PERSONAL INFORMATION

1. Name : **Dr. Manish Kumar**

2. Designation : **Assistant Professor (GPB)**

3. Employer: **Sri Karan Narendra Agriculture University, Jobner**

4. Address for correspondence: **Department of Genetics and Plant Breeding, Rajasthan Agricultural Research Institute, Durgapura**

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EDUCATIONAL PROFILE

Qualifications	University/Board	Fields of specialization/ Subjects
Ph.D.	Banasas Hindu University, Varanasi	Genetics and Plant Breeding
M.Sc.	Central Agricultural University, Imphal	Genetics and Plant Breeding
B.Sc.	Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Akola	Agriculture

RESEARCH INTERESTS

My focus on the genetic improvement of grain legumes, particularly Mungbean, Urdbean, Lentil, and Field Pea (MULLaRP) with the aim of enhancing genetic gain to address food and nutritional security. I am engaged in developing high-yielding, stable and climate-resilient varieties through the integration of conventional and modern breeding approaches.

A major component of my research involves breeding for resistance and tolerance to biotic and abiotic stresses, including diseases, insect pests, drought, heat, salinity and other environmental constraints that limit crop productivity. Emphasis is placed on identifying and utilizing diverse germplasm sources and deploying efficient selection strategies to improve stress resilience in legume crops.

I have strong expertise in conventional plant breeding and heterosis breeding, focusing on parent selection, combining ability analysis and hybrid development to exploit genetic variability and hybrid vigor for yield and adaptability.

In addition, my research integrates molecular breeding tools, particularly marker-assisted selection (MAS) and association mapping to accelerate breeding progress. These approaches support precise selection for complex traits and facilitate the development of improved legume varieties suited to diverse agro-ecological environments.

SCHOLARSHIP AND AWARDS

ICAR-National Talent Scholarship during B.Sc. | Dr. PDKV, Akola

CAU-PG Scholarship during M.Sc. | CAU, Imphal

UGC- Research Scholarship during Ph.D. | BHU, Varanasi

M.Sc. Genetics and Plant Breeding

Thesis: *"Combining Ability Studies in Field Pea (Pisum sativum L. Var. arvense) for Yield and Its Attributes."*

Institution: Central Agricultural University, Lamphel, Imphal, Manipur, India | Pin: 795 004

Department: Genetics and Plant Breeding

Major Findings:

- **Gene Action Controlling Yield Traits**
  Combining ability analysis revealed that non-additive gene action predominated for most yield and yield-related traits ($\sigma^2gca/\sigma^2sca < 1$). However, days to first flowering, nodes to first flowering, seeds per pod, and 100-seed weight were governed by both additive and non-additive gene action, suggesting potential for improvement through both selection and hybridization.

- **Superior Parents and Cross Combinations**
  Based on general combining ability (GCA), Makyatmubi and Makuchabi were identified as the best parents. For specific combining ability (SCA) and overall performance, the crosses Makyatmubi × KPMR-851, Makuchabi × VL-58, and Makuchabi × Prakash showed highly significant SCA effects, high per se performance, and involvement of at least one good general combiner.

- **Exploitation of Heterosis for Yield Improvement**
  Significant heterosis for seed yield per plant was observed, ranging from 6.17–119.48% over the better parent and 42.28–192.48% over the standard check (Rachna). Thirteen crosses showed significant heterosis over both standards, and the best-performing crosses also exhibited heterosis for multiple yield components, confirming their potential for hybrid breeding and yield enhancement in field pea.

Ph.D. Genetics and Plant Breeding

Thesis: *Marker-Assisted Gene Introgression for Bacterial Leaf Blight Resistance in Rice (Oryza sativa L.)*

Institution: Banaras Hindu University, Varanasi, India

Department: Genetics and Plant Breeding

Major Findings:

- The selected rice genotypes showed substantial **genetic diversity for yield and related traits**, supporting their usefulness for achieving significant genetic gain. The **high genetic similarity (0.77)** between the recurrent parent (HUR917) and donor parent (IRBB66) facilitates rapid recovery of the recurrent parent genome with minimal genetic load. The donor IRBB66, carrying **five R genes**, is ideal for trait improvement through a **single crossing program using MABC**.
- **Markers pTA248, xa13prom, and RM122**, tightly linked to R genes **Xa21, xa13, and xa5**, exhibited high resolving power and were highly effective for **foreground selection** in F_1 and advanced backcross generations. Additionally, **70 informative STMS markers** distributed

across the rice genome (average PIC = 0.31) enabled efficient **background recovery** of the recurrent parent.

- Molecular analysis of 12 selected BC_2F_2 lines using **Graphical Genotyping Tool (GGT)** revealed **genome recovery ranging from 90.71% to 96.43%**, with lines carrying **triplet homoalleles (Xa21+ xa13+ xa5)** showing >90% genomic recovery.
- **Bioassays against eight Xoo races** confirmed the efficacy of markers in predicting phenotypic resistance, validating **marker-trait associations** and demonstrating improved **BLB resistance** in popular rice cultivars.
- The resulting **backcross-derived NILs** maintained key agronomic traits (duration, plant height, grain dimension, cooking quality, and productivity) while incorporating **broad-spectrum BLB resistance**, making them suitable for **enhancing the yield and disease resistance of HUR917** under natural disease pressure in Eastern India.
- Yield and BLB resistance traits exhibited significant effects individually and in combination, indicating **epistatic interactions**, except for days to maturity in HUR917 × IRBB66, which showed no significance.
- The **pyramided lines** developed in this study provide valuable genetic resources for **BLB resistance breeding**, offering an environmentally friendly approach to disease management and facilitating **future introgression of multiple R genes** into other elite rice cultivars.

PROJECTS

1. **MULLaRP Breeder** under ICAR-AICRP on MULLaRP funded by ICAR & State Govt. (75:25)
2. **Co-PI in PM-RKVY Project** on "Maintenance Breeding for Enhancing Seed Quality of Wheat and Barley" (2025). The project provides financial support of **₹ 64.57 lakh** for the development of infrastructure and procurement of machinery.
3. **Co-PI in PM-RKVY Project on "**Strengthening and Mechanization of University Farms to Enhance Quality Seed Production" (2025). That project provides financial support of **₹ 422.20 Lakh** to Ten constitutive colleges of our university for development of infrastructure and procurement of machinery.
4. **Nodal Officer** for the execution of establishment of **Seed Hub** and **Specialized Seed Storage Units** at ARS, Navgaon, Alwar. The project provides financial support of **₹ 249.82 lakh** for the development of infrastructure and revolving fund for seed production.

TECHNICAL EXPERIENCE

MOLECULAR AND STATISTICAL COMPETENCIES

- Wet-lab experiments:
  - ✓ DNA isolation and quantification
  - ✓ Polymerase Chain Reaction
  - ✓ Gel Electrophoresis
- Proficient in using internet resources
- Field Book- Digital Field data collection
- Software Package:
  - ✓ MS office - Excel, Word, PowerPoint
  - ✓ Biometrical- IndoStat, OPstat

PUBLICATIONS

RESEARCH ARTICLES (More Than 6 NAAS Rating)

Kumar, Manish, Ravi Pratap Singh, Debarchana Jena, Vineeta Singh, et al. 2023. "Marker-Assisted Improvement for Durable Bacterial Blight Resistance in Aromatic Rice Cultivar HUR 917 Popular in Eastern Parts of India" Plants 12, no. 6: 1363. https://doi.org/10.3390/plants12061363. (**NAAS rating – 10.10**)

Limbalkar, O.M., Vasisth, P., Singh, R. **Kumar, M.,** et al. Infusing genetic variability for productivity and drought tolerance traits from Brassica carinata into Brassica juncea genotypes. Genet Resour Crop Evol 71, 4603–4629 (2024). https://doi.org/10.1007/s 10722-024-01922-7 (**NAAS rating – 8.00**)

Limbalkar, O.M., Vasisth, P., Singh, G. **Kumar, M.,** et al. Dissection of QTLs conferring drought tolerance in B. carinata derived B. juncea introgression lines. BMC Plant Biol 23, 664 (2023). https://doi.org/10.1186/s12870-023-04614-z **(NAAS rating - 10.80)**

Singh, A., Singh, S. B., & Singh, A. K. **Kumar, M.,** et al (2023). Effect of sequential application of pre and post-emergence herbicides on dynamics of weeds associated with DSR system and rice-growth and sustained yield. Agriculture Association of Textile Chemical and Critical Reviews Journal. https://doi.org/10.58321/AATCCReview.2023.11.04.08. **(NAAS rating - 6.00)**

EDITORSHIP - ANNUAL REPORT/INSTITUTE PUBLICATIONS

1. **Booklet on** Seed Production at SKNAU: Assessing the Current Status and Outlining Future Directions
2. **Booklet on** The Scenario of Pulses in Rajasthan: Scope and Opportunities
3. **Booklet on** The Sacred Status and Cultural Impact of Barley in Hindu Heritage
4. **Booklet on** Pulses: Nutritional Value, Cultivation Practices, and Global Impact

RESEARCH EXPERINECE

- Planning, laying out, and conducting field experiments for plant breeding programs.
- Handling segregating generations and germplasm for biotic and abiotic stress resistance/tolerance to develop pre-breeding lines and enhance genetic gain.
- Support breeder seed production of released varieties to maintain genetic purity.
- Conducting statistical analysis and interpretation of molecular and field data and preparing technical reports

Research Outputs:-

- CRMS 54A (WA) (2018): Mid-early duration CMS rice line with >30% out-crossing, suitable for early- to medium-duration hybrid development.
- CRMS 55A (Kalinga-I) (2018): Mid-early duration CMS line with >30% out-crossing and seedling-stage cold tolerance, suitable for Boro ecosystem hybrids.

- Pyramided bacterial blight resistance genes (Xa21 + xa13 + xa5) into BLB-susceptible rice variety HUR-917 (PhD work).
- Pyramided fertility restorer genes (Rf3 and Rf4) into partial restorer rice varieties Gayatri and Mahalaxmi.
- Malt barley variety RD 3064 identified and released for NWPZ of India at the 64th ICAR-AICRP on Wheat & Barley (RVSKVV, Gwalior; Aug 2025).

RELEVANT COURSEWORK

Principles of Genetics | Principles of Plant Breeding | Principles of Quantitative Genetics | Principles of Cytogenetics | Breeding for Biotic and Abiotic Stress Resistance | Biotechnology for Crop Improvement | Principles of Biotechnology | Plant Tissue Culture and Genetic Transformation | Molecular Breeding | Experimental Design | Statistical Methods for Applied Sciences | Genomics in Plant Breeding| Seed Pathology | Heterosis Breeding in Crop Plants | Breeding for Quality Traits | Breeding Designer Crops | Advances in Breeding of Major Field Crops | Techniques in Molecular Biology - I | Gene Regulation and Expression | Floral Biology, Seed Development and Maturation | Molecular Cell Biology | Introduction to Bioinformatics |

EXTRA CORRICULAR ACTIVITIES AND OTHER ACHIVEMENTS

- Qualified ASRB-National Eligibility Test (NET) conducted by ASRB on behalf of I.C.A.R in the Discipline of Genetics & Plant Breeding for eligibility of Lectureship/ Assistant Professorship.
- Attended training on "**Plant Genomics-Insight and Technology for Crop Improvement**" at Punjab Agricultural University, Ludhiana.
- Attended Hands on training programme on "**Mutation Breeding for crop improvement**" sponsored by Board of Research on Nuclear Science (BRNS), Department of Atomic Energy (DAE), Government of India and organized by the Bhabha Atomic Research Centre (BARC), Mumbai.
- Participated in 21 days 5th Orientation Programme on "**Agriculture Education, Research and Extension Management**" organized by DHRM, SKNAU, Jobner.

(Manish Kumar)