Profile of the Scientist

1. **Name of the scientist** : **Dr. Sanjeev Kumar**
   Phone : 09415224064, 9305054565
   Email : Sanjeev.Kumar7@icar.gov.in / sanjeeviivr@gmail.com,
2. **Personal information**
   a) **Designation** : Principal Scientist (Agricultural Biotechnology)
   b) **Date of joining ICAR** : 05/11/1998 (as ARS Scientist at IIVR, Varanasi)
   c) **Date of joining IISR** : 13/08/2013 (as Senior Scientist)
   d) **Discipline Specialization** : Agricultural Biotechnology
   Plant tissue culture studies, transgenic development, molecular marker, genomics
3. **Training/advance exposure in the area of work**:
   - Attended Subject Matter Training Course "Fish genomic and proteomic data analysis with high throughput computing" at NBFGR, Lucknow during Nov. 19-24, 2015
   - Attended Subject Matter Training Course "Bioinformatics Approaches in Genomics, Transcriptomics and Proteomics" at NBFGR, Lucknow during Nov. 12-22, 2013
   - Attended 21 days winter school on "Plant Genetic Engineering and Molecular Breeding" at NRC on Plant Biotechnology, IARI, New Delhi during Sept. 25-Oct 15, 2003
   - Attended one week Orientation Course on "Biosafety Considerations for evaluation of Transgenic Crops" at NBPGR, New Delhi during Nov. 20-28, 2002
4. **Contribution to the scientific advancements**:

Key differentially expressed genes and SNPs involved in early sucrose accumulation in sugarcane: This study is based on a segregating population raised in sub-tropical India, where, sucrose accumulation starts at ~ 10-month crop stage. RNA-seq data of two extreme bulks from a segregating full-sib population and its parents were used to identify differential genes and single nucleotide polymorphisms (SNPs) associated with early season high sucrose accumulation. A total of 49 common significantly differential genes were identified between high- and low- sucrose parents and bulks among which chlorophyll a-b binding protein and psaK were observed as initial points of sucrose-mediated feedback regulation.

Identification of microRNAs involved in sucrose accumulation in sugarcane: Two sugarcane genotypes contrasting for sucrose content along with two extreme bulks from their F_1 population were used to identify differentially expressed miRNAs which might play a regulatory role in sucrose accumulation. A total of 161 miRNAs were identified, of them, 23 were significantly differential for contrasting sucrose content. The target genes of the identified miRNAs were predicted and some of them were validated using transcriptome library-based gene expression levels. The study revealed that miRNA might be involved in sucrose accumulation in sugarcane, not by directly targeting the sucrose metabolism genes but by targeted regulation of transcription factors.

Marker-trait associations for sucrose and yield contributing traits in sugarcane: LD-based MTAs were identified for sucrose and yield contributing traits using a panel of 108 sugarcane genotypes and 989 SSR marker loci. Significant MTAs were identified for 4 markers with cane diameter, 7 markers each with cane length and number of millable canes (NMCs), 11 with number of nodes, 6 with sucrose per cent, and 5 markers with average cane weight.

Identification of putative candidate genes for red rot resistance in sugarcane: This study utilized a panel of 119 sugarcane genotypes fingerprinted for 944 SSR alleles. Mixed linear model detected four MTAs; and EST sequences diagnostic of three could be mapped on to sorghum genome. Several genes encoding important plant defense related proteins were localized to the vicinity of these MTAs.

Contributions in pointed gourd: For the first time, an RAPD markers $OPC07_{567}$ (associated with femaleness) was identified. This marker can reliably identify the sex of the plantlets well before flowering. Owing to problems in seed germination in *T. dioica*, embryo culture was resorted to raise the only sexual progeny on record to study the inheritance of leaf and stem traits.

5. Variety development:

- Associated as a member of multidisciplinary team in the development of sugarcane varieties CoLk 11203 (*IKSHU-5*), CoLk 12207 (*IKSHU-6*), CoLk 12209 (*IKSHU-7*), CoLk 14201 (*IKSHU-10*), CoLk 14204 (*IKSHU-8*), CoLk 15201 (*IKSHU-11*), CoLk 15207 (*IKSHU-12*) and CoLk 15466 (*IKSHU-13*) identified for release and notification from CVRC.

6. Externally funded projects handled:

- DBT-Accredited Test Laboratory (ATL) for Genetic Fidelity Testing and Virus Indexing; New Phase 2021-2026; 148.5 Lakh; NCS-TCP, DBT, New Delhi (Coordinator & PI-Genetic Fidelity).
- DBT-Accredited Test Laboratory (ATL) for Genetic Fidelity Testing and Virus Indexing; 2015-2021; 125.29 Lakh; NCS-TCP, DBT, New Delhi (Coordinator & PI-Genetic Fidelity).
- Investigating sucrose accumulation through RNA-seq bulked segregant analysis in sugarcane; 2018-2021; 30.0 Lakh; DST, New Delhi, WoS-A Scheme (Mentor).
- Genomic selection-based accelerated breeding in sugarcane (*Saccharum* species complex); 2018-2021; DST-SERB, New Delhi; Rs. 49.78 Lakh (PI).
- RNA Seq for SNP mining and linkage mapping in sugarcane; 2014-2018; Rs. 50.28 Lakh; DBT, New Delhi, BioCARe Scheme (Mentor).

7. Publications [Research articles: 52; Books: 4; Reviews: 20; Total citations: 912; H-index: 17]:

Selected Research Articles:

Banerjee N, Kumar S, Alok Singh, Annadurai A, PK Singh, J Singh, RK Singh and **S. Kumar**. 2022. An early season perspective of key differentially expressed genes and single nucleotide polymorphisms involved in sucrose accumulation in sugarcane. *Tropical Plant Biology*. (**IF**. **1.5**) doi: https://doi.org/10.1007/s12042-022-09311-z.

Banerjee N, Kumar S, Singh A, Annadurai A, Thirugnanasambandam PP, **Kumar S**. 2022. Identification of microRNAs involved in sucrose accumulation in sugarcane (*Saccharum* species hybrid). *Plant Gene* 29: 100352. doi: https://doi.org/10.1016/j.plgene.2022.100352.

Chandra A, Singh D, Joshi D, Pathak AD, Singh RK and **Kumar S**. 2021. A highly contiguous reference genome assembly for *Colletotrichum falcatum* pathotype *Cf*08 causing red rot disease in sugarcane. *3 Biotech* 11: 148 (**IF**. **2.41**). doi: https://doi.org/10.1007/s13205-021-02695-x.

Singh SR, Yadav P, Singh D, SK Shukla, Tripathi MK, Lal B, Mishra A and **Kumar S**. 2021. Intercropping in sugarcane improves functional diversity, soil quality and crop productivity. *SugarTech* 23: 794-810 (**IF. 1.59**). doi: https://doi.org/10.1007/s12355-021-00955-x.

Singh SR, Yadav P, Singh D, Lal B, Singh SP, Yadav AK, Mishra A, Yadav PPS and **Kumar S**. 2020. Impact of different crop grown system on microbial diversity, soil quality and nutrient index. *Land Degradation and Development* 31(14): 3973-3991 (**IF**. **4.98**). doi: https://dox.doi.10.1002/ldr.3863.

Singh SR, Yadav P, Singh D, Tripathi MK, Lal B, Singh SP, Mishra A and **Kumar S**. 2020. Cropping systems influence microbial diversity, soil quality and crop yields in Indo-Gangetic plains of India. *European Journal of Agronomy*. 121: 126152. (**IF**. **5.12**) doi: https://doi.org/10.1016/j.eja.2020.126152.

Shingote PR, Mithra SVA, Sharma P, Devanna NB, Arora K, Holkar SK, Khan MS, Singh J, **Kumar S**, Sharma TR and Solanke AU. 2019. LTR-Retrotransposons and highly informative ISSRs in combination are potential markers for genetic fidelity testing of tissue culture-raised plants in sugarcane. *Molecular Breeding* 39(2): Article 25 (**IF. 2.59**) doi: https://doi.org/10.1007/s11032-019-0931-5.

Khan MS, **Kumar S**, Singh RK, Singh J, Duttamajumder SK and Kapur R. 2018. Characterization of leaf transcriptome, development and utilization of unigenes-derived microsatellite markers in sugarcane (*Saccharum* sp. hybrid). Physiology and Molecular Biology of Plants 24(4): 665-682 (**IF. 2.39**), doi: https://doi.org/10.1007/s12298-018-0563-y.

Siraree A, Banerjee N, **Kumar S**, Khan MS, Singh PK, Kumar S, Sharma S, Singh RK and Singh J. 2018. Agro-morphological description, genetic diversity and population structure of sugarcane varieties from sub-tropical India. *3 Biotech* 8(11):1-12 (**IF. 2.41**) doi: https://doi.org/10.1007/s13205-018-1481-y.

Siraree A, Banerjee N, **Kumar S**, Khan MS, Singh PK, Kumar S, Sharma S, Singh RK and Singh J. 2017. Identification of marker-trait associations for morphological descriptors and yield component traits in sugarcane. *Physiology and Molecular Biology of Plants* 23(1): 185-191 (**IF. 2.39**) doi: https://doi.org/10.1007/s12298-016-0403-x.

Singh RK, Banerjee N, Khan MS, Yadav S, **Kumar** S, Duttamajumder SK, Lal RJ, Patel JD, Guo H, Zhand D and Paterson AH. 2016. Identification of putative candidate genes for red rot resistance in sugarcane (*Saccharum* species hybrid) using LD-based association mapping. *Molecular Genetics and Genomics* 291: 1363-1377 (**IF. 3.29**) doi: https://doi.org/10.1007/s00438-016-1190-3.

Banerjee N, Siraree A, Yadav S, **Kumar S**, Singh J, Kumar S, Pandey DK and Singh RK. 2015. Marker-trait associations for sucrose and yield contributing traits in sugarcane (*Saccharum* spp. Hybrid). *Euphytica* 205: 185-201 (**IF. 1.89**) doi: https://doi.org/10.1007/s10681-015-1422-3.

Singh H, **Kumar S** and Singh BD. 2015. *In vitro* conservation of pointed gourd (*Trichosanthes dioica*) germplasm through slow-growth shoot cultures: Effect of flurprimidol and triiodobenzoic acid. *Scientia Horticulturae* 182: 41-46 (**IF. 3.46**) doi: https://doi.org/10.1016/j.scienta.2014.11.009.

Rai GK, Rai NP, Rathaur S, **Kumar S** and Singh M. 2013. Over-expression of rd29A::*AtDREB1A*/*CBF3* in drought stress exposed tomato plants alleviates oxidative stress by regulating key enzymatic and non-enzymatic antioxidants. *Plant Physiology and Biochemistry* 69: 90-100 (**IF. 4.27**) doi: https://doi.org/10.1016/j.plaphy.2013.05.002.

Rai NP, Rai GK, **Kumar S**, Kumari N and Singh M. 2013. Shoot and fruit borer resistant transgenic eggplant (*Solanum melongena* L.) expressing *Cry1Aa3* gene: Development and bioassay. *Crop Protection* 53: 37-45 (**IF. 2.57**) doi: https://doi.org/10.1016/j.cropro.2013.06.005.

Rai GK, Rai NP, **Kumar S**, Yadav A, Rathaur S, Singh M. 2012. Effects of explant age, germination medium, pre-culture parameters, inoculation medium, pH, washing medium and selection regime on *Agrobacterium*-mediated transformation of tomato. *In Vitro Cellular Developmental Biology-Plant* 48(5): 565-578 (**IF. 2.25**) doi: https://doi.org/10.1007/s11627-012-9442-3.

Scientific reviews

Chauhan JS, Govindaraj P, Ram B, Singh J, **Kumar S**, Singh KH, Chaudhary PR and Singh RK. 2022. Growth, varietal scenario and seed production of sugarcane in India: Status, impact and future outlook. (**IF**. **1.59**) *SugarTech* doi: https://doi.org/10.1007/s12355-022-01148-w.

Banerjee N, Khan MS, Swapna M, Singh RK and **Kumar S**. 2020. Progress and prospects of association mapping in sugarcane (*Saccharum* species hybrid), a complex polyploid crop. *SugarTech* 22(06): 939-953 (**IF. 1.59**) doi: https://doi.org/10.1007/s12355-020-00852-9.

Swapna M and **Kumar S.** 2017. MicroRNAs and their regulatory role in sugarcane. *Frontiers in Plant Science* 8: 1-7 (Article 997) (**IF. 5.75**) doi: https://doi.org/10.3389/fpls.2017.00997.

Kumar S and Singh BD. 2012. Pointed Gourd: Botany and Horticulture. *Horticultural Reviews* 39: 203-238.

Books

BD Singh and **Sanjeev Kumar**. 2007. Molecular Biology, Genetic Engineering and Biophysics. Kalyani Publications, New Delhi, p. 275 (ISBN: 978-81-272-4128-5).

BK Prasad, BD Singh and **Sanjeev Kumar**. 2011. Objective Biotechnology. Kalyani Publications, New Delhi, p. 557 (ISBN: 978-81-272-6937-1).

Dibendu Dutta, **Sanjeev Kumar**, Major Singh and SP Das. 2010. Biotechnology in Crop Improvement: Concept and Manual. Kushal Publications and Distributors, Varanasi, p. 136 (ISBN: 978-81-860-9926-3).

HP Singh, Mathura Rai, Sudhakar Pandey and **Sanjeev Kumar**. 2009. Vegetable Varieties of India. Studium Press (India) Pvt. Ltd., New Delhi, p. 325 (ISBN: 978-81-907-5776-8).

5. Other relevant activities of the scientist:

Recognitions:

- Conferred '**Elected Membership'** of National Academy of Sciences India (NASI).
- Conferred the '**Fellowship**' of Indian Society of Vegetable Science (ISVS).
- Conferred the '**Fellowship' in Crop Science** by U.P. Academy of Agriculture Science.
- Conferred **Elected Membership** of Plant Tissue Culture Association-India (PTCA-I).
- Recipient of "**Dwarika Nath Memorial Gold Medal-2008 for Best Ph.D. Thesis**" in the field of Vegetable Science awarded from Indian Society of Vegetable Science.
- Received "**SARC Gold Medal for outstanding contribution in the field of Vegetable Biotechnology**" awarded during 14-16 Sept. 2011 at *National Symposium on Advances in Biotechnology Research in Agri-horticultural Crops*, SVBPUA&T, Meerut
- Recipient of "**Best Poster Presentation Awards**" in:
  - National Symposium on Abiotic and Biotic Stress Management in Vegetable Crops, 12-14 April, 2013, IIVR, Varanasi.
  - International Conclave on Sugar Crops, 15-17 Feb., 2014, IISR, Lucknow.
  - International Congress on Post-harvest Technologies of Agriculture Produce, 10-12 Nov., 2016, Integral University, Lucknow.
  - National Symposium on Challenges, Opportunities and Innovative Approaches in Sugarcane, Dec. 21-23, 2016, UPCSR, Shahjahanpur.
  - National Symposium on Eco-friendly approaches for plant disease management: recent trends and opportunities (Dec. 29-30, 2016), IIPR, Kanpur.

Life member:

- Society for Plant Biochemistry and Biotechnology, NRCPB, New Delhi
- UP Academy of Agricultural Sciences, UPCAR, Lucknow
- Indian Society of Vegetable Science, IIVR, Varanasi
- Biotech Research Society of India, NIIST, Trivandrum

Reviewer: SugarTech, Scientia Horticulturae, Physiology and Molecular Biology of Plants, Current Science.

Other activity: DBT Nominee: Institute Biosafety Committee (IBSC), ICAR-CISh, Lucknow and ICAR-IIPR, Kanpur.