



ICFRE

Proceedings of **REGIONAL RESEARCH CONFERENCE**

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आज़ादी का
अमृत महोत्सव

on

**Bio-fertilizers and Bio-
control Agents - *Success,
Challenges and Future***



Date:
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IFGTB

Organized by
Institute of Forest Genetics and Tree Breeding
(Indian Council of Forestry Research and education)
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Proceedings
of
Regional Research Conference
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Bio-fertilizers and Bio-control Agents – Success, Challenges and Future
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A. Introduction

Trees being a renewable resource, diverse forest tree species are being raised by forest departments, tree growers and farmers for afforestation programmes, reclamation of problem soils and to meet industry demands. Various products derived from trees are playing an increasingly important role in the economy of the country. Hence, there is widespread interest in increasing the productivity of tree species by various management techniques. One of these is the use of fertilizers. The use of fertilizers in forest production falls into two very distinct categories namely forest nurseries and in the fields such as plantations and natural stands.

Soil microorganisms like plant growth-promoting rhizobacteria, arbuscular mycorrhizal fungi, and the consortia of other beneficial microbes colonizing the rhizosphere have a tremendous impact on the nutrient uptake capacity of the plants. These microbes can be termed as biofertilizers and can sustain plant growth performance and help in attaining high growth and productivity even in challenging situations like drought, salinity and problem soils.

Various research works in the past have demonstrated that use of bio-fertilizers supplies the nutrients and enhance the productivity in a short time, utilizes smaller amounts of energy, reduces contamination of soil and water, increases soil fertility, and encourages antagonism and control of phytopathogenic organisms. Improvement and development of biofertilizer market is increasing steadily because of the identification of effective technology for the manufacturing and application of biofertilizers.

In this context a review of the diversity of microbial inoculants, efficient biofertilizer and biocontrol production technologies, their success, challenges and future with regard to their impacts on forest tree growth and productivity was held through a Regional Research Conference on ***Bio-fertilizers and Bio-control Agents – Success, Challenges and Future*** on 15 February 2022 at Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore in both offline and online mode with support of Institute of Wood Science and Technology, Bangalore and Institute of Forest Biodiversity, Hyderabad.

B. Proceedings

The conference was initiated with the welcome address by **Dr. R. Yasodha** *Scientist - G and Group Coordinator (Research)*, IFGTB. She welcomed the participants and highlighted the importance of the conference theme.

Dr. A. Karthikeyan, *Scientist F and Organizing Secretary*, IFGTB introduced the theme of the conference and briefed on various work carried out in field of biofertilizers and its application.

Dr. C. Kunhikannan, *Director*, IFGTB, gave an overview of the conference. He also emphasised the importance of Biofertilizers in landscape restoration especially in degraded areas.

In his inaugural address **Shri. R.K Dogra**, *Deputy Director General (Research)*, ICFRE expressed his happiness to be a part of the Regional Research Conference and recalled the ill-effects of chemical fertilizers and synthetic pesticides that resulted in a change in policy making to promote biofertilizer and bio-control agents in agriculture, horticulture and forestry. He highlighted the works carried out by ICFRE particularly in bringing out various biofertilizer and bio-control products for tree farming community. He also mentioned about the capacity building and technology development programmes of ICFRE for the stakeholders. He stressed the need of quality planting stock production for various afforestation programs by the government and wished that biofertilizers would play a major role in bringing out quality seedlings from the nurseries. He recalled the AICRP projects on biofertilizers initiated by ICFRE and hoped that this conference will definitely bring out ideas for future research programmes. He wished all success for the Regional Research Conference.

Dr. A. Karthikeyan *Scientist- F and Organizing Secretary* IFGTB presented the significant research achievements in the field of biofertilizers and bio-control agents research at IFGTB. He explained the works carried out in IFGTB on planting stock improvement, rehabilitation of problem soils, and afforestation in barren lands using biofertilizers. He also presented the effect of biocontrol agents in controlling diseases in tree crops. He showcased various biofertilizers and biocontrol products developed by IFGTB and mentioned that well accepted such products.

Dr. Krishna Giri, *Scientist*, RFRI, discussed about the effectiveness of liquid media for biofertilizer formulations and enquired about the shelf-life. **Dr. Karthikeyan** replied that the combination of media broth and water would help uniform distribution of spores and the shelf-life of three months can be extended up to six months under refrigerated conditions.

Dr. C. Kunhikannan *Director* IFGTB, enquired about the existence of antagonistic effect by other microbes against bio-fertilizers. **Dr. Kartikeyan** replied that research is underway in the AICRP project on Biofertilizers. **Dr. A. Muthukumar**, *Scientist*, IWST suggested that containers made of specific materials can increase shelf life of formulations. **Dr. Srinivasan** from T-Stanes & Company enquired about the dosage recommendation for large areas. **Dr. Karthikeyan** responded that inoculations (10 ml /bag) be done in the seedlings in nursery are carried forward to the field also. Separate application in the field is not required so that rizhosphere and other microbes are not disturbed. **Dr. Srinivasan** also enquired about the viability of the spores in formulation before application. **Dr. Karthikeyan** replied that preparation and supply is done as and when the demand arises and therefore, viability is not an issue as in commercial formulation.

Dr. Ratnaker Jauhari IFS, *Director*, Institute of Forest Biodiversity, Hyderabad explained about the research and development works carried out in Telangana and Andhra Pradesh area on biofertilizers. He stressed the need for demonstration of biofertilizer and bio-control usage in field conditions for successful lab to land transfer. Some of the other needs, he brought forward were identification of bio-agents for extreme environmental areas, creation of awareness among farmers through KVKs and VVKs, increasing shelf life for the formulations, promotion of organic farming in forestry sector, certification system for the products for international markets, marketing mechanism and identifying subsidized price for biofertilizer products for farmers. For a query raised by **Dr. Yashoda** about the bio-fertilizer units available with the forest department in the area **Dr. Jauhari** replied that some units are functioning but production on sustained basis is not available in the area.

Shri S.Santhosh Kumar, *DCF* (Research) Kerala Forest Department gave an elaborate description of the use of biofertilizers in Kerala. He said that repeated floods and heightened vulnerability of forests in Kerala demand an integrated, innovative eco-restoration policy. There is a shift in the forest governance in Kerala where attempts are being made to convert plantations into natural forests, use of native species for restoration instead of exotic species and improve trees outside forests and plantations in farmlands. There is a plan to further conserve sacred groves, mangroves, RET (Rare, Endangered, Threatened) species for which use of biofertilizers will go a long way in the establishment and conservation in their respective areas. The state also has plans drawn to eliminate alien invasive species through bio-control agents. He recalled the association the Kerala Forest Department with IFGTB in sharing research results, providing training to forest department staffs and farmers of Kerala. He said that the research support in field practices are now limited to

nurseries. He hoped that IFGTB would support the state in providing bio-fertilizer technology and bio-control agents for various restoration programs planned by the forest department.

Shri. Puviarasan, *Range Officer*, Tamil Nadu Forest Department, spoke about the biofertilizer production and usage by the state forest department of Tamil Nadu. He said that the central nurseries in different locations of Tamil Nadu under the state forest department have elaborate infrastructure to mass multiply and supply biofertilizers for the needs of forestry operations of the department as well as for the farmers. There is a demand for 1 crore seedlings per year for planting under various programmes like tree cultivation in private lands, agroforestry plantations and various other massive tree plantation programme by the state. The central nurseries have a capacity to produce 500 tons of VAM per year. The state forest department have tree specific biofertilizer protocols for nursery seedlings production with biofertilizers.

Dr. T. Muthukumar *Professor*, Bharathiar University presented on the root endophytes which can play a role in sustainable forestry. He discussed about the Dark Septate Endophyte (DSE) fungus which is not extensively studied. This fungus which has a high tolerance against abiotic and biotic stress, plays a significant role in decomposition, uptake of nutrients and water by plants and can be cultured under *in-vitro* conditions. He also highlighted some of the other endophytic fungi species like the one associated with neem tree which can enhance azadirachtin and can be used in bio-prospecting of chemicals, drug development, food technology, developing drought and salt tolerance in plants, enzyme production, heavy metal tolerance. Elaborate research is required in these lines with this group of endophytic fungi can help in production of high-quality resilient seedlings. Further research is also required in development of suitable culture media for these root endophytes, identification of more efficient species, understanding multiple and standardising delivery methods of these endophytes for forestry tree species.

Dr. A. Muthukumar *Scientist- E*, IWST elaborated on the role of biofertilizers in overcoming problems in urban tree cultivation. He mentioned that a lot of phytoplasma infections are being recorded in urban trees. There is a need to study the inter strain diversity of microbes and how the mutualism can be used for solving many problems faced by the urban trees. He stressed the need for collaboration of ICFRE with ICAR for research in these lines because there are specific strains of microbes based on the soil type and the diversity of local microbes' population need to be studied.

Dr. J.P. Jacob informed that with the MoU already signed between ICAR and ICFRE possibilities of collaborative project can be explored in these lines.

Dr K. V. Gomathi, *Professor*, Tamilnadu Agricultural University, Coimbatore, talked about the drought mitigation microbes particularly methylo- bacteria which can help in inducing drought tolerance in plants. She explained about the work in similar lines in tomato. She suggested developing an efficient consortium of such microbes as drought mitigating microbes for use in forestry crops.

Dr. Ken-ichi-Kucho, *Professor* from Kagoshima University, Japan spoke about the *Frankia* mutant defective in nitrogen fixation and vesicle formation. He said that gene functioning in vesicle differentiation can be impaired due to mutations. This aberration should be identified for nitrogen fixation activity in the free-living condition as well as the nodulation ability in the symbiotic condition. He also explained how the enzymes activity is affected in *Frankia* species due to mutation in NAD⁺.

Dr. P. Chezhan *Senior Manager*, Tamilnadu Newsprint and Papers Limited, Karur explained how the bio-inoculants developed by IFGTB laboratory has gone to the field to overcome the issues related to controlling a bacterial wilt disease in casuarina hybrid plantation by application of Micromonospora in Tamil Nadu. He also highlighted the overall enhancement of productivity of tree species by utilizing various silvicultural, bio-fertilizers inputs provided by IFGTB in industrial plantation establishment. During the discussion he enquired about the possibility of development of a “cocktail” of microbial formulation for application in the field and the problem of missing information on microbial counts on commercial products. **Dr. Jacob** replied that the production methods, its effectiveness and economics in development of a combination of microbes need to be studied. **Dr. A. Karthikeyan** added that the products brought out by IFGTB carry the required information about microbial counts and related details on the label.

Dr. John Prasanth Jacob, *Conference Coordinator* consolidated the key points that emerged during the Regional Research Conference with respect to the success made so far in biofertilizer and bio control research and the possible future research programs.

Status of the knowledge

- Available knowledge needs to be utilised for creation of awareness among farmers through KVKs and VVKs.

- Exchange of knowledge between different Councils-ICAR, CSIR, ICFRE to avoid duplication and enhance knowledge base.

Research needs of the region

- Certification system for the products like Biofertilizers and biocontrol agents for international markets.
- Identification of marketing mechanisms and working out subsidized price for biofertilizer products for farmers.

Future directions/ recommendations

- Identification of Biofertilizers and biocontrol agents for trees in extreme environmental conditions.
- Use of biofertilizers to support landscape restoration. This includes specialised areas like sacred groves, mangroves, RET (Rare, Endangered, Threatened) Species.
- Identification and application of bio-control agents to manage alien invasive species.
- Identification of strains of microbes based on specific soil types and tree species.
- Identification of efficient consortium of drought mitigating microbes for use in forestry crops.

Networking research options and opportunities

- Networking among State Forest Departments, Universities, Research Institutes and industries to facilitate demonstration of biofertilizer and bio-control usage in field conditions for successful lab to land transfer.

New concepts leading to new research programmes

- Promotion of organic methods of raising nursery and plantations in forestry sector.
- Basic studies on Root endophytes Dark Septate Endophyte (DSE) fungus
- Identification of mutant microbes which may interfere with nitrogen fixation activity.
- Evolve consortium of microbes for large scale application in forestry.
- Tree species specific and soil type specific microbes.

Dr. J.P. Jacob, *Conference Coordinator* proposed the formal vote of thanks.

Annexure-I. List of Participants

Annexure-II. Programme Schedule

Annexure-II. Photographs

Annexure-I. List of Participants

Name	Contact
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Mishra Avinash, MTS, IFGTB	
A.Sowmiya, MTS, IFGTB	
Krishnamurthy, JRF, IFGTB	

Annexure-II. Programme Schedule

PROGRAMME		
10:00	Welcome Address	Dr. R. Yasodha <i>Scientist-G & Group Co ordinator Research</i>
10:10	Introduction to the Theme	Dr. A. Karthikeyan <i>Scientist-F & Organising Secretary</i>
10:20	Overview of the Webinar	Dr. C Kunhikannan <i>Director, IFGTB, Coimbatore</i>
10:30	Inaugural Address	Shri R.K. Dogra, IFS <i>Dy. Director General(Res), ICFRE, Dehradun</i>
10:45	Significant research achievements in Bio-fertilizers and Bio-control Agents at IFGTB	Dr A Karthikeyan <i>Scientist-F</i>
11:15	PHOTO SESSION & TEA BREAK	
11:30	Overview of research & development of Biofertilizer in Andra Pradesh and Telangana	Dr. Ratnaker Jauhari, IFS Director, IFB, Hyderabad
11:40	Overview of research & development of Biofertilizer in Kerala	S . Santhosh Kumar, DCF (Research), Kerala Forest Department
11:50	Root endophyte- A key player in sustainable forestry	Prof. T. Muthukumar Bharathiyar University, Coimbatore
12:00	Mycorrhizae-Wonders of nature	Dr. A. Muthukumar, <i>Scientist E</i> , IWST, Bangalore
12:30	Eco friendly drought mitigating microbes	Prof. V. Gomathi TNAU, Coimbatore
13:00	LUNCH BREAK	
14:00	Frankia mutants defective in nitrogen fixation and vesicle formation	Ken-ichi-Kucho, Kagoshima University, Japan
14:30	Biocontrolling of bacteria wilt disease in Casuarina	Dr. P. Chezhan, TNPL, Karur
15:00	Role of biofertilizers in forest nurseries	Mr. S. Puviyarasan Range officer, Biofertilizer Production Unit, Tamilnadu Forest Department.
15:30	Vote of Thanks	Dr. J. P. Jacob <i>Scientist G & Conference Co ordinator</i>

TEA

Annexure-II. Photographs



Dr. C. Kunhikannan, Director IFGTB



Offline participants



Dr. R. Yasodha, Group Co-ordinator (Research), IFGTB



Dr. A. Karthikeyan, Scientist F, Organizing Secretary



Sh. R. K. Dogra IFS, DDG (Res)



On line participants



Sh. Ratnaker Juhari, IFS Director IFB



Dr. Kenichi-kucho, Japan



Dr. P. Chezhan, Sr. Manager, TNPL



Sh. S. Puviarasan, Tamilnadu Forest Department



Sh.S. Santhoshkumar, Kerala Forest Department



Dr. T. Muthukumar, Professor, Bharathiar University



Dr. J.P. Jacob, Scientist G , Conference Co ordinator



Group photo