

## SCIENTIST PROFILE



1. Name & Designation : Dr. Ramani Kumar Sarkar  
Principal Scientist
2. Date of Birth : 17<sup>th</sup> February, 1955
3. Date of joining ICAR : 3<sup>rd</sup> December, 1983
4. Date of joining the present post : 3<sup>rd</sup> December, 2004
5. Qualification (highest degree) : Ph.D
6. Post Doctoral Research Experience/Training:
  - Training on ‘Rice Cultivation Technology’, Japan, 1995, 275 days.
  - Training on multiple abiotic stress tolerance especially salinity and submergence: Plant Physiological and Gene Expression aspects, IRRI, Philippines, 2008, 45 days.
7. Area of Specialization/research interest: Plant Physiology
8. Significant Contribution including products and patents (Five bullets):
  - New genetic resources tolerant to submergence, anaerobic germination, waterlogging and multiple abiotic stress tolerant rice genotypes have been identified. Ten genotypes have been registered.
  - Flood water characteristics and submergence tolerance are now understood. Oxygen level above saturation point is injurious. Alkaline pH decreased the availability of CO<sub>2</sub>: inhibited photosynthesis, which resulted greater plant mortality. Survival chances were more under lower temperature (20-25°C) than high temperature (30-35°C). Among the water-related factors turbidity was the most injurious factor followed by temperature.
  - Traits associated with submergence tolerance / protection is now known. Submergence tolerant cultivars maintained greater quantities of non-structural carbohydrate (NSC) contents before and especially after submergence. Variation in structural carbohydrate (e.g. hemicellulose, cellulose and lignin) contents in stem did not show any relationship with submergence tolerance. Minimum elongation during submergence aided in survival due to greater preservation of NSC as application of GA increased susceptibility whereas GA biosynthesis inhibitor paclobutrazol increased tolerance. Plant survival depends on maintenance of under water photosynthesis by preserving chloroplast functional and structural integrity. Efficient reactive oxygen species (ROS) scavenging during and after submergence improved survival chances and plant productivity. Chlorophyll fluorescence based fast screening technique is developed.
  - Mechanism associated with anaerobic germination is unraveled. Tolerant genotype maintains greater activities of  $\alpha$ -amylase and starch phosphorylase enzymes. Seed priming with simple tap water and 2% Jamun (*Syzygium Cumini* L.) leaf extract improved the grain yield both under anaerobic seeding and stress-free environment in Swarna and Swarna-Sub1.
  - Factors associated with greater rice yield production in wet season is understandable. Increase in grain yield due to higher rates of N application could be attributed to pre-anthesis dry matter production, better light penetration capacity (i.e. lower light extinction coefficient), efficient translocation of pre-anthesis stored NSC to developing grains, enhancement of Pn during ripening stage and greater sink size. N application at the neck-node differentiation stage significantly increased spikelet differentiation and that at the active meiosis stage significantly reduced spikelet degeneration. Seed weight of inferior spikelets in rice panicle can be improved by increasing activities of starch synthesizing enzymes through manipulation of ethylene production.

9. Awards/Honours:

- Generation Challenge Programme Travel Grant Award 2008, CIMMYT, Mexico.
- Best article award sponsored by International Rice Research Institute, Philippines for the celebration of the International Year of Rice'2004.
- CRRI-Best Worker Award
- Ph. D. thesis examiner of different Universities in India and abroad.
- Reviewer for National and International Journals
- Editor of different journals in India and abroad.

10. Publications (10 best):

- Sarkar RK** and Bhattacharjee B (2011). Rice genotypes with Sub1 QTL differ in submergence tolerance, elongation ability during submergence, and re-generation growth at re-emergence. **Rice** (DOI 10.1007/s12284-011-9065-z).
- Das KK, Panda D, **Sarkar RK**, Reddy JN and Ismail AM (2009). Submergence tolerance in relation to variable floodwater conditions in rice. **Environmental and Experimental Botany** 66: 425–434.
- Sarkar RK** and Panda D (2009). Distinction and characterisation of submergence tolerant and sensitive rice cultivars, probed by the fluorescence OJIP rise kinetics. **Functional Plant Biology** 36: 222-233.
- Panda D, Sharma SG and **Sarkar RK** (2008). Chlorophyll fluorescence parameters, CO<sub>2</sub> photosynthetic rate and regeneration capacity as a result of complete submergence and subsequent re-emergence in rice (*Oryza sativa* L.). **Aquatic Botany** 88: 127-133.
- Sarkar RK**, JN Reddy, SG Sharma and Abdelbagi M. Ismail (2006). Physiological basis of submergence tolerance in rice and implications for crop improvement. **Current Science** 91: 899-906.
- Das KK, **Sarkar RK** and Ismail AM (2005). Elongation ability and non-structural carbohydrate levels in relation to submergence tolerance in rice. **Plant Science** 168: 131-136.
- Sarkar RK**, Das S and Ravi I (2001). Changes in certain antioxidative enzymes and parameters as a result of complete submergence and subsequent re-aeration of rice cultivars differing in submergence tolerance. **Journal of Agronomy and Crop Science** 187: 69-74.
- Sarkar RK**, De RN, Reddy JN and Ramakrishnayya G (1996). Studies on submergence tolerance mechanism in relation to carbohydrate, chlorophyll and specific leaf weight in rice. **Journal of Plant Physiol** 149: 623-625.
- Sarkar RK**, Nanda BB, Dash AB and Lodh SB (1994). Grain characteristics and cooking quality of aromatic and non-aromatic long slender varieties of rice (*Oryza sativa*). **Indian Journal of Agricultural Sciences** 64: 305-309\*\*\*
- Sarkar RK**, Banerjee A and Mukherji S (1986). Acceleration of peroxidase and catalase activities in leaves of wild dicotyledonous plants as an indication of automobile exhaust pollution. **Environmental Pollution** (Series A) 42: 289-295.

\*\*\* The article helped in protecting the right of Basmati growers in India. It was quoted in 'Basmati' court case.