Curriculum vitae

Name: Dr. Periyasamy Panneerselvam
Designation: Senior Scientist
Department: Crop Production Division
Institute: ICAR-National Rice Research Institute, Cuttack
Date of Birth: 01/05/1972
Sex: Male
Email: panneerccri@rediffmail.com

Education Details:

Institution Place	Degree Awarded	Year	Field of Study
Tamil Nadu Agricultural University, Coimbatore, India.	Post-Graduation (Gold Medalist)	1997	Agricultural Microbiology
Tamil Nadu Agricultural University, Coimbatore, India.	Ph.D. (Gold Medalist)	2006	Agricultural Microbiology

Employment Details:

Institution Place	Position	From (Date)	To (date)
Coffee Board of India, Bengaluru - 560 001, Karnataka, India.	Scientist	08.01.1998	05.12.2006
ICAR- Indian Institute of Horticultural Research, Bengaluru, Karnataka 560089 India	Scientist	08.01.2007	23.09.2015
ICAR-National Rice Research Institute, Cuttack-753006, Odisha India	Senior Scientist	24.09.2015	Till date

Honors/Awards:

Reader	Description
Fellow of Confederation of Horticultural Associations of India (CHAI)	*w.e.f* May 2015
Gold medal and Prof. Dr. S. Kannaiyan and Dr. Surendar award	The best student in Ph.D (Agricultural Microbiology) for the year 2006
Best NRRI worker (Senior Scientist)	ICAR-National Rice Research Institute, Cuttack
RULA award	International journal for Research under Literal Access (IJRULA)
Dr. B. Vasantharaj David Award	Applied Zoologists Research Association (AZRA), Bhubaneswar, Odisha
Best poster award	3rdARRW Int. Symposium, NRRI
Best poster award	XXI Biennial National Symposium of Indian Society of Agronomy, MPUAT, Udaipur, Rajasthan
Outstanding Scientist Award	IJTA 3rdInternational conference : International conference on Agriculture, Horticulture and plant scienceNew Delhi
Received "Outstanding Scientist Award 2016 in IJTA	3rd International Conference on Agriculture, Horticulture and Plant Science held at New Delhi, India from 25-26th June 2016 organized by IJTA and Serials Publication Pvt Ltd New Delhi , India.
I have been invited to present research paper entitled" Induction of defense Mechanisms in Coffee against Coffee Leaf Rust caused by Hemileia vastatrix by native Rhizobacterial isolates at the 18th Annual Congress"	Postgraduate Institute of Agriculture, University of Peradenia, Sri Lanka
In competitive mode, I have been sponsored overseas short term training on Bio-remediation of heavy metals	Under Prof. Nanthi S. Bolan, Chair in Environmental Sciences (CFRA), University of South Australia, from 21th February to 19th May 2010 by HRD program of NAIP under Component – I of Learning and Capacity Building

	(L&CB).
Received outstanding certificate in recognition of my research work on microbial remediation of heavy metal contamination in soil	At Centre for Environmental Risk Assessment and Remediation (CERAR), University of South Australia.
ICAR-JRF fellowship	In Agricultural Microbiology for post graduation.
Passed NET Examination	conducted by Agricultural Scientists Recruitment Board (1997
The U has recognized me as one of the Ph.D examiners and evaluated Ph.D thesis entitled "Influence of Biosolids based Co- Composts in the (im)mobilization and bioavailability of heavy metals".	University of South Australia
Gandhigram Rural University, Tamilnadu has recognized me as PhD examiner and evaluated thesis entitled "Studies on Native Microbial flora and influence of Bio-inoculants in Jatropha curcas"	Gandhigram Rural University, Tamilnadu
Anna University, Chennai, Tamilnadu has recognized me as PhD examiner and evaluated thesis entitled "Rhizosphere Engineering to enhance Carbon sequestration potential in degraded Forest Chennai, India.	Anna University, Chennai
Received three best Research paper awards	From National conference/ sympossium.
Reviewed the many research papers in the following journals viz., Journal of Horticulture Science, African Journal of Agricultural Research, Biotechnology, 3 Biotech, Journal of Cotton Research, Proceedings of the National Academy of Sciences, Indian section B: Biological Sciences, Karnataka Journal of Agriculural Sciences, Oryza, Waste management	Reviewed the many research papers
Recognized as PG teacher in Microbiology from Five following Universities viz., IARI, New Delhi/ UAS, Bengaluru/ UHS, Bagalkot Karnataka/ Gandhigram Rural university, Tamilnadu/ JNTU, Hyderabad	Recognized as PG teacher in Microbiology

Publications:

Sl. No.	Reader	No.
1.	**Books**	3
2.	**Technical/ popular Articles**	12
3.	**Technical / Extension bulletin, Training Manual**	3
4.	**Book Chapter(s)**	11
5.	**Patents Filed**	1
6.	**Technologies developed**	16
7.	**Research and review publication**	65
8.	**Concepts**	8
9.	**Process/ methodology development**	6
10.	**Professional Experience and Training**	12
11.	**E-Publication**	>150

Books:

1. **P. Panneerselvam** and Thangaraju, M.2014. Bio-Fertilizers Consortium for GrowthPromotion in Coffee, ISBN 13: 9783639702859, Scholars' Press, Waldshut-Tiengen, Germany. p.300.
2. S. Mohandas and **P.Panneerselvam**, 2015, ArbuscularMycorrhiza in Fruit Crop Production. Astral International (P) Ltd., New Delhi.
3. Debasis Mitra, Divya Jain, **P. Panneerselvam,** A. N. Ganeshamurthy, Ei Mon Myo, RittickMondal, AnsumanSenapati. 2019. Microbial Resources for Sustainable Agriculture. Lambert Academic Publishing. ISBN: 978-613-9-83608-6. p. 1-119.

Some of the recent Technical/ popular Articles

1. **Panneerselvam P.,** U. Kumar, S. Saha, T. Adak and S. Munda. 2016. Effect of Bis-pyribac sodium on ArbuscularMycorrhizal fungal association in rice. NRRI, News letter, Vol.37. No.1 Jan-March. p18.
2. **Panneerselvam P**., U. Kumar, Snigdhasahu and S.D. Mohapatra.2016. Entomopathogenic bacteria isolated from pink stem borer (*Sesamiainferens*). NRRI, News letter, Vol.37. No.2. April -June. p15.

3. Upendra Kumar and **P.Panneerselvam**. 2016. Comparative Analysis of functional microbial community in paddy soil in NRRI, Sundarban and Bhitarkanika. NRRI, News letter, Vol.37. No.3. July-September. p13.
4. Upendra Kumar and **P. Panneerselvam**. 2016. Characterization of plant-growth promoting bacteria associated with different species of *Azolla* NRRI, News letter, Vol.37. No.4. Oct-Dec. p16.
5. **Panneerselvam P**, Kumar U, Anandan A, Parameswaran C, Nayak AK. 2017. Will specific group of AM fungi prefer low phosphorous tolerant rice cultivars? NRRI News letter. Vol.38(1): Jan –March, p11.
6. **Panneerselvam P**, Kumar U, AnandanA ,Selvakumar G, Nayak AK 2017. Arka Microbial Consortium and ArkaActino Plus for sustainable rice production. NRRI, News Letter. Vol. 38(3), July-Sep, p15.
7. Kumar U, **Panneerselvam, P** 2017. Development of simple combo- kit for rapid screening of plant growth promoting bacteria. NRRI News letter. 38(4), Oct-Dec p.21.
8. Kumar U, **Panneerselvam P.** 2017. Standardized q-PCR-based methodology to quantify nprA gene from agricultural soils. NRRI News letter. 38(4), Oct-Dec p.21.
9. Kumar U, **Panneerselvam, P**. and Nayak.A.K. 2018. Endophytic nitrogen fixing bacterial inoculants for rice crop. NRRI News letter. 39(1), Jan-March. p.15.
10. Kumar U, **Panneerselvam, P** and Nayak.A.K. 2018. Rhizospheric nitrogen fixing bacterial inoculants for rice crop. NRRI News letter. 39(1), Jan-March. p.15.
11. Kumar U, **Panneerselvam, P** and Nayak.A.K. 2018. Azollasporocarp formulation for sustainable rice production. NRRI News letter. 39(1), Jan-March. p.16
12. Kumar U, **Panneerselvam, P** and Nayak.A.K. 2018. Standardization of q PCR based functional genes related to nitrogen transformation . NRRI News letter. 39(2), Jan-March. p.14.

Technical / Extension bulletin, Training Manual

1. Anandan, A, SK.Pradhan, SD. Mohapatra, SanjoySaha, **P.Panneerselvam** and ON. Singh. 2016. High yielding and water saving NRRI aerobic rice varieties. NRRI Technology Bulletin – 121. ICAR-National Rice Research Institute, April-2016.
2. Anandan, A, SK.Das, S.K. Pradhan, SD, SSC. Pattanaik, L. Behra, J. Meher, B.B. Marndi, **P.Panneerselvam**, S. Lenka, K. Chattopadhyay, ON. Singh. T. Mohapatra 2016. NRRI released different rice varieties suited for different environments. NRRI

Technology Bulletin – 124. ICAR-National Rice Research Institute, September-2016 (Tamil version).

3. **Panneerselvam P**, Kumar U, Chourasia M, Nayak AK. 2017. Use of biofertilizer for soil health management. In Soil health and its management (Sarangi et al. eds). Technical Bulletin No. 10. KrishiVigyan Kendra Cuttack, ICAR-National Rice Research Institute, Cuttack, pp: 16-18.

Book Chapter(s):

1. **P. Panneerselvam**, A.N. Ganeshamurthy, B.S. Prabhakar, S.S. Hebbar and P.R.Ramesh.2010.Changes in soil quality in vegetable based cropping system under organic practices.Westvillepublishing house (Eds. H.P. Singh and G.V. Thomas). 252-257.
2. Selvakumar, G., **P. Panneerselvam** and A.N. Ganeshamurthy. 2013. Legume root noduleAssociated bacteria. In: Plant Microbe symbiosis- Fundamentals and Advances (Ed: AroraNaveen Kumar) ISBN: 978-81-322-1286-7, Springer, 215-232.
3. Selvakumar, G. **P. Panneerselvam** and A.N.Ganeshamurthy. 2011. Microbial mediatedalleviation of abiotic stress in crops. ISBN: 978-3-642-23464-4, Bacteria in Agrobiology:Stress Management (Ed. D.K. Maheshwari,) Springer, Germany, 205-224.
4. Selvakumar, G. **P. Panneerselvam**, G.H. Bindu and A.N.Ganeshamurthy. Pseudomonads: Plantgrowth promotion and Beyond. ISBN: 978-81-322-2067-1. Springer India, 193-208.
5. **P. Panneerselvam** and A.N. Ganeshmurthy. 2014. Biofertilizers for betelvine. 2014. In:Souvenir – National Meet on Betelvine – Farmers, Traders and Research interface, IIHRBengaluru, IICAR-IIHR, Bengaluru. P 8-11.
6. **Panneerselvam, P**. and B. Saritha. 2013. Response of Horticultural rootstocks to Arbuscularmycorrhizal fungi. In: ICAR Sponsered Short course on Rootstocs in Resilient horticultureProduction System, ICAR-IIHR, Bengaluru. 162-176.
7. Ganeshamurthy, A.N., **Panneerselvam, P**. 2013. Soil health Management and microbialintervention in papaya production. In: National Papaya consultations meet, ICAR-IIHR,Bengaluru. 83-93.
8. **P. Panneerselvam**, G. Selvakumar, B. Saritha and A.N. Ganeshamurthy.2015. Plant GrowthPromotingRhizobacteria (PGPR) As A Tool to Combat Plant Pathogenic Bacteria. CRC Press,USA.ISBN: 978-1-4822-4053-5.

9. **Panneerselvam, P**., Selvakumar, G. and Ganeshmurthy, A.N. (2016). SabjiyonKeTikauUtpadanKeliyeArkaSukshmanaviyaMishran (Hindi) translated by Anil Kumar Nair andJagadeesan A.K. (Eds), ICAR-IIHR, Bengaluru.
10. **P. Panneerselvam**, Asish K. Binodh, , T. Sugitha, Upendra Kumar and A. Anandan.2016.Microbial association in brown rice and their influence on human health. In: Brown Rice ,Eds(A. Manickavasagan, SK. Chandini and N. Venkatachalam) Springer Publication (In press).
11. Upendra Kumar, **P. Panneerselvam**, Vadakattu VSR Gupta, M Manjunath, PriyankaPriyadarshinee, ArchanaSahoo, SoumyaRanjita Dash, SangitaSahoo, K Annapurna. 2017.Diversity of sulfur oxidizing and reducing microbes in diverse ecosystems. In Advances in soilmicrobiology: Recent trends and future prospects (Adhya et al.), Vol I, Springer Publication

Patents Filed:

1. Method for Mass Production of Soilless Arbuscular Mycorrhizal Fungal Inoculum

Technologies developed:

1. Arka Microbial consortium **(India Science, Technology and Innovation)**
2. Method of mass production of soil-less arbuscular mycorrhizal fungal inoculums **(India Science, Technology and Innovation)**
3. Arka Fermented cocopeat
4. Protocols for Seed Pelleting of onion
5. Arka Actino Plus
6. Endophytic Nitrogen Fixing bacteria for rice production
7. Biofertilizers consortium for nutrient management
8. Microbial consortium for plant diseases management
9. *Skermanella* : A novel entomopathogenic bacteria for controlling rice leaf folder
10. Microbial consortium for pest and disease management
11. *Azolla*–sporocarp formulation for sustainable rice production
12. Development of simple combo- kit for rapid screening of plant growth promoting bacteria
13. Microbial consortium for paddy straw decomposition
14. *Azolla pinnata* : Good Source of Green manure or Biofertilizer for rice cultivation
15. Ascorbic acid formulation for improving diazotrophic efficacy Nitrogen Fixer

16. Method of mass production of soilless arbuscular mycorrhizal fungal inoculums

Concepts:

1. Phosphorous tolerant rice varieties and their unique AM fungal association
2. Nitrogen fixing bacterial association in Azolla
3. Elevated CO_2 alters mycorrhizal association in rice soil
4. AM fungal consortium works better in wetland rice cultivation
5. Enhancing diazotrophic efficacy Nitrogen Fixer through application of Ascorbic acid
6. Acceleration of Paddy straw decomposition through supply of air through perforated pipe
7. Azolla pinnata : A good source of green manure
8. Mycorrhized rice seedling production

Process/ Methodology Development:

1. Standardized qPCR-based methodology to quantify nprA gene from agricultural soils and this gene is play important role in nitrogen mineralization in soil.
2. Standardized qPCR-based methodology to assess the functional gene related to nitrogen transformation (nifH, amoA, nirK ans nosZ) i.e. nitrogenase, ammonium monaoxigenase, nitrie and nitrox oxide reductase in soil.
3. As one of the co-investigators, standardized 2-D gel electrophoresis protocol to study seed proteome and this work has been published in Oryza journal.
4. Standardized the suitability of AML1/AML2 primer pair for analyzing AMF diversity using next- generation sequencing technique i.e. IlluminaMiSeq® platform.
5. Methodology for soil based azolla sporocorp production has been standardized
6. Simple laboratory screening tool i.e. Combo kit methodology has been standardized for quick screening of PGPR bacteria

Significant contributions:

1. Developed ***Arka Microbial Consortium*** (combination of N fixer, P solubilizer and growth promoter) for horticultural and plantation crops, ***Arka Actino Plus*** (*Streptomyces* based product for nutrient and disease management of horticultural crops), ***Arka Fermented Cocopeat*** (prepared from coir waste by using fungal and bacterial consortium) and ***Decomposers (Fungal consortium)***– for horticultural seedlings production and decomposition crop residues These technology has been licensed /

commercialized to **thirty *private companies*. 14 companies and generated 34.16 Lakhs as revenue (as License fee) to our council (ICAR) during the period from 24.09.2015 to 24.09.2018**

2. Developed ***Soilless Arbuscular Mycorrhizal fungi mass production*** by using cocopeat as substrate (***patent has been granted – patent number 342299)*** and this has been released as technologies at institute level (IIHR, Bangalore)
3. Developed ***Endophytic Nitrogen fixing inoculants*** for rice cultivation and **decomposing microbial consortium** for ex-situ decomposition of rice straw
4. Developed AM fungal and bio-fertilizers package for fruit crops production
5. Developed following two technologies *viz*., Bio-fertilizers consortium for nutrient management, and Microbial consortium for pest and disease management for Sikkim organic agricultural production developed by us under DBT project.

Projects Handled: As PI and CO-PIs handled 17 projects including 06 external funding projects

Students Guided : 15 students, 01 PhD (Main Guide) , 01 PhD (Co-Guide)
10 PG students (Guide), 03 PG students (Co-Guide)

Publication Details: (2005 – 2020)

S. no.	Title of Paper	Author	Reference of journal	Year
1.	Influence of elevated CO_2 on arbuscular mycorrhizal fungal community elucidated using Illumina MiSeq platform in sub-humid tropical paddy soil	**Panneerselvam, P**., Kumar, U., Senapati, A., Parameswaran, C., Anandan, A., Kumar, A., Jahan, A., Padhy, S.R. and Nayak, A.K.	Applied Soil Ecology 145, 103344	2020
2.	Understanding the Plant-microbe Interactions in CRISPR/Cas9 Era: Indeed a Sprinting Start in Marathon	S.R. Prabhukarthikeyan, C. Parameswaran*, U. Keerthana, Basavaraj Teli, Prasanth Tej Kumar Jagannadham, B. Cayalvizhi, **P. Panneerselvam**, Ansuman Senapati, K.	Current Genomics	2020

		Nagendran, Shweta Kumari, Manoj Kumar Yadav, S. Aravindan, S. Sanghamitra		
3.	Current scenario and future prospects of plant growth-promoting rhizobacteria: an economic valuable resource for the agriculture revival under stressful conditions	Khoshru, B., Mitra, D., Khoshmanzar, E., Myo, E.M., Uniyal, N., Mahakur, B., Mohapatra, P.K.D., **Panneerselvam, P**., Boutaj, H., Alizadeh, M. and Cely, M.V.T.,	Journal of Plant Nutrition 1-31	2020
4.	Metal (loid) s (As, Hg, Se, Pb and Cd) in paddy soil: Bioavailability and potential risk to human health.	Khanam, R., Kumar, A., Nayak, A.K., Shahid, M., Tripathi, R., Vijayakumar, S., Bhaduri, D., Kumar, U., Mohanty, S., **Panneerselvam, P.** and Chatterjee, D.	Science of the Total Environment 699, 134330	2020
5.	Phosphate-Solubilizing Microbes and Biocontrol Agent for Plant Nutrition and Protection: Current Perspective.	Mitra, D., Anđelković, S., Panneerselvam, P., Senapati, A., Vasić, T., Ganeshamurthy, A.N., Chauhan, M., Uniyal, N., Mahakur, B. and Radha, T.K.	Communications in Soil Science and Plant Analysis51(5), pp.645-657.	2020
6.	Ascorbic acid formulation for survivability and diazotrophic efficacy of Azotobacter chroococcum Avi2 (MCC 3432) under hydrogen peroxide stress and its role in plant-growth promotion in rice (Oryza sativa L.)	Upendra Kumar, Megha Kaviraj, **P Panneerselvam,** Himani Priya, Koushik Chakraborty, P Swain, SN Chatterjee, SG Sharma, PK Nayak, AK Nayak	Plant Physiology and Biochemistry 139: 419-427	2019
7.	Understanding interaction effect of Journal of Basic Microbiology arbuscular mycorrhizal fungi in rice under elevated carbon dioxide	**Panneerselvam, P.,** Sahoo, S., Senapati, A., Kumar, U., Mitra, D., Parameswaran, C.,	Journal of Basic Microbiology59(12), pp.1217-1228	2019

	conditions.,.	Anandan, A., Kumar, A., Jahan, A. and Nayak, A.K.,		
8.	Bio-protection of brown spot disease of rice and insight into the molecular basis of interaction between Oryza sativa, Bipolaris oryzae and Bacillus amyloliquefaciens.	Prabhukarthikeyan, S. R., Yadav, M. K., Anandan, A., Aravindan, S., Keerthana, U., Raghu, S., ... & Rath, P. C.	Biological Control, 137, 104018.	2019
9.	Cyanobiont diversity in six *Azolla* spp. and relation to *Azolla*-nutrient profiling.	Kumar, U., Nayak, A. K., Panneerselvam, P., Kumar, A., Mohanty, S., Shahid, M., ... & Dash, P. K.	Planta, 249(5), 1435-1447.	2019
10.	Effects of water deficit stress on agronomic and physiological responses of rice and greenhouse gas emission from rice soil under elevated atmospheric CO2.	Kumar, A., Nayak, A.K., Das, B.S., Panigrahi, N., Dasgupta, P., Mohanty, S., Kumar, U., **Panneerselvam, P.** and Pathak, H.,	Science of the Total Environment, 650, pp.2032-2050.	2019
11.	Web-based tool for calculating field-specific nutrient management for rice in India. Nutrient Cycling in Agroecosystems,	Sharma, S., **Panneerselvam, P.,** Castillo, R., Manohar, S., Raj, R., Ravi, V. and Buresh, R.J.,	113(1), pp.21-33.	2019.
12.	Monsoon variability trends and strategies to get through its vagaries in rice-based systems in eastern India.	**Panneerselvam, P.** and Sudhanshu, S.,	CAB Reviews, 14(003), pp.1-12.	2019.
13.	Structural diversity and efficacy of culturable cellulose decomposing bacteria isolated from rice–pulse resource conservation practices	**P**radeep Kumar Dash, Pratap Bhattacharyya, Mohammad Shahid, Pritesh Sunder Roy, Soumya Ranjan Padhy, Chinmaya Kumar Swain, Upendra Kumar, Anjani Kumar, Priyanka Gautam, Banawari Lal, **Periyasamy**	Journal of basic microbiology, 59(10), 963-978.	2019

		Panneerselvam, Amaresh Kumar Nayak		
14.	Antagonistic and plant-growth promoting novel Bacillus species from long-term organic farming soils from Sikkim, India	**Panneerselvam, P.,** Senapati, A., Kumar, U., Sharma, L., Lepcha, P., Prabhukarthikeyan, S.R., Jahan, A., Parameshwaran, C., Govindharaj, G.P.P., Lenka, S. and Nayak, P.K.,	3 Biotech	2019.
15.	Larvicidal potential of *Skermanella* sp. against rice leaf folder (*Cnaphalocrosismedinalis*Guenee) and pink stem borer (*Sesamiainferens* Walker)	**Panneerselvam P.**, Kumar U, Sahu S, Mohapatra SD, Dangar TK, Parameswaran C, Jahan A, Senapati A, Govindharaj GP.	Journal of invertebrate pathology, 157:74-79	2018
16.	Influence of AM fungi and its associated bacteria on growth promotion and nutrient acquisition in grafted sapota seedling production	**Panneerselvam, P** and B. Saritha.	Journal of Applied and Natural Science 9 (1): 621-625.	2017
17.	Understanding the AM fungal association in flooded rice under elevated CO_2 condition	Sowarnalisha S, **Panneerselvam P**, Tapas C, Anjani K, Kumar U, Afrin J, Ansuman S, Anandan A.	Oryza, 54(3):290-7.	2017
18.	Effects of water deficit stress on agronomic and physiological responses of rice and greenhouse gas emission from rice soil under elevated atmospheric CO_2.	Kumar, A., Nayak, A.K., Das, B.S., Panigrahi, N., Dasgupta, P., Mohanty, S., Kumar, U., **Panneerselvam, P.** and Pathak, H.	Science of the Total Environment.	2018
19.	Arbuscularmycorrhizal fungi (AMF) for sustainable rice production.	**Panneerselvam, P.,** Kumar, U., Sugitha, T.C.K.,Parameswaran, C., Sahoo, S., Binodh,	In Advances in Soil Microbiology: Recent Trends and Future Prospects (pp.	2017

		A.K., Jahan, A. and Anandan, A.	99-126). Springer, Singapore.	
20.	Antagonistic potential of Mycorrhiza Associated *Pseudomonas putida* against soil borne Fungal Pathogens.	Saritha B, **Panneerselvam P**, Ganeshamurthy AN.	Plant Archives. 15(2):763-8.	2015
21.	Morpho-physiological responses of grape rootstock 'Dogridge'to arbuscularmycorrhizal fungi inoculation under salinity stress.	Upreti, K.K., Bhatt, R.M.,**Panneerselvam, P.** and Varalakshmi, L.R.	International journal of fruit science, 16(2), pp.191-209.	2016.
22.	Studies on host preference of *Glomus*sp and their synergistic effect on sapota (*Manilkaraachras* (mill) Forsberg) seedlings growth.	Saritha, B., **Panneerselvam, P.,**Mohandas, S., Sulladmath, V.V. and Ravindrababu, P.,	Plant Arch, 14(2), pp.701-706.	2014.
23.	Effect of mycorrhiza-associated bacteria on enhancing colonization and sporulation of *Glomusmosseae* and growth promotion in sapota (*Manilkaraachras* (Mill) Forsberg) seedlings	**Panneerselvam, P**., Saritha, B., Mohandas, S., Upreti, K.K., Poovarasan, S., Sulladmath, V.V. and Venugopalan, R.	Biological agriculture &horticulture, 29(2), pp.118-131	2013
24.	Mycorrhizae colonizing actinomycetes promote plant growth and control bacterial blight disease of pomegranate (*Punicagranatum* L. cv Bhagwa).	Poovarasan, S., Mohandas, S., **Paneerselvam, P**., Saritha, B. and Ajay, K.M.	Crop protection, 53, pp.175-181.	2013
25.	Guava (*Psidiumguajava* L.) rhizosphere*Glomusmosseae* spores harbor actinomycetes with growth promoting and antifungal attributes.	Mohandas, S., Poovarasan, S., **Panneerselvam, P**., Saritha, B., Upreti, K.K., Kamal, R. and Sita, T.	Scientiahorticulturae, 150, pp.371-376.	2013
26.	Glomus mosseae associated bacteria and their influence on stimulation of mycorrhizal colonization, sporulation, and growth promotion in guava (Psidium guajava L.) seedlings.	Panneerselvam, P., Mohandas, S., Saritha, B., Upreti, K.K., Poovarasan, Monnappa, A. and Sulladmath, V.V.,	Biological Agriculture & Horticulture, 28(4), pp.267-279.	2012.
27.	Impact of delay in processing on mold development, ochratoxin-A and cup quality in Arabica and	Velmourougane, K., Bhat, R., Gopinandhan, T.N.	World Journal of Microbiology and Biotechnology,	2011.

	Robusta coffee.	and Panneerselvam, P.,	27(8), pp.1809-1816.	
28.	Management of Aspergillus ochraceus and Ochratoxin-A contamination in coffee during on-farm processing through commercial yeast inoculation.	Velmourougane, K., Bhat, R., Gopinandhan, T.N. and Panneerselvam, P.,	Biological Control, 57(3), pp.215-221.	2011.
29.	Role of organic amendments on enhanced bioremediation of heavy metal (loid) contaminated soils.	Park, J.H., Lamb, D., Paneerselvam, P., Choppala, G., Bolan, N. and Chung, J.W.,	Journal of hazardous materials, 185(2-3), pp.549-574.	2011.
30.	Uses and management of poultry litter.	Bolan, N.S., Szogi, A.A., Chuasavathi, T., Seshadri, B., Rothrock Jr, M.J. and Panneerselvam, P.,	World's Poultry Science Journal, 66(4), pp.673-698.	2010.
31.	Microbial consortium and its effect on controlling coffee root-lesion nematode (Pratylenchus coffeae) under nursery conditions.	Panneerselvam, P., Thangaraju, M. and Senthilkumar, M.,	Journal of Biological Control, 22(2), pp.425-432.	2008.
32.	Occurrence of ochratoxin-A (OT-A) in green and commercial coffee samples.	Velmourougane, K., Panneerselvam, P., Keshamma, E. and Raghuramulu, Y.,	J Food Sci Technol, 44(3), pp.247-249.	2007.
33.	Induction of defense mechanisms in coffee (*Coffea arabica* L.) against coffee leaf rust caused by Hemileia vastatrix by native rhizobacterial isolates.	Panneerselvam, P. and Thangaraju, M.	Postgraduate Institute of Agriculture, University of Peradeniya: Peradeniya,	2006.
34.	Effect of nutrient levels and herbicides on weeds and sugarcane.	Manuel, R.I. and Panneerselvam, P.,	Indian Journal of Weed Science, 37(1and2), pp.114-116.	2005.

Project(s) submitted/being pursued/carried out by Investigator:

S. no.	Title of Project	Funding Agency	From Date - To Date	Current Status of Project (Role)	Approved Cost
1.	**Paddy straw residues management through in-situ microbial decomposition with mechanical interventions**	ICAR-NASF	2020-2023	On Going (Principal Investigator)	235.66 lakhs
2.	**Developing microbial consortium for horticultural crops in rice based cropping system to promote growth, nutrient uptake and diseases management in organic farming in Sikkim**	DBT Twining mode project	2016-2019	Completed (Principal Investigator)	DBT sponsored project Rs.59.2 lakhs (22.38 Lakhs for NRRI and 36.82 lakhs for Sikkim University)
3.	**Incentivizing Research in Agriculture: Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals"**	ICAR	2017	On-going (Co-Principal Investigator)	
4.	**Setting up of model bio-fertilizer production unit for supply of quality bio-inoculants for rice and rice-based cropping system in Odisha**	RKVY	2018	On-going (Co-Principal Investigator)	Rs. 284.36 lakhs
5.	**Enhancing resilience of rice based production system to climate change**	ICAR	2018	On-going (Associate)	Rs. 239.87 lakhs

Professional Experience and Training relevant to the Project:

1. As one of the organizing committee members from Crop Production Division, organized and participated in the Akshsaya Tritiya Celebration and farmer fair Exhibitions, at NRRI, Cuttack
2. Organized training cum field demonstration on Mode of delivery of microbial consortium and enrichment of microbial inoculants with compost / organic amendments for sustainable agricultural production at Namin Village, East Sikkim. Twenty-six farmers were benefited.
3. Organized training cum demonstration on Mode of delivery of microbial consortium and enrichment of microbial inoculants with compost / organic amendments for sustainable agricultural production on 27th October 2017 at East Sikkim. Thirty officers including, Deputy Directors, Agricultural/ Horticultural officers were benefitted.
4. Served as Laboratory officer for maintaining/ smooth running/ renovations of Labs at Crop Production Division, NRRI, Cuttack from the year 2016-2018.
5. Served as Co-coordinator for preparation of RAC/ QRT reports and presentations at Division level from the year 2016-18.
6. Served as In-Charge for maintenance Microbiology Glass house, ICAR-NRRI, Cuttack from the year 2016-2018
7. Organized four days training on Modern technique of Microbiology and Biotechnology and exposure visit to IFFCO, Paradeep to 13 students from University of Burdwan, West Bengal from 10.05.2017 to 13.05.2017 at ICAR-NRRI Cuttack
8. Served as examination officers for conducting common written examination for the post of Technician (T1) on 04.09.2016
9. Served as verifying officers to conduct physical verification of assets and stores including library books of different Divisions/ sections/ units/ KVK for the year 2016-17
10. Served as selection committee chairman for selection of Senior Research Fellow post under External funding DBT project
11. Served as verifying officers to conduct physical verification of assets and stores including library books of different Divisions/ sections/ units/ KVK for the year 2017-18
12. Served as one of the Judges in the essay competition programme organized in the connection with 72nd ICAR-NRRI foundation day and Dhan Diwas on 13.04.2018 at NRRI, Cuttack.

Highlight Your Significant Contributions:

Bioprospecting and use of microbial resources for soil, pest and residue management

Studies on insecticidal properties of entomopathogenic bacteria against rice leaf folder/ stem borer

Skermanella sp. isolated from diseased *S. inferens* larvae was found to have stronger larvicidal activity against *S. inferens* and *C. medinalis* than *B.thuringiensis* (TB161), which was isolated from the rice agroecosystem, under *in vitro* conditions. *Skermanella* sp. was the first time reported as entomopathogenic bacterium from rice pink stem borer larvae as well as recorded its larvicidal activity against both rice leaf folder and stem borer. This information has been published ***Journal of Invertebrate Pathology***.

Entomopathogenic bacteria against rice leaf folder/ stem borer

Screening of efficient rice straw degrading microbes

Out of 59 lignocellulolytic microbial isolates, the following efficient isolates *viz*., *Aspergillus* sp, *Trichoderma*, *Streptomyces* sp and *Bacillus* sp were selected based on rice straw decomposing efficiency and compatibility test. Application of combination of these isolates at the rate of 4.0 % inoculum along with 0.5 % urea found drastically bring down CN ratio (19:1 to 22:1) in paddy straw under small scale (30 kg straw per /pit) compared to inoculated control (CN ratio 37:1, after 40 days of inoculation.

efficient rice straw degrading microbes

Harnessing microbial resources for alleviating abiotic and biotic stresses for improving soil health (Co-Principal Investigator)

Evaluation of *Skermanella* sp and *B. thuringiensis* against rice leaf folder under filed condition

Field evaluation of liquid formulation of *Skermanella* sp *and B. thuringiensis* (three strains BT1, BT2 and BT3) against rice leaf folder under field condition in Lalat rice variety during kharif season showed *Skermanella* sp and BT3 application significantly reduced leaf folder incidence (5.2 - 6.4 %) compared to other ***B. thuringiensis*** (BT1 and BT2). There was 4.2 and 13.2 % leaf folder incidence were recorded in chemical spray and un-inoculated control, respectively.

Development and evaluation NRRI microbial consortium for *ex-situ* decomposition of paddy straw

NRRI decomposing microbial consortium was developed using efficient lignocellulolytic microbes comprising *Aspergillus* sp, *Trichoderma*, *Streptomyces* sp and *Bacillus* sp and its decomposing potential of rice straw was evaluated under *ex-situ* condition. Application of NRRI consortium (@ 2% inoculum) along with Cowdung (1%) and Urea (0.5%) either with pipe (for aeration) or without pipe found efficient, which decomposed paddy straw within 50 days without turning under pilot scale evaluation in open condition.

Azolla–sporocarp formulation for sustainable rice production (Co-Principal Investigator)

An attempt was made to reduce the initial inoculums load by developing sporocarp-based formulation of *Azolla*. After extensive screening, *A. pinnata* (CRRI-1) has been identified as superior strain for soil-based sporocarp production and it contains 50 spores per 10 gm of soil. This novel sporocarp-based formulation may considerably reduce the quantity of primary inoculums for wet land rice production.

Azolla–sporocarp formulation

Enhancing nutrient use efficiency and productivity in rice based system

Evaluation of Microbial Consortium for enhancement of rice yield under low land and aerobic condition

Based on three seasons field experiment, application of microbial consortium (Arka Microbial Consortium / Arka Actino Plus) (@ 20 kg ha^{-1}) along with 75% N, 100% P,K or 75% P, 100% N,K under low land rice cultivation recorded yield at par with 100 % recommended dose of fertilizers, whereas under aerobic condition, the same treatment increased rice yield by 6-11% in addition to saves 25% P or N.

Evaluation of MC under low land and aerobic condition

Studies on AMF interaction in rice plants

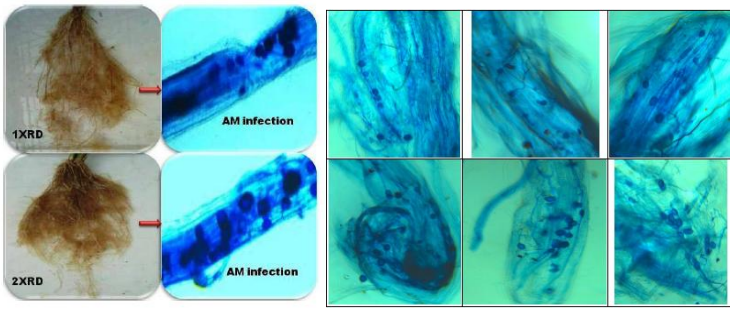
The analysis of AMF diversity through Illumina-MiSeq® sequencing technique in flooded paddy soils exposed to eight years eCO_2 drastically reduces Glomerales but encouraged the population belonging to order Diversisporales. This study also finds the suitability of AML1/AML2 primer pair for analyzing AMF diversity using next- generation sequencing technique, this information has been accepted in ***Applied Soil Ecology journal***. Based on evaluation and screening, the following AMF isolates *viz*. *Funneliformis, Rhizophagus, Claroideoglomus* and *Glomus spp* were selected for wetland cultivation of paddy.

We have proved that the external application of AMF works better at recommended level of fertilizers in flooded rice cultivation at ambient as well as elevated CO_2 conditions (***published in Oryza journal***). Among different methods of AMF application, transplanting of mycorrhized seedlings is better in enhancing mycorrhizal colonization and plant phosphorous uptake as compared to the regular method of basal application of AMF.

Management of rice weeds by integrated approaches (Co-Principal Investigator)

Effect of herbicides on Arbuscular Mycorrhizal association in rice

Different herbicide molecules *viz*., Bis-pyribac sodium, Flucetosulfuron, Fenoxaprop-p-ethyl, Ehoxysulfuron and Penoxulam were evaluated individually and combination and assessed their effects on AMF colonization and other microbial properties in rice under glass house condition. None of the herbicide molecules harm the AMF colonization and sporulation after 30 -45 days after sowing.



AM fungal root colonization in Bis-pyribac sodium -treated rice (Naveen)

Assessing weed dynamics, management for improving productivity and production of rice

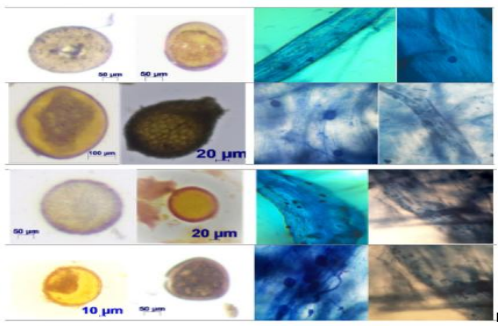
Impact of mixed herbicides and their effects on soil microbial properties in flooded paddy soil

The following ten different herbicides combinations viz., Azimsulfuron, Bispyribac sodium, Flucetosulfuron, Penoxsulam, Cyhalofop-butyl, Fenoxopro-p ethyl, Ethoxysulfuron, XR 848 (benzyl ester), Pretilachlor, Bensulfuron methyl were evaluated. The results indicated that the population of bacteria, fungi and actinomycetes is found disturbed in soil immediately after herbicides application, but there was no significant variation after 20-30 days of herbicides application. Similar trend was observed in FDA, dehydogenase, acid and alkaline phosphatase activities in rice soil.

Formulation, validation and refinement of IPM modules in rice (Co-Principal Investigator)

Studies on effect of different pesticides on AM fungal association in rice

Evaluation of three different insecticides *viz*., chlorpyriphos, cartap and bavistin on AM fungal association in rice under controlled condition indicated that the recommended and double the recommended dose of cartap and bavistin significantly reduced the microbial properties like MBC, FDA, DHA, AMF colonization and sporulation as compared control.

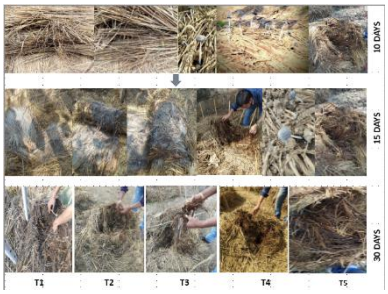


AM fungal association in rice

Economic and environment friendly use of rice straw (Co-Principal Investigator)

Evaluation of *ex-situ* decomposition of paddy straw

Three different microbial consortia were evaluated for their efficiency of paddy straw decomposition in large scale (10 t/ pit). In general, the composting rate was higher at 15-30 cm depth as compared 0-15 cm depth. Application of microbial consortium (at 1.0% v/w multiplied in jaggery solution) (*Aspergillus + Streptomyces +Trichoderma*) with urea (0.5%) found to be promising for decomposition of paddy straw after 60 days compared to uninoculated control.



ex-situ decomposition of paddy straw

Genetic improvement of rice for enhancing input use efficiency (Co-Principal Investigator)

Understanding the bacterial diversity to develop suitable rice variety for aerobic condition

16S Illumina MiSeq metagenomics was done to study the structural diversity pattern of bacteria in aerobic and anaerobic soil where monocropping was practiced for last ten years. Around 42.7% of population was found to be common between aerobic and anaerobic condition, 29.1% were found to be unique under aerobic. It was observed that the most abundant genus was WD2101 (Planctomycetes) followed by either *Kaistobacter* sp (Proteobacteria) or the unclassified genus from acidobacteria.

Developing microbial consortium for horticultural crops in rice based cropping system to promote growth, nutrient uptake and diseases management in organic farming in Sikkim" DBT Twining mode project (PI) (DBT sponsored project)

The following two microbial technologies viz., i) Biofertilizer consortium for nutrient management ii) microbial consortium for pest and disease management were developed for different crop plants under Sikkim Condition. Field evaluation results showed that application of the above said two microbial consortium @ 5.0 lit per ha^{-1} either through soil drenching (mixing one lit per 100 lit water) or FYM enrichment (1 kg with 100 kg FYM) significantly increased brinjal, okra and beans yield compared to un inoculated control.

consortium for horticultural crops

Incentivizing Research in Agriculture: Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals" ICAR Project (Co-Principal Investigator)

As one of the Co-investigators, liquid formulation of endophytic nitrogen fixer (*Azotobacter chroococcum* Avi2) and free-living *A. vinelandii* SRIAz3 have been formulated for rice cultivation. The salient feature of these bio-inoculants is that application these inoculants could save approximately 12-25% of N without compromising the rice yield. This product is ready for commercialization.

liquid formulation of endophytic nitrogen fixer

Setting up of model bio-fertilizer production unit for supply of quality bio- inoculants for rice and rice-based cropping system in Odisha

Initiated works on setting up model biofertilizers production unit through floating tender for purchase of different instruments and construction of unit by CPWD.

DECLARATION

I certify that the information furnished above is true to the best of my knowledge and belief, and that if at any stage it is found to be incorrect/false, I shall be liable for disciplinary action against me as deemed fit.

(P. Pnneerselvam)

Place: NRRI, Cuttack Signature