Expression of Vacuolar Iron Transporter (VIT)-Like genes	National Institute of Plant Genome Research
38.	Defining gene targets of rice OsMADS2 a transcriptional regulator of floral organ differentiation and fertility	INDIAN INSTITUTE OF SCIENCE, Bangalore
39.	Mapping and transfer of novel resistance genes for multiple biotic stresses in wheat (<i>Triticum aestivum</i> L.)	IARI, New Delhi
40.	Development of herbicides against Acetyl Co-A Carboxylase to address resistance and cross resistance in <i>Phalaris minor</i> : A weed of wheat crop field	Central University of Bihar
41.	Targeting Pup1 independent mechanisms for improving low soil phosphorus tolerance and use-efficiency in rice	National Institute of Plant Genome Research ICAR-Indian Institute of Rice Research
42.	Integration of plant and parasite omics to decipher the interactions and identify molecular targets for the management of root knot disease of rice	IARI, New Delhi.
43.	Identification and characterisation of phytoalexin receptor kinase gene family of rice vis-a-vis Arabidopsis and elucidating its role in abiotic stress tolerance	SKUAST, Jammu South Asian University, New Delhi
44.	NIPGR Flagship Programme “Imparting Sheath Blight Tolerance in rice”	NIPGR, New Delhi
45.	CRISPR mediated genome engineering for developing thermo-sensitive genic male sterile lines (tgms) in rice (<i>oryza sativa</i>)	TNAU, Tamil Nadu
46.	Editing MPK3, a mitogen activated protein kinase gene using CRISPR/Cas9 tool in rice to study its role in cell cycle and grain yield	NIPGR, New Delhi

47.	Development of a haploid inducer stock through CRISPR/Cas9 ribonucleoprotein complex mediated knockout of ZmPLA1 gene and its orthologue in Maize and Rice	PAU, Ludhiana
48.	CRISPR/Cas-mediated multiplex genome editing of disease and herbicide tolerance traits in rice for improved performance under aerobic condition and irrigated conditions	UAS, Bengaluru TIGS, Bengaluru
49.	Elucidating the Genetic Architecture of tillering in wheat through CRISPR/CAS based editing of Ideal Plant Architecture gene IPA1 and Teosinte Branched 1 (TB1)	PAU, Ludhiana; NABI, Mohali; IIT, Roorkee
50.	Bio-degradable nanofiber encapsulated biofertilizer to enhance phosphorous and other micro nutrient uptake in rice	INST, Mohali; TERI, New Delhi; ICAR-NRRI, Cuttack; CUTN, Tamil Nadu
51.	Nanoscale Zeolite-Zinc-Carbo-Mycolizers (ZinCarbolyzers) to Improve Productivity of Rice	IIT, Kanpur; IIRR
52.	Development of multiple stress tolerant versions of Rice varieties Gomati and Tripura Chikan through molecular breeding	ICAR-RC-NEH, Tripura ICAR-NRRI, Odisha
53.	Marker assisted pyramiding of three major genes (Pi54, Pi1, Pita) for blast resistance into elite rice varieties, Bhalum 5 and Shahsarang and identification of new sources for blast resistance in native land races of Meghalaya	ICAR-RC-NEH, Meghalaya ICAR-IARI, New Delhi
54.	Development of Climate-smart rice for NE India: Introgression of drought (qDTY1.1 + qDTY2.1 + qDTY3.1) and submergence (Sub1) tolerant genes/QTL into high yielding glutinous RC Maniphou-7 rice variety (<i>Oryza sativa</i> L.).	ICAR-RC-NEH, Meghalaya
55.	Genome wide association mapping for identification of novel genes/QTLs of Bao rice population of Assam for deep water tolerance and nutritional quality trait	RARS, AAU, Assam ICAR-NIPB, New Delhi
56.	Generating high-depth genomics information for the Himalaya rice cultivars for improving nutritional quality and stress tolerance	IBSD, Manipur SKUAST, Jammu & Kashmir AAU, Assam ICAR-NIPB, New Delhi ICGEB, New Delhi NABI, Mohali
57.	Strategic understanding of mechanisms that restrict grain yield, grain protein content and	UAS Bangalore

	quality in rice through an interface between clinical nutrition and agriculture research	
58.	A National Mission Mode Program On Nutritional improvement of digestible protein content and quality in rice: Lead	NIPGR, New Delhi
59.	High resolution QTL mapping for Fe, Zn, grain protein and phytate content and their introgression in high-yielding wheat cultivars: Lead	NABI Mohali

B). Biotechnology Industry Research Assistance Council (BIRAC)

1.	Applying Marker Breeding to develop rice hybrids: (a) resistant to Brown Plant Hopper (BPH), Blast and Bacterial leaf Blight, (b) salt tolerance, drought resistance, biotic resistance
2.	Applying Genetic engineering (GM) technology for development of rice genotypes/hybrids (a) tolerant to drought and salinity, (b) Enhanced tolerance against Lepidopteran insect and yellow stem borer, <i>Scirpophagaincertulas</i>
3.	Double haploid breeding in development of Rice varieties for enhancing resilience against biotic and abiotic stresses.
4.	Improvement of line yield per se and efficiency of hybrid seed production in rice using genome editing technologies.

C). Details of ongoing R&D projects supported on Rice and Wheat by Indian Council of Agricultural Research

S.No	Project Title
1.	Network Project on Functional Genomics and Genetic Modification (formerly, Network Project on Transgenics in Crops) to promote genomics & molecular marker, and genetic modification research works in number of crops including rice and wheat.
2.	Incentivizing Research in Agriculture
3.	Consortium Research Platform on Molecular Breeding
4.	Consortium Research Platform on Biofortification

D). Details of ongoing R&D projects supported on Rice and Wheat by National Agricultural Science:

S. No.	Title of the project	Lead centre
1.	Re-designing rice crop for improvised grain micronutrient quality using CRISPR- Cas9/Cpf1 genome editing	ICGEB, New Delhi
2.	Fine mapping and marker-assisted breeding for alternative dwarfing genes Rht14 and Rht18 to develop semidwarf wheat genotype suitable for conservation agriculture	ARI, Pune

3.	Harnessing haplotype diversity of genes controlling yield, stress tolerance and resource use efficiency traits in rice for accelerating genetic gains	TNAU, Coimbatore
4.	Exploring aus rice for drought, submergence and phosphorus starvation tolerance: Mining superior alleles and deciphering mechanism of tolerance	ICAR-NRRI-CRURRS, Hazaribag
5.	Utilization and refinement of haploid/doubled haploid induction systems in rice, wheat and maize involving molecular and invitro strategies	NRRI, Cuttack PAU, Ludhiana VPKAS, Almora
6.	Genetic improvement of rice for yield, NUE, W UE, abiotic and biotic stress tolerance through RNA Guided Genome Editing (CRISPR-Cas9/Cpf1)	IARI, New Delhi ICGEB, New Delhi NRCPB, New Delhi NRRI, Cuttack IIRR, Hyerabad TNAU, Coimbatore
7.	Identification of super donors and alleles for spikelet fertility and low chalkiness under thermal stress in rice	University of Delhi, Delhi IARI, New Delhi IGKV, Raipur University of Delhi, Delhi PJ TSAU, Hyderabad
8.	Epigenomics of Drought Acclimatization and Stress Memory in Rice	IARI, New Delhi
9.	Exploiting alien genetic resources for developing climate resilient wheat and understanding mechanism of heat tolerance	IIWBR, Karnal PAU, Ludhiana NRCPB, New Delhi
10.	Development of sensors for blast and blight diseases and stomatal activity measurement in rice (<i>O. sativa</i> L.)	BITS Pilani, Rajasthan IIT, Roorkee Anna University, Chromepet, Chennai
11.	Identification of QTLs for subcomponent traits of W UE through strategic utilization of whole genome sequences and accurate phenotyping in rice	UAS, Bengaluru TNAU, Tamil Nadu ICAR-NIPB, New Delhi
12.	Developing precision nutrient management protocols for rice-wheat and rice-maize systems in Indo-Gangetic Plains	ICAR-IARI, New Delhi ICAR-RCER, Patna ICAR-IIFSR, Meerut
13.	Paddy straw residues management through in-situ and exsitu microbial decomposition and mechanical interventions	ICAR-NRRI, Cuttack ICAR-IARI, New Delhi PAU, Ludhiana CCSHAU, Hisar
14.	Fine mapping and marker-assisted breeding for alternative dwarfing genes Rht14 and Rht18 to develop semi-dwarf wheat genotype suitable for conservation agriculture	MACS - ARI, Pune ICAR-IARI, New Delhi

E). Details of ongoing R&D projects supported on Rice and Wheat by Science and Engineering Research Board:

S.No.	Project Title	Institute name
1	Functional characterization of rice EG45-like domain containing protein through development of overexpression and knock-down plants to identify its salinity-responsive role in rice.	University Of Calcutta (State University (Public)) 87 /1, College Street, Kolkata Kolkata-700073 (West Bengal)
2	Understanding the molecular cross talk between light and abiotic stress in regulating the miRNA expression patterns modelled using rice plants.	International Centre For Genetic Engineering And Biotechnology (Institution under central government) Aruna Asaf Ali Marg, Jawaharlal Nehru University
3	Investigating gene regulatory networks operating downstream of OsAP2/ERF-40 during rice adventitious root development	Indian Institute Of Technology Roorkee (Institution under central government) Roorkee - Haridwar Highway, Roorkee Roorkee-247667 (Uttarakhand)
4	Genetic dissection of 13-lipoxygenases to modulate JA biosynthesis for enhanced N, P, K deficiency tolerance in rice	National Institute Of Plant Genome Research (Institution under central government) Nipgr, Aruna Asaf Ali Marg New Delhi-110067 (Delhi)
5	Investigating the roles of matrix metalloproteinase (MMP) gene family in abiotic stress adaptation by generating CRISPR-mutants through multiplex-knockout approach in rice	Indian Agricultural Research Institute Pusa (Institution under central government) Pusa, New Delhi New Delhi-110012 (Delhi)
6	Understanding the effect of aerobic adaptation loci on yield of drought tolerant rainfed shallow lowland cultivar in rice using genome editing tools	Central Rice Research Institute (Institution under central government) Bidyadharpur, Cuttack, Or Cuttack-753006 (Odisha)
7	Investigating the role and regulatory aspect of intrinsically disordered region(s) in DOF-transcription factor(s) with emphasis to rice grain quality	National Agri-food Biotechnology Institute (Institution under central government) Sector 81, Sahibzada Ajit Singh Nagar Mohali-160071 (Punjab)
8	Characterization of GABA-transaminase gene promoter for regulatory mechanism	Lucknow University, University Rd, Babujanj, Hasanganj, UTTAR

	during rice leaf senescence process	PRADESH-226007
9	Roles for rice transcription factors OsETT1, OsETT2 and OsSPT in carpel development and floret fertility	Indian Institute Of Science (Institution under central government) Cv Raman Rd, Bengaluru Bangalore Urban District-560012 (Karnataka)
10	Fungal Mimicry of Host Chemical Defense: Plant-Mediated RNAi-Based Investigation of Rice-Blast Fungus Interaction.	Indian Institute Of Technology Bombay (Institution under central government) Iit Po Powai, Mumbai Mumbai City-400076 (Maharashtra)
11	Functional characterization of TaMSL5-D gene of bread wheat	Panjab University (State University (Public)) Sector 14, Chandigarh