

TREE BREEDING AND IMPROVEMENT THEORIES AND TECHNIQUES

K.T. Parthiban • N. Krishnakumar • P.S. Devanand



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FOREWORD

Tree breeding has gained potential attraction across the country due to growing wood demand coupled with restriction on wood supply from natural forest. The National Forest Policy (1988) and Agroforestry Policy (2014) have directed for increased participation of wood based industries in agroforestry towards meeting their raw material resources. It has attracted increased attention in tree breeding as well to evolve new varieties and clones for higher productivity, improved wood quality and the associated resistance towards various stresses. The growing concern on depletion of forest genetic resources, genetic erosion, over exploitation etc. have also indicated tree breeding as a conservation tool.

Keeping this in view, ICAR has recommended starting an exclusive PG programme in Tree Breeding in all SAUs accredited with B.Sc and M.Sc programme in Forestry. Accordingly, several institutions have started an exclusive Tree Breeding programme at PG level and created specialization in doctoral studies. This research and educational activities have demanded wide range of text books incorporating the fundamental and application aspects of Tree Breeding and Improvement. In India, over 25 different tree species have been incorporated in tree breeding and there is no reference material for use in tree breeding both for academic and practical applications. Above all, several competitive examinations incorporated the fundamental and application aspects of tree breeding both through objective and subjective modes. The existing books on Tree Breeding are based on experiences with temperate species and as on date, there is no exclusive text book to deal with practical aspects of tropical tree breeding.

Under such circumstances, I am happy to see that the scientific team of FCRI has brought out a comprehensive text book entitled **"Tree Breeding and Improvement-Theories and Techniques"** which has 19 chapters encompassing all facets of tree breeding which will cater to the needs of UG, PG and Ph. D programme in Forestry and Tree Breeding. Above all, the book will act as a ready reckoner for all academic and competitive examinations. The tree breeding scientists involved in varietal development will find this book as practical guide for them towards improving and conserving the Forest Genetic Resources.

I congratulate the authors for their efforts in bringing out such a basic text book which is being demanded by students, scientists and professional foresters.

I wish the authors every success.

Date: 17.03.2020
Place: Coimbatore


(N.KUMAR)

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BASIC AND COMPONENTS OF TREE IMPROVEMENT

INTRODUCTION

Forests in India have played a significant and critical role in meeting the domestic industrial raw material requirements besides catering to the needs of socio economic and livelihood opportunities of the people. These forests were traditionally managed with the intensive silvicultural system without taking into consideration the breeding value of the forest genetic resources. This has witnessed the low productivity ($0.5\text{m}^3/\text{ha}/\text{annum}$) of the existing natural forests compared to the global average of $2.1\text{m}^3/\text{ha}/\text{annum}$. The growing population, urbanization, industrialization and the associated science and technology development in the country have demanded increased use of wood and wood products. Till the recent past, these wood and wood products demand has predominantly been met from the natural forests; but due to the policy and legal restrictions, the supply from natural forest has decreased very rapidly. The Forest Conservation Act 1980 and the subsequent directions of the Honorable Supreme Court in the year 1996, have almost totally stopped the felling operation in natural forests and reduced the supply of wood and wood products to the wood based industries.

The growing wood demand, restriction on felling coupled with poor productivity of India's forest have ushered in a total mismatch between demand and supply of both domestic and industrial wood requirement. These developments have witnessed large scale promotion of forestry plantation outside its natural range particularly through agro forestry and farm forestry systems. These

promotional activities compelled the need for the improvement of Forest Genetic Resources through systematic tree breeding and improvement approaches. Traditional tree breeding and improvement works were concentrated only on limited species like teak, sal, deodar and few pines. However due to increasing demand for wide range of wood and wood products' over 25 different trees species have been prioritized for varied industrial utility and demands intensive tree breeding and improvement approach to increase the productivity, reduce the rotation, augment the wood quality, early flower induction, development of varieties for stress tolerance and other specific objectives. As of now, there is no comprehensive text book is available to cater to the academic needs of forestry colleges in the country and also for practically applied breeding methods for adoption by researchers and professional foresters. Against this backdrop the current book on "Tree Breeding and Improvement - Theories and Techniques" has been conceived and presented for use by stakeholders.

HISTORICAL DEVELOPMENTS IN TREE BREEDING

Forest tree breeding and improvement program compared to agriculture is only an young science which had its recognizable start eight to nine decades back. Globally, Sweden was the pioneer in tree breeding and other countries subsequently initiated and strengthened the tree breeding program which resulted in productivity improvement. Predominantly, the tree breeding program was approached through selection and hybridization methods with little initiatives in mutation breeding. The tree breeding and improvement program attempted globally and regionally has been traced and presented.

The global forest genetists and breeders as traced and presented in Zobel and Talbert, (1984) is furnished below for understanding the tree breeding developments across the world.

1717	Bradley (England)	Importance of seed origin
1760	Duhamel de Monceau (France)	Inheritance : oak
1761	Koehltreuter (Germany)	Hybridization
1787	Bursdorf (Germany)	Plantation for seed production