

CHAPTER – 1

IMPORTANCE OF IMPROVED SEED AND PLANTING STOCK IN PLANTATION FORESTRY

1.1 Introduction

Forests are the planet's largest and most important terrestrial ecosystem. They have a profound influence on the structure and function of the human habitat locally and globally. Forests sustain much of the world's diversity of life with its body of genetic information, developed over evolutionary time that defines survival of life itself (WCFSD, 1999).

Forests provide the means for livelihood of tens of millions of people living in or close to forest boundaries the world over. Forests protect drainage basins, create and retain soil, and affect productivity of fisheries and agriculture. The metabolism of forests affects the carbon dioxide, methane and nitrous oxide content of the atmosphere, and the temperature of the earth and its climate.

Unfortunately, the rich green mantle of forests that once covered nearly half of the earth's land surface is being replaced by a chequered landscape of cities, highways, agricultural fields, pastures, degraded wood lands, forest plantations and land degraded by salinity and erosion.

Forestry is the second-largest land use in India after agriculture with a forest and tree cover of 76.88 million ha or 23.4% of the geographical area (Anon., 2005). India has about 2.5% of the world's geographical and 1.8% of the forest area. The country supports 16% of the world population and 18% of the domestic cattle population, amounting to about 500 million. India has diverse geographical features and varied climates making it one of the twelve mega diversity countries of the world. The forests of the country (from tropical rain forests in the south and the northeast to the dry alpine forests in the northwest Himalayas) have been classified into 16 types and 251 subtypes on the basis of climatic and edaphic conditions. Some of the principal commercial species are highly valued and are becoming increasingly costly, e.g. teak (*Tectona grandis*), sal (*Shorea robusta*), *Dipterocarpus* spp., and conifers (pine, deodar, fir, spruce etc.). Forests are also the most important source of fibre for paper and pulp industries, with bamboo occupying the key position (NFC, 2006). The main species under social and agroforestry include eucalypts, acacias, poplar, *Melia*, *Dalbergia*, *Leucaena* and *Casuarina*.

Roughly 275 million poor rural people in India – 27 per cent of the total population depend on forests for at least part of their subsistence and cash livelihoods, which they earn from fuelwood, fodder, poles, and a range of non-timber forest products such as fruits, flowers, and medicinal plants. Half of India's 89 million tribal people live in forest fringe areas, and have close cultural and economic links with the forest. Forestry and logging accounted for just 1.1 per cent of India's Gross Domestic Product (GDP) in 2001; adding non-market benefits of environmental services,

subsistence fuelwood, fodder, and many other non-timber forest/ products, doubles the GDP contribution (World Bank, 2006).

The increasing human population and rapid economic growth have put immense pressure on forests and other natural resources. About 41% of the forest cover in the country has already been degraded and dense forests are losing their crown density and productivity continuously. At present 70% of forests have no natural regeneration and 55% are prone to fire (NFC, 2006).

1.2 Demand and supply of Wood Raw Material

India is facing a severe scarcity of wood as is evident from the statistics in

Table 1.1

Table 1.1 Demand and supply of wood (in million cu. m.)

Year	2000	2010	2020
Demand	58.0	95.0	153.0
Supply	29.0	70.5	100.7
Gap	29.0	24.5	52.3
% Of demand gap	50.0	25.70	34.0

Source: Ganguly, 2003.

However, we are of the firm opinion that substantial improvement in the domestic supply of timber as projected in this table for 2010 and 2020 will not be possible unless the central and State Governments ensure, through innovative policies and massive investments, that the degraded forest lands are converted into technology based plantations and there is major growth in Agroforestry plantations. Moreover all future plantations must be based on genetically improved seed and clonal planting stock and supported with sound silvicultural and management practices for ensuring high productivity and improved quality of wood. We foresee the demand and domestic supply gap to increase and imports to keep growing for many years and we must take all possible steps to expand plantations with substantial improvement in productivity. Ensuring availability of adequate quantities of genetically improved seed and clonal plants is the first pre-requisite for that.

The annual fuelwood requirement in the country is estimated to be about 250 million tonnes. Availability of fuelwood from forests on a sustainable basis is reported to be about 17 million tonnes. Thus, supply will have to be supplemented from other sources such as agroforestry, trees growing on wastelands, biogas, solar energy etc. The paper industry in particular is plagued by raw material shortage. The deficit is being met by imports. Midgley *et al.* (2007) report gross and net imports valued at USD 2.75 and 2.20 billion respectively. Even our forests at the optimum level of conservation and productivity would find this task impossible. More than 50% of the industrial wood of industrial timber is being contributed by agroforestry in the private sector. A large portion of the annual 250 million tonnes of fuelwood consumption also comes from community lands. With forests under increasing pressure, agroforestry is the only segment that can record growth in production of

timber, fuelwood, industrial timber, fodder and grass, medicinal plants and the rest. Therefore, the country's needs of timber, fuelwood, fodder, industrial wood and medicinal plants must be met from private lands and community lands (NFC, 2006).

As per the National Forest Programme, 1999 an area of 3 million ha must be brought under high yielding plantations annually for the next twenty years. Availability of genetically improved seed and clonal planting stock of tested clones in sufficient quantities shall be a major pre-requisite for achieving these high but most essential targets successfully. Such plantations conserve biodiversity rich natural forests, generate ample employment opportunities and meet essential needs of society for paper, timber, fuelwood and non-wood forest products (NWFPs) on a sustainable basis. Such plantations shall also contribute immensely to the promotion of forest based industries, nationaleconomic development and amelioration of environment. In order to meet the growing demand for forest products, the National Forest Commission, 2006 has laid stress on, among others, improving productivity of degraded forests (10-40% crown density) by regeneration and afforestation, growing high yielding plantations and promotion of social and agroforestry plantations based on genetically improved seed/planting stock.

1.3 Planted Forests and Sustainable Forest Management

The latter part of the twentieth century saw the beginning of a powerful transition in forestry and in the production of wood for industry, humans are now meeting an increasing portion of their industrial wood needs from planted forests, many of them high-yielding. By the middle of the twenty-first century, the transition to tree cropping will be completed, and the greatest part of human wood consumption will come from planted forests (Sedjo, 2001).

Two powerful forces drive the trend towards tree planting: economics and environmental concerns. Promising economic returns on tree planting have been realized especially in tropical and sub tropical areas of South America, Asia and Africa, where biological growth rates are high. Many planted forests are on land that was previously in low-productivity agricultural uses. The economic returns on planted forests, especially high-yielding intensively managed forests are sufficient to continue to induce substantial investments in plantation forestry (Sedjo, 1999). Thus the trend towards planted forests and tree breeding imply that huge volumes of forest products will be produced from relatively small areas of land. Consequently, most of the natural forests would remain for biodiversity conservation and other purposes.

The trend to high-yielding planted forests is receiving additional momentum from environmental concerns, which have resulted in prohibitions on harvesting from some old growth and secondary forests. Sayer and Maginnis (2004) have identified seven important drivers for change in forest management systems toward more integrated and holistic management systems. In India, the key process for promoting ecosystem approaches to forest management is the Bhopal process on sustainable Forest Management. The process measures progress towards enhancement of forest resource productivity by, among others, the extent of seed production areas, seedling seed orchards and clonal seed orchards.

1.4 Tree Improvement

Tree improvement has few applications in the absence of planted forests. As planted forests become more common, the actual and potential applications of tree improvement using traditional techniques or biotechnology increase.

Forest tree improvement consists of a “marriage” of silviculture and tree parentage to obtain the greatest overall returns. Tree improvement has an important role in Forest Management when production of high volumes of good quality timber or non-timber forest products is the principal management objective (Zobel and Talbert, 1984). Success in the establishment and productivity of forest tree plantations is determined largely by the species used and the source of seed within species. The need to use the best-adapted source of seed was recognized early in the twentieth century. The most successful tree improvement programmes are those in which proper seed sources and provenances are used. Willan (1988) reported the results of provenance trials in the tropics and sub tropics. The trials involved a fairly large number of species viz., *Cedrela*, *Cordia*, *Eucalyptus*, *Gmelina*, *Pinus caribaea*, *P. kesiya*, *P. patula*, *Tectona grandis* and *Terminalia*. Considerable improvement in productivity was observed in most species. The results include trials of teak and *Gmelina* in India.

At present, most of the genetic material (seed/planting stock material) used in forestry sector in India is obtained from unspecified sources, from stands, natural or planted, which are neither classified nor managed specifically for seed or planting stock material production. For example bamboo cultivation is being promoted, sponsored and financed by various States on a large scale in private areas. Bamboo is a self pollinating species. Its thickness, growth and clump forming habits are the function of its genetic make up which ultimately determines economics of bamboo plantations on a particular site. Thus, procuring seed and planting material will require conscientious efforts in the selection of species and strains for various types of planting sites ranging from wastelands to fertile soils, from drought prone areas to areas with well-distributed rainfall, and from tropical to alpine climates.

Dogra and Sharma (2005) reported that the Laura area and Kennedy river provenances of *E. tereticornis* and Petford provenance of *E. camaldulensis* were found to be superior to the local land race of *E. hybrid*. Kumaravelu et al. (1985) reported similar results. Lal *et al.* (2006) reported considerable variation within provenances of *E. tereticornis* and *E. camaldulensis* and recommended clonal plantations of the two species to capture the gains. They found that at 4 years the mean volume of top three clones was about 50% more than the mean volume of all clones under test. Our interaction with forest officers has revealed that in a number of states, such as Andhra Pradesh, Tamil Nadu, Kerala and Maharashtra productivity gains in teak, eucalyptus and acacia plantations based on improved seed clonal material were of the order of 20-30%.

Green revolution in agriculture and the unprecedented gains in productivity of wheat and rice would not have been possible without the development of new high yielding varieties. Genetically improved seedlings or clonal planting stock supported with improved package of practices can usher in a new revolution in productivity and quality of plantation timbers. For example, clonal planting stock of poplars and

eucalypts, being promoted by some of the wood based industries on a limited scale supported with good technical extension services, has improved productivity to an average of 25-30 m³/ha/year with very significant improvements in the quality of timber. Very high productivity up to 50 m³/ha/year has also been achieved by many farmers both in case of poplars and clonal eucalyptus plantations (Dogra *et al.*, 2007; Lal, 2003; Lal, 2004; Lal *et al.*, 2006).

Genetically superior and tested clonal planting stock captures both additive and non-additive variation and offers possibilities of major immediate gains in productivity of plantations. Following data in table 1.2 pertaining to field trials for evaluating comparative genetic superiority of eucalypt clones at Bhadrachalam in Andhra Pradesh by ITC Limited and Semi, near Jalandhar in Punjab by Pragati Biotechnologies amply demonstrate the vast superiority of selected clones which laid the foundations for large scale commercial clonal agroforestry plantations in many states including Andhra Pradesh, Orissa, Maharashtra, Punjab, Haryana and Madhya Pradesh.

Table -1.2 Growth data of clones and seedlings in clonal testing areas
At Bhadrachalam, A.P. and Semi, Jalandhar, Punjab

Sl.No.	CTA Number	Age years	No. of Clones Tested	MAI-Vol./ha In cubic meters For Best Clone	MAI-Vol./ha In cubic meters For Seedling Control	MAI-Vol./ha In cubic meters For trial mean
1	1	8	19	44	*	18
2	2	5	14	33	15	11
3	21	6	15	38	9	25
4	23	6	9	58	*	25
5	S-1	4	36	30	18	19
6	S-2	4	17	36	12	22

* Seedling control treatment was not planted in CTA numbers 1 and 23

CTA – Clonal Testing Area; MAI- Mean Annual Increment, Vol. / ha- Under-bark volume per ha in cubic meters.

Trials at serial number 1-4 were located at Bhadrachalam in Andhra Pradesh with 3 M x 2 M spacing and trials at serial numbers 4 & 5 were located at Semi, Jalandhar, Punjab, with 4 M x 2 M spacing. Peak mean annual increment for most of the clones was reached around 8 year age at Bhadrachalam. However, clonal trials at Semi were not retained till 8 years and spacing adopted was also much higher as the objective was to compare various clones as well as demonstrate the potential of these clones for timber production for veneer logs and saw- milling

Likewise, clonal eucalypt plantations have been raised on very large scale in many countries including Brazil, China, South Africa, Vietnam, Thailand etc. Clones of *Eucalyptus grandis* and its hybrids with *Eucalyptus urophylla* have been extensively planted in many tropical countries with productivity often more than 50 m³ ha⁻¹ yr⁻¹. Tropical pines have been extensively planted in many countries including USA, New Zealand, Chile etc. Some Acacia species native to Australia and

neighbouring countries are significant in the rural economy of many countries. Just a few species, mainly *Acacia mangium*, *A. auriculiformis*, *A. mearnsii* and *A. saligna* cover almost 2 million ha (Midgley and Turnbull, 2003). *Acacia mangium* and hybrids of *A. mangium* x *A. auriculiformis* have been planted extensively in many tropical countries. The APRIL group in Indonesia plants nearly 143 million seedlings and rooted cuttings of acacias and *E. grandis*, and hybrids of *E. grandis* with *E. pellita* or *E. urophylla* annually, covering more than 50,000 ha yearly. Sabah Forest Industries in Sabah province of Malaysia have plans to plant 5,000 ha this year and 10,000 ha next year with *A. mangium* and *E. grandis*. It is estimated that close to 10,000 ha are being planted to *Acacia mangium* in the high rainfall areas of Malaysia, Indonesia, India, Sri Lanka and Vietnam both for pulp and timber production.

Seed should either be procured only from most dependable and trust-worthy sources or collected under personal supervision of user agencies. The cost of improved seed or clonal planting stock constitutes a very small percentage of the total plantation cost. Superior genetic qualities of seed have profound positive impact on growth rates and productivity of plantations and quality of the produce. Gains from use of better quality seed and planting stock always far outweigh the slightly extra cost of better quality seed. Willan (1988) surveyed the literature on economic returns to be expected from tree improvement. He concluded that economic returns are likely to be excellent in most species. Looked at another way, no one can afford the substantial losses, which will result from not implementing a realistic tree improvement programme.

Forest resources in India are under productive and unable to meet the growing needs of fuelwood, timber and industrial round wood. Land resources are limited and per capita land availability is extremely low. Hence the only way to meet the nation's needs for primary products from agriculture and forestry is to make major improvements in productivity and quality of produce on a sustainable basis. Use of high quality genetically improved seed and planting stock, integrated with scientific management practices, is critically important for achieving these twin objectives. Hence, production of adequate quantities of genetically improved seed and planting stock of all important species used for reforestation and agro-forestry plantations must receive top priority of ICFRE, MoEF, State Forest Departments, wood based industries and others engaged in promoting technology based plantations.

Quality assurance in respect of seed and planting material for growing long gestation timber species is extremely important for safeguarding the genuine interests of all users including farmers and forest departments. Therefore, certification of genetically superior seed and clonal planting stock of important trees/plantation species should receive very high priority for ensuring supply of genuine, truthfully labeled certified seed and clonal plants of field tested and proven genetically superior clones. This should be supported by an institutional and regulatory mechanism for certification of forest reproductive material.

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CHAPTER – 2

SEED CERTIFICATION AND TESTING IN AGRICULTURAL SECTOR

2.1 Introduction

Genetically improved seed is a critical and basic input for attaining sustained growth in agricultural production. Use of assured quality seed is necessary for attaining higher crop yields. Policy initiatives taken by Government of India during 1960s and 1970s for quality seed production and distribution of improved plant varieties developed by the scientists laid the foundations of our self-sufficiency in food grains. The Indian seed industry has shown impressive growth and continues to provide further impetus to growth in agricultural production. The Indian Seed programme largely adheres to the limited generation system for seed multiplication. The system recognizes three generations, namely breeder, foundation and certified seed.

Seed Certification is a system that provides assurance to seed buyers that the seed being purchased are what they are represented to be by the producer or seller. This certification of identity (and sometimes quality) is typically provided by an independent third party for a fee that is charged to the producer and becomes part of the production costs. The system is simple and effective; it is used all over the world in various, yet basically similar, forms for agricultural, horticultural, and forestry seed or other propagules (Mangold and Bonner, 2001).

2.2 Seed Certification in Agriculture

Certification of agricultural seed has been practiced in the United States since the early 1900's (Copeland and McDonald, 1995; Hackleman and Scott, 1990) and has been a positive force in the development of modern agriculture. Certification in individual states is typically controlled by an agency that is authorized by the state to carry out the procedures. The agencies are commonly called crop improvement associations, but some carry other designations. The organizational structures of these agencies may vary, but their goals are similar and they act cooperatively through the Association of Official Seed Certification Agencies (AOSCA 1994; Mangold and Bonner, 2001). Agricultural Seed Certification is an assurance of the varietal (genetic) identity of the material, but it is also normally a de facto assurance of genetic quality. Developers of improved varieties of agricultural species (state land grant universities or private seed companies) widely publicize the results of their field trials, and the expected performance of new varieties is well known and documented before they reach the market. Seed buyers want the assurance from certification that their seed are really the variety that the producer says they are. The slightly higher cost required for this assurance is gladly paid as the benefits in terms of improvement in yields and quality far exceed the extra cost of superior seed.

2.3 OECD Agricultural Codes and Schemes

The Organization for Economic Co-operation and Development (OECD), an inter-governmental organization founded in 1961, provides a multilateral forum to discuss, develop and reform economic and social policies. The OECD's mission is to promote policies for sustainable economic growth and employment, a rising standard of living, and trade liberalization. It is at the forefront of efforts to help governments understand and respond to new developments and concerns so that economic and social developments are not achieved at the expense of environmental degradation. It shares expertise and exchanges views with more than 100 countries worldwide and engages in dialogue with business, labour, and civil society organizations on topics of mutual interest (OECD, 2006).

The OECD Agricultural Codes and Schemes facilitate international trade through the simplification and harmonization of documentation, inspection and testing procedures. The Codes and Schemes were created in the late 1950s/early 1960s and the number of participating countries has been constantly rising. The schemes are open to any OECD or non-OECD country that is a member of the United Nations or of the World Trade Organization. In addition to the 30 OECD countries, which are all members of at least one of the Codes & Schemes, participation currently encompasses 30 non-members, including some of the major players in world trade (Argentina, Brazil, China, India, Russia, South Africa etc.). There is also close co-operation with the UN family, especially the FAO as well as specific non-governmental scientific and industrial organizations.

OECD Seed Schemes

The OECD Seed Schemes provide an international framework for the certification of agricultural seed moving in international trade. The Schemes which were established in 1958 are driven by a combination of factors including a fast-growing seed trade, regulatory harmonization in Europe, the development of off-season production, the seed breeding and production potential of large exporting countries in America (North and South) and Europe, and the support of private industry. Membership of the Schemes is voluntary and participation varies. There are seven agricultural Seed Schemes (OECD, 2006).

The objectives of the Schemes are to encourage the use of "quality guaranteed" seed in participating countries. The UN family of bodies, a vast range of non-governmental organizations (UPOV, ISTA) and seed industry networks participate actively in the Schemes. The Schemes authorize the use of labels and certificates for seed produced and processed for international trade according to agreed principles ensuring varietal identity and purity. The Schemes facilitate the import and export of seed, by the removal of technical trade barriers through internationally recognized labels (passports for trade). They also lay down guidelines for seed multiplication abroad as well as for the delegation of some control activities to the private sector ("accreditation"). The quantity of seed certified through the OECD Schemes has grown rapidly in recent years and reached 590,000 tonnes in 2004/2005.

The success of international certification depends upon close co-operation between members, seed producers, traders and the designated authority (appointed by the government) in each participating country. Frequent meetings allow for a multi-stakeholder dialogue to exchange information, discuss case studies, prepare new rules and update the Schemes.

2.4 FAO & Seed Certification

The Food and Agriculture Organization coordinates action of seed sector stakeholders. Seed security underpins food security particularly in the developing countries of the Asia – Pacific Region. In this region agricultural production has shown remarkable progress since the mid-sixties. This has been fuelled by the development and effective dissemination of high yielding crop varieties, particularly rice and wheat. Production increases of maize, vegetables, fruit and plantation crops have also been significant. Implementation of seed security is one of the major activities outlined in the global plan of action for conservation and sustainable utilization of plant genetic resources for Food and Agriculture. A National Seed Policy is necessary for a country to implement measures that directly enhance the level of seed security. The significant components of a national seed policy include:-

- a) Plant improvement and variety development
- b) Variety evaluation, registration and release procedures.
- c) Plant variety rights legislation.
- d) Seed certification.
- e) Quarantine
- f) Production, storage and marketing of seed
- g) Strategic seed reserves

2.5 Seed Certification in India

In India, agricultural seed certification is regulated in accordance with the Seed Act, 1966 and the rules made there under.

The Seed Act, 1966, Act 54 of 1966, is an Act to provide for regulating the quality of certain seed for sale and matters connected therewith. The main features of this Act are: -

- a) Constitution of a Central Seed Committee consisting of representatives of the Central Government and the State Governments, the National Seed Corporation and other interests, to advise those Governments on all matters related to the implementation of legislation;
- b) Fixing minimum standards for germination, purity and other quality factors;

- c) Testing seed for quality factors at the seed testing laboratories to be established by the Central and the State Governments;
- d) Creation of seed inspection and certification agency in each State and grant of certificates to producers of seed and licensing of dealers in seed;
- e) Compulsory labeling of seed containers to indicate the quality of seed offered for sale; and
- f) Restricting the export, import and inter-State movement of non-descript seed.

Organizations desirous of producing and marketing of certified seed of various varieties of agricultural crops have to arrange foundation or registered seed for sowing and raising the seed crop under the supervision of representatives of state seed certification agencies who inspect the seed at various stages till harvest. Off type plants are rogued to maintain purity of variety. Harvesting, thrashing, processing, grading, packing and labeling are carried out under the supervision of seed certification authorities.

Classes and Sources of Certified Seed

The Seed Rules, 1968 specify three classes of seed and each class should meet the following standards for that class: -

- a) Foundation seed shall be the progeny of breeder's seed, or be produced from foundation seed, which can be clearly traced to breeder's seed. Production shall be supervised and approved by a seed certification agency and be so handled as to maintain specific genetic purity and identity and shall be required to meet certification standards for the crop being certified;
- b) Registered seed shall be the progeny of foundation seed that is so handled as to maintain its genetic identity and purity according to standards specified for the particular crop being certified;
- c) Certified seed shall be the progeny of registered or foundation seed that is so handled to maintain genetic identity and purity according to standards specified for the particular crop being certified.

2.6 Seed Testing

Seed testing in India is done by the Central Seed Laboratories in collaboration with the State Seed Laboratories to promote uniformity in test results. The laboratories collect data continually on the quality of seed found in the market and make this data available to the Seed Committee. The seed samples are analyzed in

accordance with the procedure laid down in the Seed Testing Manual published by the Indian Council of Agricultural Research as amended from time to time.

2.7 Seeds Bill -2004

The Seed Act is currently under revision and is proposed to be replaced by the Seeds Bill, 2004. Over the years, the following deficiencies have been noticed in the existing Seed Act.

- a) Registration of seed variety not compulsory.
- b) Non-notified varieties are not covered.
- c) Commercial crops and plantation crops are not covered.
- d) Certification only through State Seed Certification Agencies.
- e) No provision for regulation of transgenic materials.
- f) Penalties for infringement are very mild.

The revision of existing Seed Act is proposed to (i) overcome its present deficiencies, (ii) facilitative growth of seed industry, (iii) enhance seed replacement rates for various crops and (iv) boost the export of seed and encourage import of useful germplasm, (v) create conducive atmosphere for application of frontier sciences in varietal development and for enhanced investment in research and development. The draft Seed Bill, 2004 is under consideration.

The highlights of the proposed Seed Bill are as under: -

Compulsory registration of varieties based on agronomic performance data; accreditation of ICAR centers, State Agricultural Universities and Private Organizations to conduct agronomic trials; accreditation of Organizations for certification; maintenance of National Register of varieties; regulation of the export and import of seed; exemption for farmers to save, use, exchange, share or sell their seed without registration; accreditation of private seed testing laboratories; enhancement of penalty for major and minor infringements, inclusion of provisions to regulate GM crops, and ban on terminator seed.

The main elements of the Bill are: -

- a) A Central Seed Committee headed by Union Agriculture Secretary.
- b) Ministry of Environment and Forests will be represented by an officer not below the rank of Joint Secretary to the Government of India.
- c) The committee has the power to notify any number of subcommittees including those for registration and certification.
- d) Provision for maintenance of National Register of Seed.
- e) Provision for State Seed Committee.

- f) Provision for State Seed Certification Agency.
- g) Registration of Horticultural Nurseries.
- h) Registration of Seed dealers.
- i) Provision for regulation of sale of seed.
- j) Provision for Central and State Seed Testing Laboratories, Seed Analysts and Seed Inspectors.

In the new Bill, unless the context otherwise requires, "agriculture" includes horticulture, forestry, medicinal and aromatic plants. However, there is no provision for registration of forest nurseries.

2.8 PPV and FR Act

The Plant Varieties and Protection of Farmers' Right Act, 2001 (PPV & FR Act) provides for an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants. It was considered necessary to recognize and protect the rights of farmers in respect of their contribution made at any time in conserving, improving, and making available plant genetic resources for development of new varieties. For accelerated agricultural development, it is necessary to protect plant breeders' rights to stimulate investment for research and development in the country. Such protection will facilitate the growth of seed industry in the country, which will ensure the availability of high quality seed and planting materials to the farmers. It may be added that India has ratified the agreement on Trade Related Intellectual Property Rights. The said Act gives effect to the said Agreement relating to protection of plant varieties. A Plant Varieties and Farmers Rights Authority has also been set up by the Government of India to implement the Act.

The Institute of Forest Genetics and Tree Breeding (IFGTB) Coimbatore is implementing a project "Developing Strategies for Describing, Testing and Registering Varieties of Forest Tree Species in India" funded by the PPV & FR Authority. Under the project it is trying to provide the descriptors of Eucalyptus and Casuarina followed by DUS (distinctiveness, uniformity and stability) testing guidelines (Gurudev Singh, pers. comm.).

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CHAPTER – 3

FOREST SEED CERTIFICATION AND TESTING: A GLOBAL OVERVIEW

3.1 Introduction

The twelfth session of the FAO panel of experts on forest gene resources noted the increased need to promote application of conventional and new genetic technologies, which had proven useful in industrial forestry and also in the management of trees grown outside the forests in agroforestry systems and land rehabilitation programmes, desertification control and for the capture of atmospheric carbon. The Panel also encouraged the FAO to further gather and disseminate relevant information on, among others, international and national seed certification systems (FAO, 2002).

The importance of matching not only species and provenances but also management practices to the site to ensure sustainable growth and yield of desired products is well recognized (FAO, 1992). Besides being of a superior provenance or cultivar, the seed, which reaches the forester for sowing in the nursery or in the forest, must be clean, viable and healthy if wastefully low yields of plants or crop failures are to be avoided. In more precise terms, the seed must be free from impurities, possess high germination capacity and be free from seed-borne pests and diseases. There are striking examples from past and present that show that forest reproductive material (FRM) of unsuitable provenance leaves the forest owner with high risks and low revenues in the long run (Konnert and Behm, 2004; Midgley, 1989). The term FRM is used globally to include seed, parts of plants or planting stock of forest trees. If the productivity of the forest is to be raised through the use of the products of selection and breeding, the supply of seed and plants must be so organized and regulated that it is possible to obtain seed and plants that are both true-to-name and satisfy certain minimum requirements of quality. The aims of forest plant breeding are an increase in resistance, adaptability to environment, quality and biomass production. Priority should be given to adaptable, vigorous and high quality stands or seed orchards. In forestry, varieties play a minor role because of their limited genetic diversity (Anon., 1995).

3.2 Need For Certification

The use of well-filled viable seed of good inherent quality provides a sound basis for the raising of vigorous and healthy forests capable of producing wood of good quality. The efforts of forest geneticists and tree breeders to introduce superior provenances and improved cultivars into forest practice depend on the organization of an adequate supply of seed for which special seed producing units are required. Seed of the best provenances is produced in selected parts of natural forests or selected plantations which have been converted into seed stands or seed production areas;

while seed of new improved cultivars is produced in seed orchards which consist of grafted plants or plants of seedling origin, derived from selected parent trees (Mathews *et al.*, 1964). The importance of quality seed and plant material has been underlined by both the National Commission on Agriculture (1976) and NFC (2006). Their recommendations are reproduced below.

“It would be necessary to undertake selection of plus trees of species important from the point of view of production and social forestry, and the State Forest Research Organizations would have to establish seed orchards and clone multiplication plots near the proposed areas for seed orchards, after collection of scion material from the plus trees. Some work in this regard has been done in the FRI. The CFRE (currently ICFRE) should arrange for evaluation of the experimental results and ensure their adoption by the States. Controlled hybridization in the case of important tree species like teak, Eucalyptus, pines, etc. would have to be intensively studied in order that tree breeding for important species is successfully carried out” (NCA, 1976).

“The forest departments must cooperate and support by providing quality seedlings and technical guidance and by enabling the farmers to freely harvest, transport and sell their produce. All restrictions on the harvest of trees, transport and sale of timber etc. must be removed. Tissue culture and cloning needs to be practiced for multiplication of planting material. For this, quality seed and material needs to be obtained by the Forest Departments.

If the forest departments themselves cannot changeover to the new biotechnology methods of multiplication mentioned above, they should establish linkages with approved institutions and registered private growers who would undertake the task for them. Department of Biotechnology has already recognized the Energy Research Institute, the National Chemical Laboratory and the Jainarayan University of Jodhpur for multiplying trees and bamboo through tissue culture” (NFC, 2006).

The object of the certification of FRM is to maintain and make available to the practicing forester and farmers sources of seed, plants and other propagating materials of superior provenances and cultivars so grown and distributed as to ensure the genetic identity and high quality of the seed and plants (Mathews *et al.*, 1964). Superior provenances are identified by means of provenance tests. The duration of these tests depends on the rate of growth and the length of the economic rotation for each species but, in general, it must be accepted that provenance tests are essentially long-term experiments. The need to provide safe prescriptions for the movement of seed and plants so that expensive losses in wood production can be avoided has led foresters in countries with large variations of site and climate to devise regions of provenance or zoning schemes defined in terms of latitude or distance and elevation. The rapid progress made with selection and breeding in the genus *Populus* has been largely due to the easy propagation of many species and hybrids by means of stem cuttings. The efforts of forest geneticists and tree breeders will be largely nullified

unless certification procedures are available to maintain the genetic purity and quality of FRM.

3.3 International Trade in Forest Seed

International trade in forest tree seed is small in volume and value compared with trade in farm crop seed but is nevertheless of great importance. While statistics on the production of most types of agricultural seed are readily available in FAOSTAT, most classification systems do not allow similar statistics for forest seed to be easily obtained as per the FAO.

Intercontinental trade in forest seed was established in the early days of the eighteenth century, when seed of several eastern American species were frequently shipped to Europe, mainly for use in ornamental plantations. Regular forest plantations of *Picea glauca*, *Pinus strobus*, and a few other American species were, however, also raised shortly after 1700 in Europe. The first seed samples of northwestern American species, including Douglas fir and Sitka spruce, were, as is well known, sent to Europe about 1825 by the famous botanical explorer, David Douglas.

The first commercial consignments of Japanese larch from Japan to Europe arrived in the second half of the nineteenth century. The first introductions of eucalypts from Australia took place in the early 1800's, mainly along the Mediterranean coast and in France. Commercial plantations were, however not raised until the second half of the century, and in some of the main eucalypt-planting countries, such as Brazil, not until 1910 or even later. In India although first introductions took place in 1860's, large-scale plantations began only in the 1960s.

Despite the lack of statistics, it seems likely that the size of market for forest seed is small in comparison to agriculture and could amount to about one percent (or less) of the total FAO (No date). The importance of international trade in forest tree seed must not, however, be judged solely from statistics of import and export. The British Forestry Commission's planting programme, for instance, envisaged domestic forests producing one-third of all timber needed in Britain by the end of the 20th Century as compared with only 4 per cent in 1938. Denmark presents another European example of successful introduction of numerous exotics, mainly Norwegian spruce. However, the most striking example of successful establishment of an exotic is that of radiata pine (*Pinus radiata*) into southern Hemisphere countries – New Zealand, Australia and Chile (Mathews *et al.*, 1964).

Eucalypts undoubtedly constitute the best-known exotics in many countries. All the eucalypts important from the forestry standpoint occur naturally only in Australia, but eucalypt plantations covering more than 1 million hectares have been created in various countries lying in world climatic zones of subtropical or Mediterranean type (Eldridge *et al.*, 1993). On rotations of frequently only 9 to 10

years, they form the basis of very considerable industrial concerns. Finally, two tropical species deserve mention, namely, the Honduras mahogany (*Swietenia mahogany*) and teak (*Tectona grandis*), seed of which are moving extensively between tropical countries of Africa, Asia and many areas in the southern hemisphere.

3.4 Importance of Improved Seed

The above are a few examples of successful importations, which emphasize the need for a well-organized tree seed trade and exchange. Supply of high quality FRM is central to the success of tree planting projects as the difference in economic terms, between quality seed and poor seed can be great (Midgley, 1989). Increasingly national governments have recognized tree seed supply as a development issue and international development agencies have been encouraged to assist in the development of tree seed centres at both the national and regional level. It is observed that despite the recognition that failure to use the best possible seed may influence the success or failure of a tree-planting project, seed matters are often considered peripheral to mainstream forestry activities. Seed cost is a small proportion of plantation establishment cost and plantation projects can afford to purchase the best seed rather than the cheapest (Gurudev Singh, pers. comm.; Midgley, 1989).

Since the 1920's, a mass of evidence has accumulated showing the existence of climatic, form, and perhaps also soil, races within many forest tree species, and it is now generally recognized that seed source in forestry is second in importance only to choice of species for planting projects. In forestry, it is even more important than in agriculture to use seed of the most suitable origin because of the long rotation normally involved from planting to cutting of the mature trees, and the resultant long time it takes to recognize a possible failure in the choice of seed source (Tulstrup, 1959).

In most countries the forest seed trade is frequently a state-forest enterprise although the situation is changing rapidly. There are the same advantages in a greater development of private forest tree seed trade as there are in private trade in agricultural seed or in other business enterprise. There would seem little doubt that the healthy and successful competition between private and state-enterprise organizations, in countries where these exist, in forest tree seed, must depend on the adoption and careful adherence to a universally acceptable FRM certification system.

3.5 International Seed Certification Schemes

Two important schemes which together cover or influence the policies of more than 60 countries are the European Council of the European Union (EU) directive of 1999 on the marketing of forest reproductive material and OECD Scheme for the certification of forest reproductive material moving in international trade, 2007.

EU Seed Certification Scheme

The main elements of the EU scheme, which is implemented by 27 European small Countries including the U.K., are being reproduced below.

- a) Forest reproductive material of tree species and artificial hybrids, which are important for forestry purposes, should be genetically suited to the various site conditions and of high quality. Reproductive material means any of the following:
 - (i) Seed unit: cones, infructescences, fruits and seed intended for the production of planting stock;
 - (ii) Parts of plants: stem cuttings, leaf cuttings and root cuttings, explants or embryos for micro propagation, buds, layers, roots, scions, sets and any parts of a plant intended for the production of planting stock;
 - (iii) planting stock: plants raised from seed units, from parts of plants, or from plants from natural regeneration;
- b) Approval of basic material and, consequently, demarcations of regions of provenance are fundamental to selection; and the Member States should apply uniform rules imposing the highest possible standards for the approval of basic material; only reproductive material derived from such material should be placed on the market;
- c) Basic material means any of the defined seed source, stand, seed orchard, and parent of families, clone and clonal mixture.
- d) Member States should draw up national registers of the basic material approved on their territory; a summary of the national register in the form of a national list should also be drawn up by each Member State;
- e) Separate Community quality standards for stem cuttings and where appropriate for sets of poplar should be introduced;

EU Categories of Reproductive Material

Forest reproductive material is divided into the following categories:

- (i) "Source-identified" reproductive material.
- (ii) "Selected" reproductive material.
- (iii) "Qualified" reproductive material.
- (iv) "Tested" reproductive material.

EU Official Body

- (i) The EU official body may be an authority, established or designated by the Member State under the supervision of the national government and

responsible for questions concerning the control of marketing and/or the quality of forest reproductive material;

- (ii) Any State authority established:
- Either at national level, or
 - At regional level, under the supervision of national authorities, within the limits set by the constitution of the Member State concerned.

Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive with effect from 1 January 2003. They shall forthwith inform the Commission thereof.

We have surveyed the literature from Great Britain, Germany, Finland and Northern Ireland. All countries have passed suitable laws to give effect to the directive.

The OECD Certification Scheme

The OECD Scheme for the Control of Forest Reproductive Material Moving in International Trade, first adopted in 1974, is a certification tool to facilitate international trade in forest seed and plants. The Scheme reflects the wish of governments to have these materials correctly identified with a view to minimizing uncertainty in achieving successful afforestation.

The object of the OECD Scheme- Certification of Forest Reproductive Material Moving in International Trade, 2007 hereinafter called "the OECD Forest Seed and Plant Scheme" or "the Scheme", is to encourage the production and use of seed, parts of plants and plants that have been collected, transported, processed, raised and distributed in a manner that ensures their trueness to name. The scheme is open to all members of OECD as well as any member of the United Nations, its Specialized Agencies or the World Trade Organization desiring to participate therein. Currently, there are 22 participating countries. The list includes countries of Europe, U.S.A., Canada, Madagascar and Rwanda.

Afforestation may relate to wood production (which remains one of the major uses of forests), soil protection and fighting erosion, producing trees for ornamental or recreational purposes (Christmas trees); landscaping, etc. More than 250 species of trees are currently eligible for certification under the OECD Scheme which covers an area of more than 13 million hectares. Forest stands; tree seed orchards and tree clones are approved by the participating countries as the basic material for harvesting the reproductive material, i.e., seed or grafts. Different OECD labels are used according to the category of material. The labeled material is then recognized internationally as of guaranteed quality and of certified origin or source.

OECD Categories of Reproductive Material

Basic material must have the approval of the Designated Authority. There are two categories recognized in the Scheme under which reproductive material can be certified.

Source-identified; this is the minimum standard permitted in which the location and altitude of the place(s) from which reproductive material is collected must be recorded; little or no phenotypic selection has taken place.

Selected; the basic material must be phenotypically selected at the population level. Other categories, to be named “Qualified” and “Tested”, that can involve other types of basic material (seed orchard, parents of family (ies), clone, clonal mixture) are under consideration for future extension of the Scheme.

Many countries, especially from Africa and South America have expressed interest in the OECD Scheme.

Approval of Basic Material

The unit of approval is the basic material. Each unit comprises a single entry in the National Register. Prior to approval, the basic material (except for basic material intended for the production of reproductive material to be certified as source-identified) will be inspected by the Designated Authority. When approved by the Designated authority, it will be maintained under its supervision until the approval is withdrawn. The approval of basic material shall be withdrawn if the minimum requirements are no longer fulfilled. Re-inspections must be made at intervals decided by the Designated Authority.

Registration of Approved Basic material

National Register

The Designated authority must establish and maintain a National Register in which each unit of approved basic material is recorded. A map or plan must be made available on request.

Inspection

The Designated Authority must control all categories of reproductive material, at least by random checking during collection, processing, storage, raising, labeling and sealing.

Method of Operation of the Scheme

Designated Authority

The government of each country participating in the OECD forest seed and plant scheme will designate the authority to implement the scheme in that country.

Review and Co-ordination

The operation and progress of the scheme will be reviewed as necessary at meetings of representatives of the National Designated Authorities. These meetings will report on the working of the scheme and make such proposals as are deemed necessary to the committee for agriculture of the OECD.

Procedure for extension of scheme to non-members of OECD.

Non-member countries may submit a written application with a copy of the national scheme giving details such as region of provenance, approved basic material, supply of FRM, availability of qualified staff and the like.

3.6 Seed Certification in U.S.

This section is drawn mainly from Mangold and Bonner (2001). In the United States certification of forest reproductive material has developed in a slightly different manner from that of agriculture. Most forest landowners do not have ready access to the performance data from field trials of selected forest materials. There are two primary reasons for this. First, field trial results in forestry are not as widely published as those in agriculture, and the publication outlets that are used are not widely seen by the general public. Second, large forest industries and the USDA Forest Service, all of whom originally intended that the improved materials would be planted on their lands only and not sold on the market, have done much of the genetic improvement in forestry. So other than technical reports in forestry journals and a few government publications, these results have not been widely disseminated, although they are available (Mangold and Bonner, 2001).

The first efforts in genetic improvement in forest reproductive materials in the U.S.A. lead to the recognition that some seed sources were more suitable for planting in certain areas than others. Application of this principle in the 1930's and 1940's led to the establishment of seed control policies and seed zones to ensure that seed and seedlings for reforestation came from the best origins (Rudolf, 1974). The use of seed zones has been very effective, and they are still widely used today. The major impetus for Forest Seed Certification however, came from the expanded reforestation programs and rapidly developing tree improvement programs in the 1950's and 1960's.

South Dakota established the first forest tree certification program in 1952 for stock selected for shelterbelt use (Rudolf, 1974). Georgia established the next program in 1959 with comprehensive certification standards for tree seed (GCIA, 1959). The AOSCA (then known as the International Crop Improvement Association) adopted almost identical standards (Rudolf 1974). AOSCA widened the scope of its tree seed certification standards to allow certification of material from all native plants, trees, shrubs, vines, herbs, and grasses (AOSCA, 1994).

The Northwest Forest Tree Seed Certifiers Association (NWFTSCA) was formed in 1966 to promote seed certification. This organization developed seed zone maps for Washington and Oregon and the framework for seed certification (Edwards, 1981). Certification was jointly administered by the Washington State Crop Improvement Association and the Oregon Seed Certification Service, a division of the Department of Crop and Soil Science at Oregon State University. The NWFTSCA provided review and advice to the agencies. Their system recognizes the following categories of reproductive material, which are indicated by standardized color-coded labels affixed to seed containers (Mangold and Bonner, 2001).

Categories of Reproductive Material

The following categories are identified:

- a) Audit class
- b) Source-identified class
- c) Selected class
- d) Tested class.

Most of the tree seed sold in the Pacific Northwest are exported to countries in northern Europe that are members of OECD (Organization for Economic Cooperation and Development), a United Nations based international economic development organization that has set up the Scheme for Control of Forest Reproductive Material Moving in International Trade. European countries that had been importing tree seed from the Pacific Northwest were required to have OECD certificates on their seed; consequently, procedures were established in the Northwest to implement this scheme (which varied only slightly from the standards already in place). The major importers have been Germany (Douglas fir), United Kingdom (*Picea sitchensis* (Bong.) Carr., Sitka spruce), and Sweden (lodgepole pine) (Piesch, 1977), with total exports presently somewhere around 4,500 kg/year (Pfeifer, 1997).

EU certificates and labels

Although the United States is not a member of EU, its seed dealers are affected when seed lots are exported to EU countries. The EU scheme differs from both OECD and North American systems in that only 2 categories of certification are recognized: selected and tested materials. Discussions are currently underway to revise the EU scheme, so there is hope that this harmonization will be realized in the near future. It should be noted that the OECD scheme covers all species and issues no limiting list of basic or reproductive material (Debois, 2004). The OECD scheme is widely used, as a model for certification standards in many non-member countries.

The Federal Seed Act of 1939 is basically a truth-in-labeling law that governs interstate commerce and importation of agricultural seed (Copeland and McDonald, 1995). Movement of seed within state boundaries is not covered under the act. Therefore all states have their own seed labeling laws to govern intrastate sales. Presently fewer than 20 states include tree seed under their labeling laws, and in most

that do, enforcement is not strict. Laws do exist in some states, however, providing legal recourse for buyers who feel wronged. Label requirements differ; some states require only the species and date of collection, whereas others require germination test results and provenance data.

The best potential for future certification of tree or other native plant seed is in restoration or reclamation planting programs. These programs require relatively small seed lots from an extraordinarily large number of species, many of which have not been grown in nurseries before. There is also a trend toward wanting only local ecotypes for restoration planting (Young, 1995) and source-identified certification to provide the assurance that proper seed sources are being used. The large number of shrub and grass seed dealers that are willing to get their products certified for source (Young, 1994) and the increasing number of seed dealers that are selling tree seed (at least 58 offering over 1,800 species) (USDA FS, 1995) indicates that commercial sources are ready and willing customers simply have to ask for certified materials. State certification agencies now have the standards and procedures to certify any or all of this material.

3.7 Seed Certification in Australia

In Australia, the central agency for seed certification in the past was the CSIRO Tree Seed Centre although each state forestry agency had a similar role in this respect. In the recent part, several state agencies that had a focus on *Pinus radiata* breeding combined their resources to form the Southern Tree Breeders Association and later expanded to include *Eucalyptus globulus*, and its membership now includes federal agencies and private sector companies. There is no legislation covering the STBA. It exists through what is essentially a contract between participants. There is no attempt to force users of tree seed to obtain seed through STBA, but all users know that the only way to get high quality certified seed is through that body or its members. So far, there does not appear to be any need in Australia from special legislation for forest seed. The standing of the STBA is sufficient to guarantee the performance of any seed that they provide (Frank Mckinnell, pers. comm.).

3.8 Forest Seed Certification in India

The Indo-Danish Project on Seed Procurement and Tree Improvement, Hyderabad, formulated a scheme entitled "Certification of Forest Reproductive Material in India, 1979" (Gopal and Pattanath, 1979a). The scheme was based on OECD Standards, Scheme and. It came out with a set of rules, which were to be strictly complied with, in the collection, transportation, processing, storage, sampling, labeling and sealing of seed for distribution.

The broad programme of seed certification, as formulated by the Project is discussed below.

Categories of Reproductive Material (Minimum Standards)

The scheme recognized four categories of stands for seed collection, which have been listed in accordance with increasing genetic control of seed quality. The

term “Reproductive Material”, in the text, refers to cones, fruits and seed intended for the production of plants, parts of plants, stem, leaf and root cutting, scions and layers intended for the production of plants; plants raised by means of seed or parts of plants; it also includes natural regeneration.

Basic material has been defined as the stands and seed orchards for reproductive material produced by sexual means and clones for reproductive material produced by vegetative means (Khullar *et al.*, 1992).

Seed Zones

The term ‘Seed Zones’, referred to above in connection with the collection of source identified reproductive material, means a geographic area delineated on State Forest Trees “Seed Zone” map as approved by the Conservator of Forest, Research (or equivalent authority). The Seed Zone maps, showing the boundaries of the seed zone, together with their code, incorporating administrative and geographic boundaries and, where applicable, altitudinal and other appropriate boundaries judged to be significant in the State have been published by the Indo-Danish Project (Gopal and Pattanath, 1979b). An approved state code letter, followed by a serial number, can identify the ‘Seed Zone’.

Approved Basic Material

In each state in India, a designated authority was to take action to compile and lists in respect of reproductive material that could be collected there from and furnish to the coordinating agency, which would then prepare a national register to incorporate information obtained from the states and circulate the same to other states for their information and use.

The Indo-Danish Project had prepared various proformae for recording and submitting the above information. The full text of the scheme is at Annexures I & II.

3.9 Seed Testing

Material in this section is mainly drawn from (Khullar *et al.*, 1992). Efficiency and success in raising plants in the nursery and their subsequent establishment in forest plantations depend to a great extent on the quality of the seed used. It follows that foresters, nurserymen, seed dealers and others need accurate estimates of the quality of the seed in which they deal or which form the basis of their afforestation projects (Turnbull 1975).

For the practicing forester, the most important object of seed testing is the provision of an accurate estimate of the capacity of a given seed lot to produce healthy, vigorous plants suitable for field planting. In the present context, seed “quality” refers to the physiological vigour of the seed rather than its genetic quality.

The essence of good seed testing is the application of reliable standard methods of examination to ensure that uniform and reproducible results are obtained (Turnbull 1975). Standardization has been greatly facilitated through the adoption of

the International Rules for Seed Testing formulated by the International Seed Testing Association (ISTA) by a number of countries. In the early stages ISTA's primary concern was for agricultural seed, but trees and shrubs seed have also gradually assumed importance.

The ISTA has a Forest Tree and Shrub Seed Committee (FTS). Members of the FTS committee deal with tree seed testing itself, but also with many other, related research activities, such as storage, pre-sowing treatment (stratification) and seed - borne diseases. Specific guidelines on testing tropical and subtropical species have been issued ISTA (1998).

Currently, the FTS members come mostly from European countries, from USA, Canada and Malaysia. However, they are seeking to involve seed technologists and scientists from other countries. In the southern hemisphere, and especially in the tropics, there are many tree species for which methods are needed for the evaluation of seed quality, for seed storage, for breaking dormancy and for maximizing germination. The committee has only just started (2001-2004) to address such issues. Revision of the ISTA Tree and Shrub Seed Handbook is currently being undertaken (ISTA on-line, 2004).

Essentials of seed testing

Seed tests are important on two occasions – first, immediately following extraction and cleaning; and second, prior to planting (Bonner, 1974). Seed Testing is a streamlined process, which begins with the drawing of a sample and ends with the interpretation and application of test results. In practice, only a small proportion of a seed lot is tested and results are applied to the whole seed lot. This is called “sampling”.

The tests which may be required are purity, authenticity, seed weight, germination, indirect testing of viability, moisture content, and seed health and damage. A prerequisite for all testing is good sampling. The CSIRO Australia and ISTA have prescribed conditions for germination and testing of selected tropical, subtropical and temperate species respectively.

In India, the first seed-testing laboratory in agriculture was established in 1961. Within a short span of 15 years, the number of seed testing stations in India increased to 47 (Khullar *et al.*, 1992). Under the provision of the Seed Acts, 1966, each State established and notified its own seed-testing laboratory. The Seed Testing Laboratory at the IARI New Delhi has been notified as the Central Seed Testing Laboratory. Besides, there are several other laboratories, which have not been notified because these are either engaged in research work, or are serving the requirements of autonomous/private Seed Corporations or Companies. The beginning of seed testing in forestry was made in the country in the year 1962, when a Seed Testing Laboratory was established at the Forest Research Institute, Dehra Dun, during the Fourth Five Year Plan. The Forest Research Institute has also started provided technical assistance for the establishment of Seed Testing Laboratories in the states.

Procedures for the Development of Seed Testing Rules

A major obstacle in taking up testing and issuing seed analysis certificate for forestry seed so far, was the absence of formalized procedures for testing them. In developing rules for seed testing, well-defined objectives have served as guidelines (Justice, 1972). The objectives, which are sought to be incorporated in seed testing programmes, may be listed as follows: (a) to provide methods by which the quality of seed samples can be determined accurately, (b) to prescribe methods by which seed analysts, working in different laboratories within the country or in different countries, can obtain uniform results, (c) to relate the laboratory results, as far as possible, to planting value, d) to complete the test within the shortest possible time.

For the development of rules for the testing of seed of Indian tree and shrub species, constitution of technical committees to cover important species is recommended. The committees are expected to consider quality factors such as purity, germination test, including the determination of hard seed, examination of noxious weed seed, viability of tree seed by the tetrazolium procedure, seed health condition i.e., seed borne organisms, genuineness of species, and sub-species, cultivar, moisture content, provenance or locality of harvest, unit weight of seed, and homogeneity of seed lots (Khullar *et al.*, 1992). The ICFRE and particularly Forest Research Institute, Dehra Dun has developed seed testing rules for some important forestry species (Khullar *et al.*, 1992). The authors have specified sample weights of seed for “submitted” and “working” samples for important Indian tree species. Details about maintaining seed in storage for orthodox and recalcitrant seed in storage have also been provided.

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CHAPTER – 4

FEED BACK FROM THE ICFRE, THE STATES AND OTHER STAKEHOLDERS

4.1 Introduction

We visited the following ten States.

- (a) Andhra Pradesh
- (b) Gujarat
- (c) Haryana
- (d) Madhya Pradesh
- (e) Maharashtra
- (f) Orissa
- (g) Punjab
- (h) Tamil Nadu
- (i) Uttarakhand
- (j) Uttar Pradesh

This samples all regions of India – Northern, Western, Southern, Central and Eastern. In addition, the Bikaner region of Rajasthan was visited, making it the eleventh State in our sample. All the States in the country were requested to furnish information on the subject for which a questionnaire was circulated (Annexure-III). The States, which were not sampled but responded to our questionnaire, are Andaman & Nicobar Islands, Assam and Chhattisgarh.

It is well known that large investments are involved in plantation establishment and that most species are managed on long rotations. The general view from the States was that the origin of seed should be ensured from the right source. In artificial regeneration where the objective of raising crop is well defined (like timber production, forest based raw material for industrial use, fuelwood, NWFP, medicinal and aromatic plants etc), it becomes all the more necessary that the seed used is of appropriate source to yield forest produce of required quality and quantity. It was felt that efforts should be made to maximize the productivity as well as the value of plantations.

During discussions, the general view that emerged was that there should be a reliable institutional mechanism to ensure that forest seed used for plantations are of certified origin. Uttarakhand is one of the several States that uses only certified seed, which are certified and supplied by the silviculturist from the department's seed production areas. Seed from other sources are not allowed to be used. The same situation prevails in some other States also. Examples are Haryana, where 2% of the plantation budget is set aside for forest seed procurement by the Seed Division, Andhra Pradesh, Tamil Nadu, Kerala and Gujarat. Unfortunately, information from other States was not available. In Kerala seed certification of teak is done by the Seed

centre of Kerala Forest Research Institute (KFRI), Peechi. The seed centre has been set up in collaboration with the Kerala State Forest Department.

In Andhra Pradesh, a serious attempt has been made to select plus trees of not only timber species but also NTFP species. The State started seed certification for a limited number of species about 8 years back and has established SSOs/CSOs of teak, eucalypts, casuarinas, and seed stands of some fast disappearing secondary species such as *Mitragyna parviflora*, *Dalbergia latifolia*, *Adina cordifolia*, *Pterocarpus marsupium*, *P. santalinus* and *Gmelina arborea*. The State has seed testing laboratories at Warangal and Rajamundhry besides a well-equipped tissue culture laboratory at Tirupati. Tamil Nadu also has a system of seed certification and has come out with a seed directory, which lists more than 100 important forestry species. The directory gives very useful information on seed collection, storage, treatment and other aspects of seed technology.

In the State of Orissa, plus trees have been selected by the Silviculture Division but the supply of improved seed is limited. It was felt that more SSOs/CSOs are required along with capacity building of all stakeholders. In some other large States such as Uttar Pradesh, Maharashtra and Madhya Pradesh availability of improved/source identified seed falls far short of their requirement although they too have established SSOs/CSOs.

A number of States have laboratories for seed testing. Uttarakhand, UP, Andhra Pradesh, Tamil Nadu and have well equipped laboratories for seed processing, grading, and storage. Staff, infrastructure and expertise do exist to some extent for the certification in the research wing of State Forest Departments. A number of States have also established tissue culture laboratories, mist chambers and the facilities connected with vegetative propagation and tree improvement. However, if a formal system of seed certification is to be implemented, most States would need additional staff, infrastructure/ resources and capacity building.

Our interaction with the States and the ICFRE during field study and with the resource persons shows that a dire need for certification of forest reproductive material is being felt across the country. During the last two decades, the World Bank has supported forestry projects in States like A.P., UP, Kerala, Maharashtra and Madhya Pradesh. The Bank has also supported the ICFRE in forestry research, extension and education. Under this project (FREEP), a large number of SPAs, SSOs, CSOs and related infrastructure have reportedly been developed. It is hoped that soon improved seed would become available. We have collected as well as compiled available information on CPTs, SPAs, SSOs and CSOs for ready reference. The information is at Annexure IV.

We recommend that the Government of India may provide financial assistance to the States to not only upgrade their infrastructure for seed collection, processing, testing and storage but also to expand SPAs and seed orchards, and to organize regular training programmes for all the stakeholders of FRM.

4.2 Role of ICFRE

ICFRE is a premier forestry research organization and is over a century old. On its roll are both outstanding scientists and foresters. The council also assists the States/UTs in establishing SPAs, SSOs, and CSOs. It has laboratories that can undertake tissue culture, seed testing and genetic research. As stated earlier, it has implemented a World Bank assisted project on forestry research, education and extension during the last decade and has established/ upgraded eight seed testing laboratories. All its nine research institutes conducted research on seed storage, tree improvement as well as planting stock improvement under the project. The important species studied include teak, *Gmelina*, *Pterocarpus marsupium*, neem, *Acer*, *Ulmus*, *Grewia*, *Casuarina*, *Dalbergia sissoo*, chir pine, bamboos, eucalypts and *Acacia nilotica*. This research should provide the underpinning for a scheme on FRM certification. Testing of various species and clones by the ICFRE and UP Forest Department led to commercial plantations of poplars under agro-forestry systems in north-west India.

4.3 Role of private sector and public sector undertaking

An important role has been played by the private sector in India for development of genetically improved seed and clonal planting stock of species like poplars, eucalypts, acacias, *Casuarina* and subabul for promotion of technology based plantations. This has given tremendous boost to growth of farm forestry plantations with very high productivity and better quality timber particularly from genetically improved clonal planting stock. The pioneering efforts of Wimco Limited for promoting poplar plantations in Punjab, Haryana, Uttrakhand and UP, and the commendable work of ITC Limited in developing, testing and commercial multiplication of genetically improved clones of eucalypts for promoting farm forestry plantations in Andhra Pradesh are well documented and known internationally.

Likewise, the State owned Mysore Paper Mills as well as West Coast Paper Mills in the private sector have developed clones of *Acacia mangium* x *A. auriculiformis* hybrids for large-scale plantations. Most of the other wood based paper mills in the country notably Ballarpur Industries Limited, JK Paper and Orient Paper Mills have been implementing large scale clonal eucalyptus plantation programmes under agro-forestry systems in Andhra Pradesh, Orissa, Maharashtra and Madhya Pradesh.

Pragati Biotechnologies with their research and development and production centre near Jalandhar in Punjab have been the pioneers in the northern region in the production and distribution of high yielding clones of eucalypts to farmers. They have been supplying clonal planting stock of eucalyptus and poplar in Punjab, Haryana, Uttrakhand and UP since 2001.

The productivity of both poplar and Eucalyptus clones is very high ranging from 20 to 50 m³/ha /yr compared to normal productivity of 4-10 m³/ha /yr from seed

route Eucalyptus plantations. The total current annual production and supply of improved clonal planting stock of eucalypts in India is estimated to be around 65 million plants, which is adequate to plant 26,000 ha. Field tested commercial clones developed by the private sector should be registered and production and supply of certified clonal planting stock of these clones under the proposed institutional and legal framework must be encouraged to bridge the ever widening gap between demand and supply of wood.

4.4 Conclusions

- (a) All the stakeholders stand for improvement of seed/planting stock and forest stands so as to maximize their productivity. Some SFDs and FDCs have a substantial number of seed stands, seed production areas, seedling seed orchards, clonal seed orchards, and candidate plus trees. Progeny trials have been completed in case of short rotation species and for many others are under progress. We need to build on this reservoir of strength and quickly develop SPAs and seed orchards to meet the requirement. Most participants wanted greater stress to be laid on production of quality FRM before initiating steps for certification and legislation. They felt that certification should come first and legislation later.
- (b) The need for producing genetically improved FRM outside forests and by the private sector was also recognized.
- (c) All the stakeholders felt the necessity for institutional and regulatory framework to support Forest Seed Certification on an all India basis including use of forest seed for departmental use by forest departments/FDCs.
- (d) Research on establishing minimum standards for certification of reproductive materials of forest species should be taken up on a priority basis. ICFRE should organize and coordinate this activity.
- (e) Financial and technical assistance may be provided by the Central Government to the States for establishing seed processing units and seed testing laboratories.
- (f) In natural regeneration areas genetically improved seed from a large number of superior mother trees or seed bearers should be encouraged so as to conserve and improve the gene potential of the natural forests.
- (g) Genetically improved and certified forest reproductive material must be used for production forestry, social forestry, agro-forestry and other plantation programmes in the public as well as the private sector.

CHAPTER – 5

KEY PRINCIPLES FOR CERTIFICATION OF FOREST REPRODUCTIVE MATERIAL

5.1 Introduction

The object of certification of forest reproductive material (FRM) is to encourage the production and use of seed, plants or other planting stock ensuring that the same have been collected, transported, processed, sampled, labeled, sealed, and distributed in a manner to represent their trueness to the name and quality. In Chapter 2 we discussed in detail the principles and the procedure underlying production and certification of agricultural seed. Most of the agricultural crops are basically annual or seasonal whereas forest crops, excepting some herbs and species of grasses, are perennial. In agricultural sector seed production takes a few months whereas a forest seed crop may take many years.

Similarities and differences of seed certification in agriculture and forestry

In agriculture, seed certification is a generation system whereby the pedigree of a superior crop variety is maintained through a series of subsequent seed production, generally a four-generation scheme. A special colour tag identifies the seed of each generation. First is the 'breeder' seed, which represents the true pedigree of the variety and is labeled with white certification tag. Next comes 'foundation' seed, which is the first generation seed from the breeder seed and is also labeled with a white certification tag. The next step; is 'registered' seed which is the seed derived from the foundation seed and is designated by purple tag. This is merely intended for the purpose of increasing by one more generation before the production of seed eligible for certification. In some places the third step is omitted and 'certified' seed is produced directly from foundation seed, and represents the final product of the certification programme and is labeled with a blue tag. For a variety to become eligible for certification, the plant breeder submits the sample for certification to the appropriate review board along with a description of the variety, its diagnostic characteristics and its performance data. Only when the variety is officially released, named and described does it become eligible for seed certification.

National Seeds Corporation, State Seeds Corporations and private sector companies desirous of producing and marketing of certified seed of various varieties of agricultural crops have to arrange foundation or registered seed for sowing and raising the seed crop under the supervision of representatives of state seed certification agencies who inspect the seed at various stages till harvest. Off type plants are rogued to maintain purity of variety. Harvesting, thrashing, processing, grading, packing and labeling are carried out under the supervision of seed certification authorities

However, in forestry there are hardly any known varieties of seed of tree species mainly because of long life cycles and predominantly out-crossing nature of most trees. Genetic improvement of seed of trees species often takes many decades. Unfortunately in India, this crucial aspect of vital importance has been neglected far too long and adequate quantities of improved seed are not available even for the most important timber species like teak. For seed of tree species, need to introduce and implement certification in respect of source of seed, category of seed and physical quality of seed to begin with unlike certification of seed of distinct varieties for agricultural crops. All of these three aspects related to forest seed / FRM certification are discussed in full detail under section 5.3 of this chapter. Clonal planting stock of field tested clones can certainly be certified based on aforesaid criteria along with distinct identity of each clone. Of course, the certifying authorities must ensure that juvenile cuttings or vegetative propagules of each clone are taken from well maintained separate hedge gardens or gene banks of same clone.

In agriculture each seed lot is from a fresh crop cultivated in a season, while in forestry, seed lots have to come from the same crop annually. Also, in forestry each year seed formation and seed maturation is subject to such vagaries of nature as the presence of a particular insect population, changes in climatic cycles and microclimates, nutrient status of the soil etc. Further, in agricultural crops it is possible to describe the diagnostic characters of an adult plant of a new variety as the time span involved from seed sowing to maturity is only one season. But in forestry, the time span involved from seed sowing to maturity of the crop runs into a number of years with a minimum of five years, depending on the species. Therefore, the concept of forest seed certification has necessarily to be different from that of agriculture (Bedell, 1998).

Because of distinct and different nature of forest seed/ FRM compared to seed of agricultural crops as explained above, a separate approach appropriate for FRM certification is required supported with a separate law like proposed as discussed in greater detail in chapter 7 of this report.

5.2 Production of quality FRM

Unlike in most developed countries where the forests are owned mainly by individuals, communities and companies, the forests in India are owned and managed by the Central and State Governments through well trained forestry personnel. Modern scientific forestry management in India is over 150 years old and has to its credit valuable experience and established professional traditions. State Forest Departments are the major producers and users of forest reproductive material (FRM), though they do provide planting material to other departments for social forestry purposes from forest nurseries. Nursery owners and kisan nurseries, created to provide gainful employment to the people, usually obtain seed either from the forest departments or collect seed from trees growing in agricultural fields or forest areas. Some of the private sector companies, particularly those owning match and paper industries, have developed genetically improved clonal planting stock of poplars,

eucalypts, acacias and *Leucaena* for supply to farmers in promotion of technology based clonal plantations with buy back arrangements.

We recognize the important role already played by private sector in developing, testing and promoting fast growing clonal planting stock for many forest species in India. We foresee and visualize a growing and major role for private sector in future production and supply of genetically improved FRM including high yielding vegetatively propagated clonal planting stock of important species amenable to cost effective vegetative reproduction.

Khullar *et al.* (1992) estimated the annual requirement of seed of important species in the country as given in Table 5.1

Table 5.1 Annual Seed Requirement of the Country for Planting Programmes

Species	Common Name	Quantity (Tonnes)
<i>Abies</i> and <i>Picea</i> spp.		8.0
<i>Anacardium occidentale</i>	Cashewnut	6.4
<i>Acacia</i> spp.		62.5
<i>Bombax ceiba</i>	Semal	1.2
Bamboos	Bans	68.7
<i>Cedrus deodara</i>	Deodar	7.5
<i>Casuarina equisetifolia</i>	Casuarina	12.8
<i>Dalbergia latifolia</i>	Rose wood	3.6
<i>D. sissoo</i>	Shisham	11.8
<i>Dipterocarpus</i> spp.	Gurjan	336.0
Eucalyptus spp.		13.8
<i>Gmelina arborea</i>	Gamhar	29.7
<i>Pinus</i> spp.	Pine	32.0
<i>Quercus</i> spp.	Oak	29.0
<i>Shorea robusta</i>	Sal	846.0
<i>Santalum album</i>	Sandalwood	10.8
<i>Tectona grandis</i>	Teak	1760.0
Grasses		27.0
Other Species		6470.0
TOTAL		9736.8

Source: (Khullar *et al.*, 1992)

Based on the figures in Table 5.1 above, it can be safely estimated that the annual requirement of seed in the country may be of the order of 10,000 tonnes. Admittedly, these are old data but they do give a sense of the magnitude of forest seed required. A more recent estimate is that given in Table 5.2.

Farmers in Andhra Pradesh and adjoining states use a very large quantity of subabul (*Leucaena leucocephala*) seed annually for pulpwood plantations. Though a

large number of tree species are planted every year 90% of the plantation programmes in the country consist of bamboos, *Eucalyptus*, *Acacia*, *Albizia*, *Casuarina*, *Prosopis juliflora*, *Dalbergia sissoo*, conifers and teak. The future annual planting target is expected to be over 3 million ha consisting mainly of bamboos, *Eucalyptus*, *Acacia*, *Albizia*, *Prosopis*, *Casuarina*, *Dalbergia*, conifers and teak (Katwal *et. al.*, 2003). The authors state that the projected annual requirement of seedlings is 6160 million of which around 23.5% is expected to be grown from SPAs of certified sources and around 15% from genetically improved sources. The projected quantities of seed needed are given in Table 5.2.

Table 5.2 Projected quantities of seed needed for tree planting activities in India, including improved seed (All figures in Kilograms, percentages are in parentheses)

Species	Seed from SPA	Genetically improved seed (C.S.)	Seed by conventional practice	Total seed
<i>Eucalyptus</i> spp.	650 (18.5%)	875 (25%)	1975 (56.5%)	3500
Acacias	88 800 (30%)	29 600 (10%)	177 600 (60%)	296 000
<i>Albizia</i> spp.	48 860 (30%)	15 620 (10%)	93 720 (60%)	156 200
<i>Casuarina equisetifolia</i>	114 (20%)	114 (20%)	342 (60%)	570
<i>Dalbergia sissoo</i>	412 (10%)	412 (10%)	3 303 (80%)	4 126
Conifers	16 660 (20%)	1670 (2%)	64 970 (78%)	83 300
<i>Tectona grandis</i>	228 570 (50%)	114 285 (25%)	114 285 (25%)	457 140

Source: Katwal *et al.*, 2003.

Some information was also collected by us during interaction with the States and is at Annexure – IV. It is quite clear that there is an urgent need to develop identified seed sources such as plus trees, seed stands, seed production areas and seed orchards and to establish central seed collection and distribution in each State.

During 1970s, the Government of India had sanctioned a project known as “Indo-Danish Project on Seed Procurement and Tree Improvement”. After detailed deliberations and research the project issued an agreed document for implementation of forest seed certification by the States namely (i) Certification of Forest Reproductive Material in India (Revised Scheme, 1979a) and (ii) Seed Zonation followed in India (Gopal and Pattanath, 1979b). Though these two official documents were finalized in consultation with all the State Forest Departments yet unfortunately, in the absence of any central intervention or a forest seed law, most of the forest departments did not implement the same and *are* left far behind in the very important field of tree improvement and certification of FRM.

There is urgent need to restore suitable sites of degraded forests to sustainable high productivity through technology based plantations using genetically improved seed and clonal planting stock soonest possible before these sites degrade to point of no return because continued of soil erosion and intense biotic pressures. Likewise, we

need to promote Agroforestry on large scale integrated with wood based industries to meet our future timber, pulpwood and fuelwood requirements on sustainable basis. Current forestry trends in India also give high importance to non-wood forest products and medicinal / aromatic plants. The approach for producing reproductive material for such categories will also be more or less the same as for timber species with certain modifications.

5.3 Principles of FRM Certification

The basic principle of seed certification or reproductive material is that it should be certified by an independent and autonomous certification agency that is different from the producer or seller of the seed. Dependence on the forest staff whose work is to be inspected may prove counter productive to the spirit of seed certification.

Producers and users of forest tree seed and planting stock comprise the following categories:

- (a) State Forest Departments and Forest Development Corporations,
- (b) ICFRE and ICAR institutions and universities,
- (c) Public and private sector companies,
- (d) Proprietorship and partnership firms, and
- (e) Individuals/ farmers.

Other stakeholders will be processors, dealers and distributors of such seed and planting stock. There are no recognized varieties and genetically improved seed sources for forest tree species, and the availability of clonal material is far too short of requirements.

Unlike seed of agricultural crops, there are three key parameters which need to be considered for certification of forest seed / forest reproductive material i.e. source, category and physical quality of seed / FRM.

a. Source

The exact geographical location from where seed / FRM is collected. For example in the Indian context, where seed zones for seed collection have not been delineated, the source of seed / FRM collected from areas under the control of forest departments, following particulars should be clearly mentioned for each lot of seed/ FRM:

- Compartment Number
- Forest Block
- Forest Range,
- Forest Division
- Agro-climatic Region of India
- State
- Altitudinal range
- Latitude and Longitude

If the seed / FRM is collected or produced in areas outside the legal definition of forest, then following particulars should be furnished:

- Name and address of producer / collector of seed / FRM
- Details of land i.e. Khasra number and Khatauni number and name of revenue village
- Tehsil or Taluqa
- District
- Agro-climatic Region of India
- State
- Altitudinal range
- Latitude and Longitude

We strongly recommend adoption of aforesaid procedure for confirming the source of seed / FRM for certification till the Seed Zones are finally delineated after thorough review.

b. Category

Category of seed shall be indicative of genetic quality of seed / FRM and the stage of tree improvement programme relevant to seed / FRM to be certified. We recommend following four categories of seed / FRM to be certified:

1) **Source-Identified Reproductive Material:**

The two requirements of this category are (i) the source or the exact geographical area where the reproductive material is collected and the origin of the basic material (which may be indigenous or non-indigenous) shall be defined and registered by a Designated Authority (ii) the seed shall be collected processed and stored and plants shall be raised under the supervision of a Certifying Authority as per guidelines issued by a Designated Authority.

2) **Selected Reproductive Material:**

The three requirements of this category are (i) the source or the exact geographical area where the reproductive material is collected and the origin of the basic material (which may be indigenous or non-indigenous) shall be defined and registered by a Designated Authority, (ii) the seed shall be collected processed and stored and plants shall be raised under the supervision of a Certifying Authority as per guidelines issued by a Designated Authority, (iii) The reproductive material shall be derived from basic material which conforms to the requirements given in Annexure I and has been approved and registered by a Designated Authority

3) **Reproductive material from Untested Seed orchards:**

The three requirements of this category are (i) the source or the exact geographical area from which the components of the seed orchard came and

the origin of these components (they may be indigenous or non-indigenous) or breeding records shall be defined and registered by a Designated Authority (ii) the reproductive material shall be derived from the basic material which conforms to the requirements given in Appendix I and has been approved and registered by a Designated Authority; (iii) the seed / FRM shall be collected processed and stored and plants shall be raised under the supervision of a Certifying Authority as per guidelines issued by a Designated Authority.

4) **Tested Reproductive Material:**

The four requirements of this category are (i) the source or the exact geographical area from where the reproductive material is collected and the origin of the basic material (which may be indigenous or non indigenous) shall be defined and registered by a Designated Authority (ii) the genetic superiority of the basic material shall be proved by tests (see Appendix II), (iii) the results of the tests shall be registered by a Designated Authority; (iv) the seed / FRM shall be collected processed and stored and plants shall be raised under the supervision of a Certifying Authority as per guidelines issued by a Designated Authority.

c. Physical Quality

It is absolutely essential to examine physical quality of seed / FRM meant for certification in an approved FRM testing laboratory to ascertain and certify following parameters:

- Purity of seed / FRM
- Extent of mixture or seed of weed if any
- Germination percentage
- Number of seed per kg of seed weight.
- Health and hygiene of seed / FRM
- Incidence of diseases / pests if any
- Vigour of seedlings and clonal planting stock
- Uniformity of clonal plants
- Symptoms of nutritional imbalances or deficiencies if any e.g. extent of chlorosis.

The elements of a comprehensive national certification scheme for forest seed /FRM are as follows:

- (a) Inspection of the seed source by a qualified and designated professional forester before pollination of the seed crop. At this time flowering, the quality of the seed trees, incidence of inferior trees and effectiveness of the isolation can be checked well before seed collection. Many forest trees do not produce seed every year and, after the first inspection, subsequent re-inspections are made only in years when seed is to be collected.

- (b) Assessment of the cone or fruit crop by a qualified and designated professional forester at an appropriate time before seed collection begins.
- (c) Collection of the cones or fruits by a registered seed collector; extraction, cleaning and packaging of the seed at a registered seed extraction plant; and storage of the seed at a registered seed store. The records of collection, processing and storage are made available for inspection and the labels must conform to minimum requirements.
- (d) Testing, under the rules of the International Seed Testing Association, of an adequate sample of the seed at an official seed testing station/laboratory.
- (e) Sowing of the seed in a registered nursery where labels and records satisfy minimum requirements. A qualified and designated professional forester should make inspection of the seedlings and transplants before the same are certified, lifted and dispatched.

5.4 Minimum Requirements for Certification of Seed and Plants

The minimum requirements for certification are as follows :

Previous history of the Seed source

A seed stand or seed production area may be formed in a natural stand (established by natural regeneration) or plantation (established by planting or sowing) of indigenous or introduced species of unknown origin.

Isolation from foreign pollen

The requirements for isolation of seed production areas and seed orchards from large stands of inferior trees of the same or closely related species and for the width of isolation strips vary somewhat with species and country. A generalized prescription for isolation distance for seed production areas and seed orchards is not possible as pollen from far away sources can fertilize female flowers of trees miles away in seed orchards particularly in case of conifers (White et al., 2007). Hence, Designated Authority may prescribe isolation limits in case of seed orchards of notified species keeping in view the pollen dispersal of concerned species, terrain and other practical considerations.

Field inspection of seed trees, seed crop and plants

Inspection of seed sources, seed production areas and seed orchards must be made by qualified and designated professional foresters nominated by the certifying agency. The standards for seed production areas are based on the number of vigorous, well-formed and healthy seed trees per hectare and removal of inferior trees. Inferior trees are marked by the inspector and if possible felled while he is in the area, but the

rate at which inferior trees are removed is often determined by local silvicultural requirements and re-inspection may be necessary when the fellings are completed.

During seed collection and processing, the cones, fruit and seed must be handled so as to prevent mixture and maintain exact identity. Similarly, mixture must be prevented and exact identity maintained in the seed store and when raising plants in the nursery.

Standards for germination and purity

The methods of determining purity, germination and moisture content and the standards of health supervision with regard to seed-borne pests and diseases are generally based on that set by the Forest Tree and Shrub Seed Committee of the International Seed Testing Association (ISTA). Standards of germination and purity for purposes of sowing the seed and getting a good yield of plants are available for a very wide range of species.

Labels and certificates

In 1950, FAO and IUFRO jointly prepared an international certificate of origin and quality for tree seed and plants and this carries a large amount of information. This certificate has great value in exchanges of small quantities of seed for provenance research, but something simpler is needed for bulk trading in tree seed and plants. Such a certificate would bear the following items (Mathews *et al.*, 1964): -

Certifying agency

Consignee (name and address)

Sender (name and address)

Species (Latin name)

Subspecies variety or cultivar name

Category (source-identified, selected, tested)

Provenance (reference number, place or region, elevation) or Seed Source

Gross weight of packages

Contents (seed or plants, quantity)

Seed treatment given (date, place, method, chemical used).

Reference numbers

Comprehensive yet simple methods of identifying the origin of seed and plants by means of reference numbers or letters are of great assistance in administering a comprehensive certification scheme. FAO has adopted the universal decimal classification system by which each country is identified by a permanent number consisting of three digits.

5.5 Methodology for FRM certification

Gopal and Pattanath (1979a) outlined some of the elements of forest seed certification in the scheme published during 1979. The full text of the scheme developed by Gopal and Pattanath (1979a and 1979b) under the Indo-Danish Project is given in Annexures – I and II. We propose the adoption of the scheme, i.e., Certification of Forest Reproductive Material in India, 1979a with suitable modifications as suggested by us in this report. These modifications have become necessary in view of the changed circumstances and priorities as well as many significant developments in the forestry sector since 1979. For instance, reforestation of degraded forest lands, waste lands and large scale promotion of agro-forestry plantations need to be given very high priority.. Some of the suggested changes are as follows: -

- (i) Producers, traders or users of FRM should not have the responsibility for certification of seed or planting stock for obvious reasons. We recommend a separate, independent and autonomous authority for FRM certification, regulation and control. The Designated Authority should be a Committee to be set up by the Government of India headed by Director General of Forests, MoEF as explained in chapters 6 and 7 of this report and not the Conservator of Forests, Research of the State concerned.
- (ii) The programme on species improvement and production of adequate quantities of genetically improved seed/ FRM should be coordinated by the National FRM Development Committee and State FRM Development Committees.
- (iii) Seed / FRM Source should be indicated and certified as per details given under section 5.3 of this chapter of our report. The recommended approach is rational, easy to adopt and implement and therefore should be adopted straight away. In due course, seed zones should be revisited and delineated by the Regional/State FRM certification committees and approved by the Designated Authority. The new States formed since then, should also be incorporated.
- (iv) National/State FRM Development Committees must pay particular attention to enhance production of genetically improved seed/ FRM of high quality supported with sound tree improvement and breeding strategies both inside the forests and by the private sector.
- (v) Norms for inspection, sealing, labeling and issue of certificates should be changed as explained in our report.
- (vi) Above all, both production and certification of forest seed / FRM must have statutory support through a separate enabling legislation by the Central Government for ensuring that the Central and State Governments really pay due attention to these critically important areas. We must make earnest efforts for achieving self sufficiency in

genetically improved seed of all important species in a time bound manner through innovative policies and allocation of adequate financial and human resources. Accordingly a draft Forest Reproductive Materials Bill 2008 forms part of this report.

The Designated Authority shall have the overall responsibility of guiding and implementing the programmes for production and certification of seed / FRM during the first two phases as explained in chapter 6 of this report and later in accordance with the provisions of the proposed Forest Reproductive Materials Bill 2008 and rules to be made there under during phase III. The Designated Authority may constitute one or more number of sub-committees as it may deem appropriate to exercise such powers and perform such duties as may be delegated to them by the Designated Authority

As the workload for FRM Certification will not be very large in many States initially, we propose setting up of Regional FRM Certification Committees. The Central Government may set up such Regional Committees in consultation with the concerned State Governments and the Designated Authority. Such Regional Committees may have their Head Quarters at the Regional Forest Research Institutes of the ICFRE. Later any or all State Governments may set up State FRM Certification Committees if deemed necessary in consultation with the Central Government and the Designated Authority as per provisions of the proposed FRM Bill.

5.6 Forest Reproductive Material Certification

We recommend recognition of four broad categories of seed / forest reproductive materials.

- (a) Source-Identified Forest Reproductive Material
- (b) Selected Forest Reproductive Material
- (c) Forest Reproductive Material form Untested Seed orchards
- (d) Tested Forest Reproductive Material

List of Approved Basic Material

The Designated Authority and the Regional / State FRM Certification Committees shall issue guidelines to enable each State Government to compile and furnish the following information to Designated Authority in respect of FRM sources:

-

- (a) List of seed available in different seed zones (source identified material).
- (b) List of seed production areas
- (c) List of plus trees.
- (d) List of seed orchards.
- (e) Test results of progeny and provenance trials.

- (f) Test results of clonal trials
- (g) Details of tested superior clones recommended for large scale multiplication

Uniformity of methods and procedures is essential for seed / FRM testing and certification throughout the country. It is necessary that a central Designated Authority in the Ministry of Environment and Forests take up the overall direction and control while ICFRE should coordinate the technical and scientific aspects. Our proposals about required institutional framework are outlined in Chapter 6.

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CHAPTER – 6

INSTITUTIONAL FRAMEWORK AND SUPPORTIVE INFRASTRUCTURE

6.1 Introduction

State Forest Departments and Forest Development Corporations collect forest reproductive material (usually forest seed) for their internal use and for supply to the public, mostly as nursery plants. According to the Seed Bill, 2004 drafted by the Ministry of Agriculture and Cooperation no seed certification is needed for internal use of FRM by SFDs / FDCs and farmers. However, supply of plants to the public would attract its provisions. In view of the scale of plantation forestry in India and its consequent ecological and economic impacts in the long run, it is desirable that the forest departments use certified seed of excellent genetic quality ensuring the right category and source as well as excellent physical health and vigour for improving productivity of plantations.

Research has shown that if forests are to be of increased value including the aspects of stability, adaptation, resistance, productivity and diversity, it is necessary to use reproductive material which is genetically superior and phenotypically suited to the site and of high quality (EU, 1999). FRM is the basic material on which the success and productivity of plantations as well as quality of produce largely depends. Therefore, it is imperative that all future plantations, both in the private sector and those raised by State Forest Departments / Corporations, are based on best available seed and preferably genetically improved and certified seed / FRM. This, as a matter of fact, is the most urgent matter and should be attended to immediately (Shyam Sunder, pers. comm.).

Seed costs are usually very small, about one to two percent of the plantation costs, but genetic quality of seed or planting stock used for raising plantations impacts the growth rates, productivity and quality of produce immensely throughout the rotation period and also the subsequent coppice crop. Hence the benefits of higher productivity and better quality produce from improved seed sources far outweigh the extra cost of good seed/ planting stock. Therefore, it makes sound economic and technical sense to invest in genetically improved seed / FRM for planting short rotation as well as long rotation trees both for reforestation and farm forestry projects.

6.2 Forest Seed Certification

The State Forest Departments / Forest Development Corporations and the public and private sector companies are extremely short of genetically improved forest seed sources to meet their current and growing requirements. Hence there is an urgent need for major policy initiatives and sound scientific programmes for developing adequate seed sources to achieve self-sufficiency in a reasonable time frame. The ICFRE should coordinate with the proposed National and State FRM Development Committees and support the efforts of all the stake holders for building up capacity for self sufficiency in superior/ certified seed of all important planted

species in a time bound manner. Programmes for improvement of forest seed and other reproductive material (FRM) must be backed by sound breeding strategies and principles of forest genetics.

Proposed National and State FRM Development Committees should realistically assess the short term and long term requirements of improved seed / clonal planting stock of all important commonly species in consultation with user agencies including the State Forest Departments/ Corporations and wood based industries. After prioritization of these short listed species, sound long term breeding strategy should be formulated and breeding as well as production populations should be established. Selection of adequate number of candidate plus trees, establishment of sufficient areas under seed production areas, seedling seed orchards and clonal seed orchards for improved seed production must be ensured. Field tested commercial clones already developed by private sector and research institutes should be registered and multiplied on large scale for use in reforestation projects as well agro-forestry plantations

Formal seed certification under a law, whether under the proposed Seed Bill 2004 or an altogether new law for forest seed may take several years to materialize because of procedural delays in enactment of legislation and notification of rules to be framed under the new Act. The moot question is whether we should wait till then? India pays a huge price on account of lost productivity and poor quality of timber because we keep planting millions of seedlings of dubious genetic quality year after year. This must change fast as land resources are limited and we must make constant efforts for improving productivity and quality of planted timbers through increased use of superior certified seed/ planting stock.

The regulatory and institutional framework for forest tree seed and planting material certification should be different from seed certification of agricultural crops as there are vast differences between the two sets of seed / planting stock. A legal framework has been suggested in the form of the proposed Forest Reproductive Materials Bill, 2008. However, it may take a long time for this proposed legislation to be passed by the Parliament and enacted into a new law. But measures for speeding up production of genetically improved seed/ FRM and certification of it should not be delayed further. We, therefore, propose that all necessary steps must be taken for increasing production of genetically improved seed and that certification of seed / FRM should be taken up urgently straightaway, in three phases as follows:

6.3 Phase I

All forests managed by SFDs have now been brought under the purview of working plans/management plans as per the directions of the Hon'ble Supreme Court. All plans now require the approval of the Central Government. It is our considered view that the Central Government should amend the forest working plans code and persuade the States / UTs to ensure that Forest Departments/Corporations use only certified FRM for their plantations. To implement this directive, the Central Government should provide financial and technical support. As a matter of fact training and capacity building of all stakeholders is likely to be a major investment.

Without this, meaningful certification may not take place and India would be left behind internationally in this important area (Ryan, pers. comm.).

We feel that the seed zones delineated by the Indo-Danish project should be revisited and improvements / alterations, as may be necessary, should be incorporated. We have indicated the modifications required in Chapter-5. Delineation of seed zones must also take into account the FRM available outside forests, for instance farm and agro forestry plantations and on other institutional lands. Accordingly, we have suggested a very simple and practical approach for indication of source of seed / FRM to be certified both in cases of seed / FRM produced by State Forest Departments and private sector organizations / farmers in Chapter-5 under section 5.3. Details given in that section about description of source, categories and physical quality of seed / FRM can straight away be adopted for certification.

We recommend that all States / UTs should implement time bound plans to achieve self sufficiency in genetically improved seed / planting stock and shift to use of only certified FRM as early as possible. This would entail, among others, substantial efforts to build the capacity of foresters to undertake this important task. It is strongly recommended that the Ministry of Environment & Forests should take effective steps in this direction including speeding up establishment of National and State FRM Development Committees with adequate long term funding support and proper infrastructure facilities. The following four categories of seed / forest reproductive materials should be recognized for certification of seed / planting stock of species proposed to be notified under the rules to be framed under the proposed Forest Reproductive Materials Bill, 2008.

1. Source identified seed / FRM
2. Selected Forest Reproductive Material
3. Forest Reproductive material from Untested Seed orchards
4. Tested Forest Reproductive Material

Details of these four categories have already been given in Chapter - 5 under section 5.3. Producers desirous of getting their seed/ planting stock certified shall notify the Certifying Authority well in time about location of production area and period / time of production/ collection so that a representative of the Authority can monitor the process of production, collection, processing, grading, packing, labeling etc. Producers shall pay prescribed fees to the Certifying Authority for their services.

Designated Authority

We therefore recommend that a Committee on FRM should be set up by Government of India to be headed by Director General of Forests, Government of India. This Committee shall be the Designated Authority under phase I of the scheme. As the quantities of seed to be certified will not be huge initially, a group of States may have a Regional Forest Seed Certification Authority or each state may set up state level Forest Seed Certification Authority. These bodies will have statutory back up after the Seed Bill 2004 or Forest Reproductive Materials Bill, 2008 is approved by Parliament and enacted into law during phases II and III.

The members of the Designated Authority shall be as follows:

1. Director General of Forests, Government of India (Chairman)
2. Additional Director General of Forests (Forest Conservation)
3. Director General, Indian Council of Forestry Research & Education (ICFRE)
4. Dy. Inspector General of Forests (FC) or one who deals with this subject should be the Member Secretary.
5. Joint Secretary to Government of India, Ministry of Environment & Forests.
6. Inspector General of Forests (National Afforestation and Eco Development Board.)
7. Director, FRI, Dehra Dun.
8. Director, KFRI, Peechi, Kerala.
9. A representative of the Ministry of Agriculture and Cooperation not below the rank of Deputy Director General.
10. Two Eminent Tree Breeders/Forestry Science Experts.
11. Six Principal Chief Conservator of Forests to represent North, South, East, West, Central and North-Eastern Zones (tenure for a period of three years on rotational basis)
12. Two members from reputed NGOs.
13. Three representatives from the private sector engaged in developing, producing, processing, or trading or planting of FRM
14. Three eminent retired foresters / tree breeders..

The Designated Authority would be responsible for and should have all the requisite powers for effective implementation of the FRM production and certification scheme. It shall advise the Central Government and the State Governments on matters relating to: -

- (i) Development of genetically improved seed/ FRM of all-important planted tree species to achieve self-sufficiency in a time bound manner in coordination with National FRM Development Committee to be set up.
- (ii) Advise and coordinate with Regional / State FRM Certification Committees on all issues related to certification and regulation of trade in FRM
- (iii) Determination and demarcation of the various regions of seed zones in respect of each of the notified species;
- (iv) Submission of proposals for revision of categories of Forest Reproductive Materials to Central Government from time to time if required;
- (v) Standards for registration, certification and testing of FRM and regulation of FRM trade as well as certification;
- (vi) Forest Reproductive Material registration and its enforcement;
- (vii) Monitor forest reproductive material certification and the quantity and quality such material available for domestic use and export.
- (vi) To establish and maintain record of different regions of seed zones and maps showing these regions of seed zones.

- (vii) Regulatory oversight on forest planting material certification and the use of standardized procedures and protocols as basis for such certification.
- (viii) Preparing new or amended legislation and ensuring that regulations as well as appropriate protocols for forest seed and planting materials (FRM) certification are in place;
- (ix) Regulation of export and import of FRM.
- (x) To perform such other functions as may be assigned to it by the Central Government

National FRM Development Committee

We propose setting up of a National FRM Development Committee, for the development of improved forest seed sources and assisting the Designated Authority in monitoring of the certification scheme at the central level, headed by DG, ICFRE with the following members: -

1. DG, ICFRE (Chairman).
2. Directors of the Regional Research Institutes of ICFRE
3. Deputy Director General Forests in-charge of ICFRE as Member Secretary.
4. Deputy Director General (In charge of FRM), ICFRE
5. Deputy Director General (Research), ICFRE
6. Representatives of six Principal Chief Conservators of Forests not below the rank of Chief Conservator of forests, to represent North, South, East, West Central and North-Eastern Zones (tenure for a period of three years on rotational basis).
7. Three eminent tree breeders
8. Two eminent retired foresters
9. Three representatives from the private sector engaged in developing, producing, processing, or trading or planting of FRM
10. Two representatives of agro-forestry farmers
11. One representative of traders in FRM
12. One representative from reputed NGOs.

The functions of this committee shall be as follows.

- (i) To formulate innovative plans and to help implement time bound programmes at the Central and State levels to develop adequate seed sources and clones of species amenable to vegetative propagation for all important plantation species supported with sound breeding strategies.
- (ii) To assist and guide similar committees to be set up at the State level by formulating suitable policies and to implement time bound programmes for achieving self-sufficiency in genetically improved

- sources of forest seed and tested clones of species of high importance to the State concerned.
- (iii) To guide and assist State level committees for scientific collection, processing, grading and storage of forest seed and maintain healthy and pure germplasm of tested and registered clones.
 - (iv) Development and production of Forest Reproductive Material to achieve self sufficiency in genetically improved and certified seed / FRM soonest possible.
 - (v) Establishment of guidelines and effective mechanism for the collection, processing, testing, certification, storage and distribution of FRM;
 - (vi) Establishment of an information network on the availability of certified planting materials with links to seed and planting materials collection, production and certification bodies in the country.
 - (vii) To establish and maintain the National Register of Approved Basic Material.
 - (viii) Establishment of an effective monitoring and evaluation system and protocols, complete with the necessary computer hardware and software manned by well-trained personnel.
 - (ix) Organize standardized training for production, collection, processing, testing, certification, packaging and storage of Forest Reproductive Material.
 - (x) Maintain regular liaison with the Designated Authority and the Regional FRM Certification Committees and State FRM Development Committees.
 - (xi) To perform such other functions as may be assigned to it by the Central Government.

Regional FRM Certification Committee

The Central Government may constitute any number of Regional FRM Certification Committees for certification of FRM in the States served by the Committee. The Regional FRM Certification Committees shall also be responsible for organizing training programmes for collection, processing, testing, certification, packaging and storage of Forest Reproductive Material. The Regional Committees will also carry out all of the functions of State FRM certification Committees in a State till that State is able to set up its own FRM Committee.

The State FRM Development Committee

The State Governments should set up FRM Development Committees for each state/ union territory with the following functions: -

- (i) To formulate innovative plans and to help implement time bound programmes at State level to develop adequate seed sources and clones

- of species amenable to vegetative propagation for all important plantation species supported with sound breeding strategies.
- (ii) Coordinate strategies, plans and policies for development and production of genetically improved seed / FRM sources with the National FRM Development Committee.
 - (iii) Establish seedling and clonal seed orchards as appropriate and feasible for selected species.
 - (iv) Establish clonal multiplication areas or tissue culture capacity for selected and appropriate species adopting experience already present in the private sector, state forest development corporations and state forest departments.
 - (v) Production, collection, processing, testing, and storage of seed.
 - (vi) Facilitate the production of clonal planting materials (ramets produced through macro- propagation or tissue culture).
 - (vii) Advise the State Governments on registration of FRM producing units, FRM processing units, FRM dealers, traders and forest nurseries.
 - (viii) Advise the State Government on all matters arising out of the administration and implementation of this Act.

The Designated Authority and the National FRM Development Committee must have close coordination not only amongst them but must guide the Regional and State level Committees both for production and certification of FRM guide and ensure similar coordination and cooperation between all concerned .

Mechanism for production of FRM

Non-availability of quality forest seed deters the farmers from growing trees (Gurudev, pers. comm.). It is, therefore, necessary to develop forest seed production systems within the forest areas and facilitate the private sector to take up this activity. The National FRM Development Committee is expected to advise/assist the State FRM Development Committees in the development of basic material and adequate sources / quantities of genetically improved seed/ FRM through appropriate tree improvement and breeding strategies. The work may be organized as follows: -

- 1) Selection of high quality seed stands, establishment of seed production areas and selection of candidate plus trees based on phenotypic selection in different seed zones of various species for production of seed. The plots will be demarcated, inferior trees and species likely to hybridize will be removed and crop thinned so as to free their crowns for production of seed to the full potential of the seed trees. The seed plot record will be maintained as done in case of sample plots.
- 2) Establishment of Seedling Seed Orchards and Clonal Seed Orchards and scientific maintenance of same for production of requisite quantities of genetically improved seed/ FRM of all important planted species
- 3) The total area of these seed plots will depend upon the total quantity of seed required for each species. The Silviculturist in association with his territorial counter part will carry out these activities. Protection of the seed plot will be the responsibility of territorial division as usual and Silviculturist will give necessary

treatment to the crop. Collection of the seed, transport/ processing, certification packing and providing labels will be done by or through the Silviculturist. Efforts should be made to make forest seed available to all.

- 4) Innovative policies should be followed to encourage and motivate private sector to play an increasingly important role in production and supply of genetically improved seed/ clonal planting stock of important species.
- 5) Seed processing, seed testing, certification will be done at centrally located places well connected by rail/ road. Seed processing and seed testing units will required to be created according to the quantum of work. Similarly, modern storage facilities for seed depending upon the quantity to be stored, duration of storage needed and climatic conditions etc. will have to be created, wherever required.
- 6) The mechanism proposed above for ensuring production of adequate quantities of genetically improved seed/ clonal planting stock and use of certified seed in future plantations to be raised by the State Forest Departments / Corporations must find a mandatory place in the forest working plans. The Working Plans Manual issued by the MoEF should be accordingly modified soonest possible.
- 7) Adequate attention must also be given to farmers for kisan nurseries, whose requirements will usually be distinct from those of larger scale plantation programmes. State Forest Departments supporting such nurseries must ensure supply of genetically improved certified seed for such nurseries. In this context, the small bag approach developed under a DANIDA project in Nepal deserves a serious consideration. Small farmers cannot afford to travel long distances and need only small amounts of seed. Therefore, high quality seed needs to be brought to the farmers. High quality seed produced by national/state tree seed improvement programmes and packed in small bags can be distributed using existing distribution networks for farm and horticultural commodities

Minimum standards

The biggest difficulty in implementing forest seed certification will be lack of information on minimum standards for seed certification. The Designated Authority should fix minimum seed certifying standard for all the notified plantation species including standard protocols for seed collection, processing, grading, packing and labeling etc.. Designated Authority should setup an appropriate centre for focused attention on this important issue related to minimum standards and for further research/ development

We were informed that the MoEF has requested MoA&C to delete the word “forestry” from the definition of “agriculture” in the Seed Bill, 2004 and that MoEF intends to draft its own law on FRM. However, as discussed above we recommend that desirable steps must be initiated forthwith to develop adequate seed sources and certification protocols and that we need not wait for the proposed law to come on the Statute Book. We would like to point out here that the Seed Bill 2004 is still awaiting approval of Parliament. We would also like to draw attention to the seed certification

systems in Australia and U.S. A. The U.S. has no Federal Law and Australia does not feel the need for it as both the producers and users of forest seed / FRM fully appreciate and recognize the immense benefits of using genetically improved seed / FRM.

The above approach, we believe, would promote inclusive development of plantation forestry both in and outside forests in the larger national interest of sustainable forest management with due regard to economic and ecological considerations. In short, adoption of an FRM certification scheme is an urgent necessity. It may not be linked to legislation on the subject as the enactment of enabling legislation, framing of rules and setting up of the institutional mechanism under the proposed FRM Bill may take a long time.

We are laying greater stress on the pro-active role of the Central Government for ensuring the success of the scheme for development, production and certification of genetically improved seed in a time bound manner. Forestry activities in the country are largely supported by the Central Government. Moreover, forestry and wildlife are on the concurrent list of the Constitution of India.

We conclude this section pertaining to Phase I by urging the MoEF and State Governments to adopt and implement the FRM development, production and certification scheme as suggested above forthwith, constitute a Designated Authority and other suggested Committees, develop adequate sources of genetically improved FRM, and issue administrative orders to State Forest Departments/Forest Development Corporations to switch over to use of only certified FRM soonest possible. Thereafter, as proposed above, a new law on FRM may be enacted and implemented in due course.

6.4 Phase II

In case the Seeds Bill, 2004 is passed before the proposed Forest Reproductive Materials Bill 2008, we recommend that Central and State Governments should proceed as follows:

1. The Seeds Bill, 2004 covers seed / FRM of forestry species as well and provides for establishment of any number of sub-committees.
2. The National Committees and Regional/ State level Committees suggested under phase I should be renamed and become subcommittees of the main Central Committee under the new Seed Act. In other words, we should have sub-committees at the national level to serve as Designated Authority and FRM Development Committee.
3. Likewise, we should have regional sub-committees for certification of FRM etc. Similarly, sub-committees may be set up at the State level in consultation with the State Governments.
4. The additional requirement would be to have a forestry cell in each of the State Seed Committees under the Seeds Bill, 2004.

All other provisions during Phase II shall be exactly as per details given under Phase I. Of course statutory support to the production and certification of seed/ FRM

will be available on enactment of Seed Bill 2004 into a law and notification of suitable rules for forest seed/ FRM under the same relating to production, certification and trade.

Staff requirement for FRM certification

According to Seed Bill, 2004 no seed can be sold without certification. Forest reproductive material is also produced / traded by private sector companies on a fairly large scale. Among the species are nursery plants of poplar and eucalyptus clones; and nursery plants of casuarinas, acacias, kadam, *Melia* etc. Private dealers in forestry seed also sell forestry seed in large quantities but the source of such seed is normally not known and mostly these are procured from forests and are of dubious genetic quality. Not infrequently the purchasers may be forestry personnel themselves. The new Seed Act will put an end to this unprofessional approach, as the dealers will have to specify the source of procurement before certification. Seed sold by the private sector will also be a subject matter of inspection by seed inspectors appointed under proposed Act. Similarly reproductive material of medicinal and aromatic species of forest origin will also come under its purview. As discussed above, State Governments may designate suitable officers as Seed Inspectors

The basic staff for a Regional / State FRM /Sub-committee may include: -

- (a) Director: Shall be responsible for the overall functioning of the agency and should be represented on all committees constituted for the purposes of variety/ clone release, notification, formulation of standards for certification, etc.
- (b) Supervisory Officer: a Deputy Director/ Chief Seed Certification Officer may head the forest cell. He may be assisted by Assistant Seed Certification Officer(s) etc. to ensure that the prescribed minimum standards are met before a seed lot is finally certified. He should also train Seed Inspectors, forestry personnel, processors and all personnel involved in seed production with regards to techniques and regulations.
- (c) Seed Certification Inspectors: Seed Certification Inspectors are considered to be the technical manpower/input in a certification programme. They should be thoroughly trained for their job. A seed certification inspector may accept or reject the seed crop on the spot in the field and report the fact to his supervising officer giving logical and valid reasons. Such decisions shall be subject to appeals and review by higher designated authorities.

The duties and responsibilities of Seed Certification Inspector will be as under: -

- (i) To arrange for suitable application, inspection and reporting formats.
- (ii) To identify sources of improved FRM that can be used for further multiplication.
- (iii) To ensure that all clonal material for production of clonal seed orchard seed or clonal planting stock has originated from acceptable approved basic sources.

- (iv) To ensure through field inspection that the prescribed minimum standards for isolation, planting distance, rouging and other requirements as specified in the seed certification standards are met.
- (v) To assist the seed producer at the time of harvesting, drying and processing to ensure that these are done correctly. This is particularly true for new producers who are just gaining experience. It should not be necessary to supervise every step of the operation after the staff has gained adequate experience in the programme.
- (vi) To sample and inspect seed lots and submit such samples to the seed testing laboratory, in order to ensure that the prescribed seed standards are met.
- (vii) To issue certification tags for the entire quantity of a seed lot conforming to standards. Ultimately, more responsibility of this kind is to be borne by the staff themselves.
- (viii) To maintain adequate records, so that the eligibility of seed lots can be determined in subsequent years.
- (ix) To operate in such a way as to ensure a close working relationship between certified seed growers, dealers, research personnel, government officials and others who have interest in certified FRM.
- (x) To investigate vigorously any violation of prescribed standards or complaints from users of certified seed and subsequently to take appropriate corrective action.

Looking to the flowering and fruiting habit of forest species the quantum of work in different months will be different. Seed production areas or seed orchards continue to be established, but many biological constraints remain. Flowering and seed setting of forest trees is often erratic and cost-effective methods of stimulating seed production have not been devised. Even if lowering is abundant, actual pollination and fruit formation may be poor or there may be very few healthy and viable seed. The actual time of seed harvest is important to ensure that seed is at its peak physiological maturity. Tackling these constraints requires a good understanding of the reproductive biology of the species (Marcus and Robbins, 2003). The number of posts of inspection staff will depend upon the number of sites to be visited, approachability and distance between different sites.

6.5 Phase III

By the time situation ripens for Phase III, all the stakeholders i.e., the producers of FRM, sellers and the users would have become used to a culture of seed certification under Phase I & II. It is necessary to provide a legal back up shield to forest seed certification under a special Act so as to consolidate the gains and ensure compliance. Use of certified seed and planting stock would be made mandatory for the organizations that use public money for raising tree plantations (such as State Forest Departments / Corporations, ICFRE, ICAR institutions etc.) and listed companies except where the FRM is required for research purpose. For individual users like farmers, choice between certified or uncertified FRM will remain and for them certification would be optional. However, sale of uncertified FRM will not be allowed. All registered nurseries must produce only certified planting stock from

certified seed and registered clones. The State forest Departments must ensure that genetically improved and certified seed is supplied to decentralized nurseries / kisan nurseries and such nurseries must also produce certified superior seedlings.

Phase III will be applicable when the proposed Forest Reproductive Materials Bill, 2008 is enacted into a new law and suitable rules are framed and notified there-under. Eventually, we feel that in the long run, this is the most important phase. Establishment of a Designated Authority and various other committees at Central / Regional and State levels shall be as under phase –I and as provided for in the Forest Reproductive Materials Bill, 2008. Implementation of various provisions of the new Act and rules made there under would ensure a systematic treatment of development, production and certification of FRM, and would contribute immensely to development of high yielding plantations and sustainable forest management. The administrative, technical and legislative approaches suggested are expected to facilitate increase in productivity consistent with conservation of forest genetic resources. The approach envisages, among other things, the following.

- (1) Enactment of the draft Forest Reproductive Materials Bill, 2008 into a law and framing / notifying rules under the new Act.
- (2) Implementation of the provisions of the New Act and rules notified there-under

The structure, composition and functions of the Designated Authority and various other central, regional and state level committees for development, production and certification of seed / FRM will be as provided for in the Forest Reproductive Materials Bill, 2008 and explained under Phase I.

6.6 NBFGR

We strongly recommend the establishment of a National Bureau of Forest Genetic Resources with a suitable mandate on the lines of NBPGR for various issues related to Forest Genetic Resources including ex situ conservation of endangered and rare species of forest flora, authentic seed samples, registration of clones and supply of basic clonal planting stock to prospective producers of certified clonal planting stock etc.

Clones of species like poplars, eucalyptus, acacias etc already developed by private sector or ICFRE/ State Forest Departments/ Corporations shall be registered with NBFGR based on published data related to testing of these clones. The basic germplasm of clonal planting stock of such clones can be obtained by new registered nurseries either from NBFGR or specified approved institutions/ organizations.

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CHAPTER – 7

NEED FOR SEPARATE LEGISLATION FOR FOREST REPRODUCTIVE MATERIAL

7.1 Introduction

The importance of using certified forest reproductive material, which is genetically improved and phenotypically suited to the site in terms of forest stability, adaptation, resistance, productivity and diversity, is well recognized. The FAO organized a regional workshop of South East Asian countries in 2001 on conservation, management and utilization of forest genetic resources (Koskela *et al.*, 2002). It was recognized that countries of the region had a great need to exchange germplasm externally to support their afforestation efforts and for promoting sustainable forest management. The workshop came up with a list of priority species many of which are important for India as well.

One of the issues for discussion on the management of forest genetic resources was the weak enforcement of law. It was pointed out that while laws and regulations are in place in many countries, their enforcement is inadequate. In the preface to a scheme for the production, distribution and sowing of certified reproductive material, submitted to the Government of India for implementation in various forestry plantation programmes in the country, the then Inspector – General of Forests mentioned that certification in forestry seed in India should be voluntary, yet experience in the agricultural sector in many countries shows that seed certification can be effective only if it is suitably armed with effective legislation (Khullar *et al.*, 1992).

As noted in Chapter 3, countries of the European Union have enacted laws governing the marketing of Forest Reproductive Material. These laws are based on the European Council Directive no. 1999/105/EC/ of 22 December 1999. Similarly, the object of the OECD Forest Seed and Plant Scheme June, 2007 is to encourage the production and use of seed and plants that have been collected, transported, processed, raised and distributed in a manner that ensures their trueness to name. The scheme is for FRM moving in international trade even though the scheme does provide a framework for enactment of a law on FRM. In practice, the OECD scheme mainly deals with trade between Europe and North America. In contrast to the EU directive, the scheme is optional and countries participate and use the scheme on a voluntary basis (Ackzell, 2002).

The People's Republic of China has a common law for agricultural and forest seed, and the goals of enacting the law include promotion of quality seed and acceleration of the development of plantation and forest industries. The law prescribes a license for production of seed, and seed production “free of quarantine plant diseases etc.” (www.fdi.gov.cn/pub). However, penalties for violation of the law are mild. In the U.S.A., as noted in Chapter 3, some 20 states have laws to regulate trade in FRM.

7.2 Need for Separate Law on FRM

If we have to identify single most critically important area of vital importance to scientific development of afforestation and agro-forestry plantations projects in India, that is the urgent need for development, production, certification and use of genetically improved seed and forest reproductive materials. This should be based on sound principles of forest genetics & appropriate breeding strategies as well as statutory support of legislation for development and certification of forest seed / FRM. High genetic quality of seed / planting stock, of commonly planted important tree species, supported with sound silviculture and plantation management technologies, will lay the foundations of a new green revolution - this time in forestry sector.

Millions of so called cheap seedlings of questionable genetic quality continue to be planted in India year after year leading to extremely low productivity of our scarce land resources and plantations, poor quality of produce and little economic returns. No wonder then that we continue to incur colossal recurring losses and pay a heavy price for neglecting the all-important area of improving genetic quality of planting stock through long term scientific breeding strategies. We can change all that positively with the enactment of a separate law for promoting development, production, certification and use of genetically improved forest seed / FRM, registration of nurseries and tested clones as well as regulation of trade in FRM.

We feel that the Seeds Bill (2004) is not appropriate and sufficient to address the requirements for FRM. This would not only require a number of amendments but may also be difficult to administer in so far as the FRM is concerned. The Ministry of Environment and Forests has the responsibility for FRM and it would be in the fitness of things if it came out with its own legislation solely for FRM.

The objectives of the Protection of Plant Varieties and Farmers' Rights Act, 2001 are quite different from the proposed Forest Reproductive Material Bill, 2008. While the former seeks to provide for the establishment of an effective system for production of plant varieties and protection of rights of farmers and plant breeders to encourage the development of new varieties, the latter seeks to establish mechanism for the development, maintenance and improvement of forests and agroforestry plantations with its manifold positive effects by providing high-quality forest reproductive material with secured identity.

In view of the foregoing discussion, it is apparent that a separate law on FRM is required as is the case in Europe. There are a number of special considerations peculiar to forestry, which are distinct from agricultural seed such as seed source or provenance; reliance on species rather than varieties and hybrids; tree seed take a much longer time to mature, from several months to over two years; trees being woody perennials rather than annuals where a generation of trees takes from several years to decades to mature; and the like.

We also interacted with Director General of Forests, MoEF Government of India. We were informed that the MoEF had advised the Ministry of Agriculture and Cooperation to exclude the word "forestry" from the definition of "agriculture" in the

Seed Bill, 2004. Moreover, through the Forest Reproductive Materials Bill 2008, the multiplicity/ overlapping of functions in MoA&C and MoEF would be avoided, as the Ministry of Environment and Forests would be responsible for the implementation of the proposed Forest Reproductive Materials Bill 2008. The forestry seed and forest reproductive material would be taken out of the purview of the proposed Seeds Bill, 2004.

7.3 Proposed Draft Law on FRM

In view of the foregoing, we propose the enactment of a separate new law on FRM. Accordingly, the draft Forest Reproductive Materials Bill, 2008 is being submitted with this report. The objective of this bill is to maintain and improve the forest with its manifold positive effects by providing high-quality forest reproductive material. The Bill also seeks to encourage the production and use of forest seed, parts of plants and plants that have been produced, collected, transported, processed, raised and distributed in a manner that ensures their trueness to name and quality. Heretofore there was no legal framework to establish a mechanism for providing and ensuring high quality forest reproductive material. In order to ensure achievement of objectives set forth in the proposed bill, we need to have a separate enactment exclusively on development, production, certification and regulation of Forest Reproductive Material in the country. The mandate of bringing in such an enactment lies with the Ministry of Environment and Forests responsible for the development of forestry in the Country as provided in the Allocation of Rules of Business issued by the Government of India.

Though for some purposes, trees raised on farmlands are treated as a crop and the income derived from them also forms part of the agriculture income, the subject matter of bringing in genetic improvement in the quality of such agro-forestry tree species on a scientific basis and to set standards for the forest seed and other reproductive material, lies in the domain of MoEF. Agro-forestry is only a small part of forestry development. It needs to be stressed that agro-forestry tree species are also derived from the forests and therefore a separate enactment to cover all types of forestry species is necessary. The MoEF has already conveyed its intention to enact a separate law on FRM. We fully endorse and support that view. Therefore, we propose a separate new law on development, production, and certification and trade in FRM on the lines of the laws developed by member states of the European Union.

7.4 Main features of the proposed law on FRM

The proposed Forest Reproductive Materials Bill, 2008 has following main provisions:

- (a) Constitution of Committees
 - (i) Constitution of a National Committee on FRM to be called the Designated Authority.
 - (ii) National FRM Development Committee

- (iii) State FRM Development Committees
- (iv) Regional FRM Certification Committees
- (v) State FRM Certification Committees

- (b) Registration of Forest Nurseries, FRM Dealers etc.
 - (i) Registration of FRM producing and processing units
 - (ii) Registration of forest seed / FRM dealers
 - (iii) Registration of FRM nurseries
 - (iv) Evaluation of performance of cultivars, clones etc.

- (c) Regulation of sale of certified FRM

- (d) FRM Testing
 - (i) FRM analysts
 - (ii) FRM inspection
 - (iii) Authorized officers

- (e) Export and Import of FRM
- (f) Offences and Punishment
- (g) Powers of Central Government
- (h) Setting up of National Bureau of Forest Genetic Resources

The Designated Authority shall be responsible for and shall have all the powers for FRM certification and effective implementation of the proposed FRM Act. Once the certification scheme proposed above becomes operational, India may consider becoming a member of OECD scheme. It is proposed to apply the law to only important plantation species, to begin with, which would be notified. Species and genera proposed to be notified are listed at Annexure-V.

Guidelines for maintenance of facilities for quality seed / planting stock production as per minimum acceptable standards should be provided to State Forest Departments by the National FRM Development Committee. Suitable recommendations have been made for registration of producers, dealers, distributors, and nursery owners for trade in certified seed and planting stock. Provisions for inspection, regulation, addressing of complaints, penalties for offences related to infringement of provisions of proposed law have also been made.

7.5 The Forest Reproductive Materials Bill, 2008

Draft of the proposed Forest Reproductive Materials Bill, 2008 follows in the next chapter.

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THE FOREST REPRODUCTIVE MATERIAL BILL, 2008.

STATEMENT OF OBJECTS AND REASONS

The object of this bill is to maintain and improve the forest with its manifold positive effects and genetic diversity by providing high-quality forest reproductive material with secured identity as well as to promote the scientific development of forests, afforestation and agro forestry plantations with high productivity and quality of produce. The bill also seeks to encourage the production and use of seed, clones, parts of plants and plants that have been produced, collected, transported, processed, raised and distributed in a manner that ensures their trueness to name and quality. The methods by which this bill seeks to achieve these objects are:

- a) Constitution of a Central Committee on Forest Reproductive Material called the Designated Authority consisting of representative of the Central Government, State Governments, Indian Council of Forestry Research and Education, Indian Council of Agricultural Research and others to advise the Government on all matters arising out of the proposed legislation.
- b) Constitution of National Forest Reproductive Material Development Committee.
- c) Constitution of Regional and State Forest Reproductive Material Certification Committees.
- d) Constitution of State level Forest Reproductive Material Development Committees.
- e) Defining sources and categories of seed/ Forest Reproductive Material and standards for approved basic material.
- e) Fixing of minimum standards for germination, purity and other quality factors.
- f) Testing of the FRM at the laboratories to be established by the Central and the State Governments.
- g) Creation of inspection and certification mechanism in each State and grant of certificates to dealers in FRM.
- h) Compulsory labeling of FRM containers to indicate the quality of FRM offered for sale.

CHAPTER I

Extent, Commencement and Applicability

1. Short Title, Extent And Commencement: - (1) This Bill may be called the Forest Reproductive Material Bill, 2008.

(2) It extends to whole of India.

- (3) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint, and different dates may be appointed for different provisions of this Act, and for different States or for different areas thereof.

2. Application: - The Act shall apply to the Forest Reproductive Material of categories mentioned in the Schedule and of the species notified by the Central Government from time to time for the purpose of this Act. Nothing in this section shall prohibit the Central Government to add, delete, modify or amend any of the Scheduled categories and the notified species.

CHAPTER II

Definitions

- 3. Definitions:-** In this Act, unless the context otherwise requires, --
- (1) “Act” means the Forest Reproductive Material Act.
 - (2) “Appellate Authority” means the authority appointed by the Central *Government* under section 32.
 - (3) “Appendix” means the appendices attached to this Act.
 - (4) “Approved basic material” means the basic material approved in terms of section 12 and section 14;
 - (5) “Authority” means the Designated Authority constituted under section 4;
 - (6) “Authorized officer” means an officer authorized under section 28;
 - (7) “Basic material” means trees from which reproductive material is obtained such as seed source, stand, seed orchard, parents of family, clone or clonal mixture.
 - (8) “Bonafide use” means the use of forest reproductive material for raising plantation on private land of the producer of the forest reproductive material or for sale, barter, market as uncertified forest reproductive material;
 - (9) “Category of Forest Reproductive Material” means the category of forest reproductive material as given in the Schedule to the Act;
 - (10) “Central Forest Reproductive Material Laboratory” means the Central Forest Reproductive Material Laboratory established or declared as such under sub-section 1 of section 26;
 - (11) “Certified Forest Reproductive Material” means the planting material certified by the Regional Forest Reproductive Material Certification Committee or the State Forest Reproductive Material Certification Committee;
 - (12) “Clone” means genetically uniform ramets derived originally from a single ortet by vegetative propagation;
 - (13) “Committee” means the National Forest Reproductive Material Development Committee formed under section 22;

- (14) "Container" means the box, bottle, casket, tin, barrel, case, receptacle, sack, bag, wrapper, tray or other thing in which any Forest Reproductive Material is packed, raised, contained or kept;
- (15) "Cultivar" means an assemblage of cultivated individuals, which is distinguished by any characters significant for the purpose of forestry and which when reproduced retains its distinguished features.
- (16) "Designated Authority" means the committee constituted under section 4;
- (17) "Export" means taking out of India to a place outside India;
- (18) "Forest Reproductive Material" means fruit, seed or seed units, parts of plants, clones or planting stock of forest trees, herbs, shrubs, grasses and bamboo..
- (19) "Forest Reproductive Material Analyst" means an analyst appointed under section 27;
- (20) "Forest Reproductive Material Dealer" means any natural or legal person engaged professionally in the dealing in sale or distribution of Forest Reproductive Material.
- (21) "Genetically modified material" means material which consists of genetically modified organisms, fruit and seed, or which contains such organisms.
- (22) "Import" means bringing into India from a place outside India;
- (23) "Indigenous Stand" means a forest stand which has been continuously regenerated by natural regeneration or one raised artificially from seed collected in indigenous stands of the same species.
- (24) "Kind of reproductive material" means one or more related species or sub species of trees used for forestry and include seed units, parts of plants, clones and planting stock.
- (25) "Marketing" means display of Forest Reproductive Material for sale, sale or delivery to another person as well as delivery to a third party for distribution or use.
- (26) "Master certificate" means the certification issued under section 17.
- (27) "National Register" means the register established and maintained under section 11.
- (28) "Notified species" means the species notified by the Central Government from time to time as envisaged in section 2;
- (29) "origin" means the place in which the trees are growing for the purpose of indigenous stand or seed sources and the place from which the seed or plants were originally introduced for the purpose of non-indigenous stand or seed sources.
- (30) "parts of plants" include stem, leaf and rooted cuttings, scions and layers intended for the production of plants.
- (31) "Plants" means the plants raised by means of seed or parts of plants which also include natural regeneration and clonal plants raised through vegetative propagation;
- (32). "Prescribed" means prescribed by rules made under this Act;

- (33) “Qualified manpower” means the manpower having qualification as may be prescribed by the Designated Authority;
- (34) “Regional Forest Reproductive Material Certification Committee” means the committee constituted under section 6;
- (35) “Schedule” means the Schedule to the Act;
- (36) “Seed” means the fruit or seed of forestry species including trees, herbs, grasses, shrubs and bamboo used as Forest Reproductive Material;
- (37) “Seed orchard” means a plantation of selected clones or seedlings progenies of selected trees which is isolated or managed to avoid or reduce pollination from outside source, managed to produce frequent, abundant and easily harvested crops of seed;
- (38) “Seed unit” means cones, infructescences, fruits and seed intended for the production of planting stock;
- (39) “Seed Zone” means the geographical area or group of areas subject to sufficiently uniform ecological conditions managed for producing seed of any notified species for raising of planting stock from seed and part of plants;
- (40) “Selected” means the reproductive material defined in the Schedule to this Act;
- (41) “Source identified” means the reproductive material defined in the Schedule to this Act.
- (42) “Stand” means a population of tree species possessing sufficient uniformity in composition, constitution and arrangement to be distinguishable from adjacent population;
- (43) “Standard” means the standards defined by the Designated Authority on the requirements given in the Appendices;
- (44) “State Forest Reproductive Material Certification Agency” means a certification agency established under section 8;
- (45) “State Forest Reproductive Material Development Committee” means a committee established under section 24.
- (46) “State Government”, in relation to a Union Territory, means the administrator thereof;
- (47) “Supplier of Forest Reproductive Material” means any natural or legal person engaged professionally in the production, marketing, processing, storage, trade, export or import of Forest Reproductive Material;
- (48) “Tested” means the forest reproductive material categorized as ‘tested’ in the Schedule to this Act;
- (49) “Transgenic variety” means seed or planting material synthesized or developed by modifying or altering the genetic composition by means of genetic engineering;
- (50) “Untested” means the forest reproductive material defined as ‘untested’ in the Schedule to this Act;

CHAPTER III
Constitution, Functions and Powers of Designated Authority

4. Designated Authority: -

1. The Central Government shall, as soon as may be after the commencement of this Act, constitute a Committee to act as Designated Authority for the purpose of this Act.
 2. The Director General of Forests, Government of India, Ministry of Environment and Forests shall act as Chairperson of the Designated Authority.
 3. The Designated Authority shall also consist of a vice chairperson, members ex-officio and other members, nominated by the Central Government.
 4. The Designated Authority shall have the following members, namely,-
 - Director General of Forests, Government of India (Chairman)
 - Additional Director General of Forests (Forest Conservation)
 - Director General, Indian Council of Forestry Research & Education (ICFRE)
 - Dy. Inspector General of Forests (FC) or one who deals with this subject should be the Member Secretary.
 - Joint Secretary to Government of India, Ministry of Environment & Forests.
 - Inspector General of Forests (National Afforestation and Eco Development Board.)
 - Director, FRI, Dehra Dun.
 - Director, KFRI, Peechi, Kerala.
 - A representative of the Ministry of Agriculture and Cooperation not below the rank of Deputy Director General.
 - Two Eminent Tree Breeders/Forestry Science Experts.
 - Six Principal Chief Conservator of Forests to represent North, South, East, Wes, Central and North-Eastern Zones (tenure for a period of three years on rotational basis)
 - Two members from reputed NGOs.
 - Three representatives from the private sector engaged in developing, producing, processing, or trading or planting of FRM
 - Three eminent retired foresters / tree breeders..
- (5) Save as otherwise specifically provided in the sub-section (4), the members of the Designated Authority shall hold office for a period of two years, which may be further extended to four years by the Central Government by re-nomination.
- (6) The Designated Authority may associate with it, in such manner, on such terms and conditions and for such purposes as it may deem fit, any person

whose assistance or advice it may require in complying with any of the provisions of this Act, and a person so associated shall have the right to take part in the discussions of the Designated Authority relevant to the purposes for which he has been associated, but shall not have the right to vote and shall be entitled to receive such allowances or fees as may be fixed by the Central Government.

- ˆ The Designated Authority may, subject to the previous approval of the Central Government, make by-laws fixing the quorum and regulating its own procedure and the conduct of all business to be transacted by it.
- (7) The Designated Authority may appoint one or more sub-committees, consisting wholly of members of the Designated Authority or wholly of other persons or partly of members of the Designated Authority and partly of other persons, as it may think fit, for the purpose of discharging such of its functions as may be delegated to such sub-committee or sub-committees by the Designated Authority.
- (8) A person shall not be eligible for being nominated, re-nominated or appointed as a member if he-
 - a) is an undischarged insolvent;
 - b) is of unsound mind and stands declared so by a competent court or
 - c) has been convicted and sentenced to imprisonment for an offence which, in the opinion of the Central Government, involves moral turpitude.
- (9) No act or proceeding of the Designated Authority shall become invalid merely by reason of -
 - (i) any vacancy therein, or any defect in the constitution thereof; or
 - (ii) any defect in the appointment of a person acting as the Chairperson or a member of the Committee; or
 - (iii) any irregularity in the procedure of the Designated Authority not affecting the merits of the case.
- (10) The Central Government shall –
 - a. appoint a person to be the Secretary of the Designated Authority; and
 - b. provide the Designated Authority and the Committees constituted by or under it, with such technical and other officers and staff officers and budget as may be necessary for the efficient performance of the functions of the Committee and sub committees constituted under this Act.

5. Functions of the Designated Authority: - (1) The Designated Authority shall be responsible for and shall have all the powers for the effective implementation of

this Act and shall advise the Central Government and the State Governments on matters relating to-

- a. Development of genetically improved seed/ FRM of all-important planted tree species to achieve self-sufficiency in a time bound manner in coordination with National FRM Development Committee to be set up.
- b. Advise and coordinate with Regional / State FRM Certification Committees on all issues related to certification and regulation of trade in FRM
- c. Determination and demarcation of the various regions of seed zones in respect of each of the notified species;
- d. Submission of proposals for revision of categories of Forest Reproductive Materials to Central Government from time to time if required;
- e. Standards for registration, certification and testing of FRM and regulation of FRM trade as well as certification;
- f. Forest Reproductive Material registration and its enforcement;
- g. Monitor forest reproductive material certification and the quantity and quality such material available for domestic use and export.
- h. To establish and maintain record of different regions of seed zones and maps showing these regions of seed zones.
- i. Regulatory oversight on forest planting material certification and the use of standardized procedures and protocols as basis for such certification.
- j. Preparing new or amended legislation and ensuring that regulations as well as appropriate protocols for forest seed and planting materials (FRM) certification are in place;
- k. Regulation of export and import of FRM.
- l. To perform such other functions as may be assigned to it by the Central Government

CHAPTER IV

Certification and Registration of Forest Reproductive Material

6. Regional Forest Reproductive Material Certification Committees:-

- (a) The Designated Authority in consultation with the Central Government shall, as soon as may be after the commencement of this Act, constitute any number of Regional Forest Reproductive Material Certification Committees, as it may deem necessary for the purpose of this Act.
- (b) The Central Government shall provide the Regional Forest Reproductive Material Certification Committees with such technical and other officers and employees, as may be deemed necessary for the efficient performance of its functions.
- (c) The Designated Authority shall make by-laws fixing the quorum and regulating procedure and the conduct of all business to be transacted

by the Regional Forest Reproductive Material Certification Committees.

7. Functions of the Regional Forest Reproductive Material Certification Committee: - The Regional Forest Reproductive Material Certification Committee shall-

- (a) establish and maintain record of different regions of seed zones and maps showing these regions of seed zones identified by the Designated Authority
- (b) establish and maintain a regional forest seed and planting material register with registration based on defined standards.
- (c) register the forest reproductive material after scrutinizing their claim as made in the application in such manner as may be prescribed.
- (d) regulate collection, processing, and storage of Forest Reproductive Material for the purpose of certification.
- (e) devise scientific mechanism and standard protocols for the collection, processing, testing, certification, storage and distribution of Forest Reproductive Material

8. State Forest Reproductive Material Certification Committee: _ (1) The State Government may, after consultation with the Central Government, establish Forest Reproductive Material certification committee as it may deem necessary for the purpose of this Act.

(2) The State Government shall provide the State Forest Reproductive Material Certification Committee with such technical and other officers and employees offices and funds, as it may deem necessary for the efficient performance of its functions.

(3) The State Forest Reproductive Material Certification Committee shall follow the guidelines issued by the Designated Authority in all matters relating to and for the purpose of this Act.

9. Functions of the State Forest Reproductive Material Certification Committees:-

The State Forest Reproductive Material Certification Committee shall-

- a. advise the State Government on registration of Forest Reproductive Material producing units, Forest Reproductive Material processing units, Forest Reproductive Material dealers, traders and forest nurseries.
- b. establish and maintain a regional forest seed and planting material register with registration based on defined standards.

- c. regulate collection, processing, and storage of Forest Reproductive Material for the purpose of certification.
- d. advise the State Government and the Committee on all matters arising out of the administration and implementation of this Act.

10. Demarcation of Seed Zones: - (1) The Designated Authority shall demarcate the regions of seed zones in respect of each of the species notified by it, by means of administrative and geographical boundaries and where applicable by altitudinal and other appropriate boundaries judged to be significant in the State.

(2) The Designated Authority shall allocate to each region of seed zone referred to sub-section (1) above, a distinct identity code.

(3) The Designated Authority shall draw up maps showing the demarcated region of seed zones referred in sub-section (1) and shall make such maps available to the public, whether by electronic means or in paper form, upon payment of prescribed fee, if any.

11. Maintenance of National Register: - (1) The Designated Authority shall establish and maintain a register of approved basic material which shall be known as the National Register of Approved Basic Material (in short "The National Register").

(2) The Designated Authority shall make the National Register available to the public, whether by electronic means or in paper form, upon payment of prescribed fee.

12. Approval of Basic Material:- (1) Unless otherwise expressly provided in this Act, no person, natural or legal, shall produce, process, sell, import, trade, deal, market or plant the forest reproductive material of the notified species and Scheduled category unless the same is registered under sub-section (2) by the Designated Authority and certified by the Regional Forest Reproductive Material Certification Committee or the State Forest Reproductive Material Certification Committee, as the case may be, in such manner as may be prescribed.

(2) Subject to the provisions of sections 14 and 15, the Designated Authority may, subject to such conditions as may be prescribed, approve basic forest reproductive material, where it is satisfied that it meets the minimum requirements given in Appendices I and II of this Act.

(3) The Designated Authority may grant provisional approval for a specified period and subject to such other conditions, as may be prescribed, to the forest reproductive material which are available in the market on the date of commencement of this Act.

(4) The Designated Authority shall have the power to issue such directions to protect the interests of producers against any abusive act committed by any third party during the period between the date of filing of his application for registration and the date of decision by the Authority on such application.

Provided that nothing in this section shall apply to landscape planting, urban planting relating to industrial and domestic development, where less than 1000 plants are used.

13. Procedure for registration: - (1) Every application for registration under subsection (1) of section 12 shall be made in such form and contain such particulars and be accompanied by such fee, as may be prescribed.

(2) On receipt of any such application for the registration of the basic material, the Designated Authority may, after such enquiry as it deems necessary and after satisfying itself that the Forest Reproductive Material to which the application relates, conforms to the claims made by the producer, importer or by the seller and fulfills the minimum requirements prescribed for the approval of the basic material intended for production of the Forest Reproductive Material under the Scheduled categories, and its safety to human being and animals, register the basic material, as the case may be, of the Forest Reproductive Material on such conditions as may be specified by it and allot a registration number thereto and issue a certificate of registration.

(3) The Designated Authority may, having regard to the efficacy of the Forest Reproductive Material and its safety to human beings and animals vary the conditions subject to which a certificate of registration has been granted and may, for that purpose, require the certificate holder by notice in writing to deliver the certificate to it within such time as may be specified in the notice.

(4) The Forest Reproductive Material approved as basic material under section 12 shall be entered by the Designated Authority in the National Register by reference to a unit of approval to which a unique register reference shall be allocated and

- (a) in the case of material whose approval under section 12 is limited in time or is subject to some condition, the date on which the approval shall end and the condition specified shall be entered in the National Register in respect of that unit of approval; and
- (b) in the case of approval being given of basic material intended for the production of Forest Reproductive Material of the category 'Selected' where approval has been granted for a specified purpose, the specified purpose shall be entered in the National Register.

(5) The following categories of person may seek approval of basic material under this Act

- (a) the owner of the basic material for which approval is sought, or
- (b) a person authorized in writing by the owner of the basic material for which approval is sought.

For the purpose of this section 'owner' shall mean, in the case of basic material, which is owned by more than one person, all the owners of the material acting together.

14. Special provision for registration of transgenic varieties: - (1) No Forest Reproductive Material of any transgenic variety shall be registered unless the

applicant has obtained clearance in respect of the same as required by or under the provisions of the Environment (Protection) Act, 1986, Biodiversity Conservation Act, 2001; Wildlife Preservation Act, 1972; Protection of Plant Varieties and Farmers' Rights Act, 2001; or any other law for the time being in force,

Provided that the Designated Authority may, subject to clearance, under the said Act, grant provisional registration certificate for a period not exceeding two years on the basis of information furnished by the producer as may be required for the purpose.

(2) Save as otherwise provided in sub-section (1), the form and manner in which the procedure for registration of transgenic Forest Reproductive Material and the fee payable thereto shall be same as applicable in case of registration under section 13.

15. Specific requirement of certain basic reproductive material after approval:- (1) A seed orchard which has been approved as basic material intended for the production of Forest Reproductive Material of the category "untested" shall be managed and its seed harvested in such a way that the objectives of the orchard referred to in Appendix I are attained.

(2) An applicant who obtains approval under section 12 of the basic material other than in the form of a seed source approved for the production of Forest Reproductive Material of category "source identified" or a seed orchard approved for production of Forest Reproductive Material of category "untested" shall notify the Designated Authority in writing of the following alterations in respect of that basic material no later than 30 days before the date on which a collection notifiable to the Committee pursuant to section 14 is to take place:

- a) a reduction in area; or
- b) a material change in the composition of stocking of the basic material.

16. Collection of forest reproductive material for marketing: - (1) No person shall collect, or produce forest reproductive material for the purpose of marketing or for use in the production of forest reproductive material which is to be marketed unless he does so from the approved basic material and in accordance with the provisions made here under:

(2) Any person proposing to collect, or cause to be collected, forest reproductive material for the purpose of marketing or for use in the production of forest reproductive material which is to be marketed shall notify the Regional Forest Reproductive Material Certification Committee or the State Forest Reproductive Material Certification Committee in writing at least 14 days before the proposed collection, providing the following particulars and documentation –

- (a) his name, address and contact details;
- (b) the place of collection;
- (c) the unique register reference or references allocated to the approved basic material from which the forest reproductive material is to be collected, or, in the case of forest reproductive

material of the category "source-identified", the seed source;
and

- (d) the proposed date, time and anticipated duration of the collection;

and shall afford the Regional Forest Reproductive Material Certification Committee or State Forest Reproductive Material Certification Committee or the persons acting on behalf of these Committees such reasonable facilities as they may require to observe the collection so notified.

17. Master Certificate: - (1) The owner of any forest reproductive material intended to be marketed which -

- (a) has been collected from approved basic material in accordance with section 12, or
- b) is in the form of seed which has been extracted from cones or fruit collected from approved basic material,

shall, himself or through his authorized representative within two months from the date of the collection, apply to the Regional Forest Reproductive Material Certification Committee or the State Forest Reproductive Material Certification Committee in writing for the issue of a Master Certificate in respect of that material, providing the particulars given in sub-section (2):

(2) The particulars referred to in sub-section (1) are -

- (a) the owner's name, address and contact details;
- (b) a description of the forest reproductive material collected, namely
 - (i) botanical name;
 - (ii) nature and category; and
 - (iii) quantity of material, as defined in sub-section (3), for which the certificate is sought;
- (c) the type of basic material from which it is derived;
- (d) the unique register reference for the basic material from which it is derived; and
- (e) such other information as may be necessary to enable the Regional Forest Reproductive Material Certification Committee or the State Forest Reproductive Material Certification Committee to complete the form on which the Master Certificate is to be issued in accordance with sub-section.

(3) "Quantity of material" referred to in sub-section (2)(b)(iii) shall mean:

- (a) in the case of seeds their weight, and where those seeds have been extracted from cones or infructescences, additionally, the volume of cones or fruit from which the seeds were extracted; and

(b) in the case of parts of plants, to their number.

(4) The owner of forest reproductive material which is produced by mixing forest reproductive material from approved basic material permitted under section 19 shall within two months from the date of mixing the material apply to the Regional Forest Reproductive Material Certification Committee or State Forest Reproductive Material Certification Committee for a Master Certificate in respect of the mixture so produced -

- (a) providing the particulars required under sub-section (2);
- (b) stating the register references of each of the components of the mixture in the case of mixtures permitted under the provisions of this Act.
- (c) stating the years of ripening and the proportion of material from each year in the case of mixtures permitted under the provisions of this Act.

(5) The Regional Forest Reproductive Material Certification Committee or State Forest Reproductive Material Certification Committee, as the case may, shall issue to the owner, or the applicant authorized by the owner, of any forest reproductive material which they are satisfied has been collected or produced for purposes of marketing in accordance with this part a Master Certificate in respect of the forest reproductive material and shall allocate to each certificate its own number.

(6) The Master Certificate shall be issued in such form as may be prescribed by the Designated Authority.

(7) A Master Certificate issued in respect of forest reproductive material produced by mixing permitted under section 19 from seed sources and stands in the category "source-identified" shall certify such forest reproductive material as "reproductive material derived from a specified seed source".

(8) A Master Certificate issued in respect of forest reproductive material produced from mixing permitted under section 19 of reproductive material derived from basic material which is not indigenous with basic material of unknown origin, shall certify such forest reproductive material as being "of unknown origin".

18. Identification and separation of forest reproductive material during production: -

(1) Except for material which is premixed in accordance with section 19, no person shall keep forest reproductive material at any stage of production, including collection and during the course of marketing, other than in separate lots in respect of each unit of approval, and distinguished from each other by reference to the following identification criteria -

- (a) Master Certificate code and number (where a certificate has been issued);
- (b) botanical name;
- (c) category of forest reproductive material;
- (d) whether for multiple forestry purposes or a specific purpose, and if the latter, specifying that purpose;
- (e) type of basic material from which it is derived;
- (f) in the case of source-identified and selected forest reproductive

material or forest reproductive material which is mixed the identity code for the seed source from which the forest reproductive material is derived;

(g) in the case of forest reproductive material derived from basic material in the form of a stand or seed source, whether the origin of the material is, indigenous, exotic or neither; or unknown;

(h) in the case of seed units, the year of ripening;

(i) the age and type of planting stock of seedlings or cuttings, whether undercuts, transplants or containerized;

(j) whether the forest reproductive material is genetically modified or derived from basic material which consists of a genetically modified organism; and

(k) in the case of permitted mixed forest reproductive material clear identification of the components of the forest reproductive material so mixed.

(2) The identification criteria and the information required under this sub-section shall be documented either by labeling which clearly distinguishes each lot, or by any other method which has been approved by the National Forest Reproductive Material Development Committee in writing prior to its use.

19. Mixing of lots: - Notwithstanding anything contained in this Act to the contrary, permission for mixing of lots may be granted by the Designated Authority, if all other requirements for the separation of lots are met subject to the following conditions.

- (a) Mixing of reproductive material from two or more units of approval will be permitted for certification either within the category *Source-identified* or within the category *Selected* and is restricted to mixing material from within a single seed zone. If mixing of reproductive material from seed sources and stands in the category *Source-identified* takes place, the reproductive material of the new combined lot will be certified as derived from a seed source.
- (b) Mixing of lots may be permitted for reproductive material derived from non-indigenous basic material with that from unknown origin, and the reproductive material of the new combined lot will be certified as of unknown origin.
- (c) Mixing of reproductive material based on seed lots from different years of ripening will only be permitted for a single unit of approval in agreement with the Regional and State Forest Reproductive Material Certification Committees.

20. Registration for Collection, Production and Processing of Forest Reproductive Material:- Save as otherwise expressly provided in this Act, no person shall grow, collect, organize production, set up any production or processing unit, set up any testing unit of Forest Reproductive Material unless the same is registered with the State Government concerned in accordance with the provisions of this Act.

Provided that no State Government shall entertain any such request unless the forest reproductive material is certified.

(2) No person shall maintain any Forest Reproductive Material processing unit for production, processing, storage or trading of Forest Reproductive Material unless such unit is registered by the State Government under this Act.

(3) No State Government shall register a producer or processing unit of Forest Reproductive Material if he or his unit does not meet the specifications prescribed by the Central Government in terms of infrastructure, equipment and qualified manpower.

(4) Every application for registration under sub-section (3) shall be made in such form and manner and shall be accompanied by such fee as may be prescribed.

(5) The State Government may, after making such enquiry and subject to such conditions as it thinks fit, grant a certificate for producing Forest Reproductive Material and maintaining, establishing Forest Reproductive Material processing unit in such form as may be prescribed.

(6) Every Forest Reproductive Material producing and processing units shall furnish periodic returns to the State Government concerned in such form and at such time as may be prescribed on the quantity of Forest Reproductive Material of different kinds or categories processed by them.

(7) The State Government may, after giving the holder of certificate of registration under sub-section (1), or sub-section (2), as the case may be, suspend or cancel the registration if -

- (a) such registration has been obtained by misrepresentation relating to the specification in terms of infrastructure, equipment or availability of qualified manpower; or
- (b) any of the provisions of this Act or the rules made there-under has been contravened.

21. Registration of Forest Reproductive Material Dealers: - (1) Every person who desires to carry on the business of selling, keeping for sale, offering to sell, bartering, import or export or otherwise supply any Forest Reproductive Material by himself, or by any other person on his behalf shall obtain a registration certificate as a dealer in Forest Reproductive Material from the State Government.

Provided that no dealer registered in certified forest reproductive material shall deal in any uncertified Forest Reproductive Material. In case of default, the registration certificate shall be cancelled by the registering authority.

(2) Every applicant for dealership under sub-section (1) shall be required to furnish information about Forest Reproductive Material stocks, sales and other related information as may be prescribed.

(3) Every application for registration under sub-section (1) shall be made in such form and manner and shall be accompanied by such fee as may be prescribed.

(4) The State Government may, after making such enquiry and subject to such conditions as it thinks fit, grant a certificate of registration as a dealer in such form as may be prescribed.

(5) Every dealer registered under this section shall furnish such information and returns regarding stocks, seed lots, expiry date of seed lots and forest reproductive material and other related information, as may be prescribed, to the State Government.

(6) The State Government may, after giving the dealer an opportunity of being heard, suspend or cancel a certificate granted under this Act if-

- (a) such registration had been obtained by misrepresentation of any material fact;
- (b) contravenes any of the provisions of this Act or the rules made there-under.

Chapter V

Mechanism for Development of Forest Reproductive Material

22. National Forest Reproductive Material Development Committee - (1) The Central Government shall, as soon as may be after the commencement of this Act, constitute a National Forest Reproductive Material Development Committee for the purpose of this Act. The Committee shall perform such duties and exercise such powers as may be delegated to it by the Designated Authority.

(2) The Committee may, subject to the previous approval of the Designated Authority, make by-laws fixing the quorum and regulating its own procedure and the conduct of all business to be transacted by it.

(3) Director General, Indian Council of Forestry Research & Education (ICFRE) shall be the Chairman of the Committee. He shall be assisted by the following members:

1. DG, ICFRE (Chairman).
2. Directors of the Regional Research Institutes of ICFRE
3. Deputy Director General Forests in-charge of ICFRE as Member Secretary.
4. Deputy Director General (In charge of FRM), ICFRE
5. Deputy Director General (Research), ICFRE
6. Representatives of six Principal Chief Conservators of Forests not below the rank of Chief Conservator of forests, to represent North, South, East, West Central and North-Eastern Zones (tenure for a period of three years on rotational basis).
7. Three eminent tree breeders
8. Two eminent retired foresters
9. Three representatives from the private sector engaged in developing, producing, processing, or trading or planting of FRM

10. Two representatives of agro-forestry farmers
11. One representative of traders in FRM
12. One representative from reputed NGOs.

- (4) The Central Government shall –
- a. appoint a person to be the Secretary of the Committee; and
 - b. provide the Committee with such technical and other officers and employees, as may be necessary for the efficient performance of the functions of the Committee constituted under this Act.

(5) The Central Government shall establish a National Bureau for Forest Genetic Resources (NBFGR) to function under the directions and control of Designated Authority to assist it in its functions including maintenance of authentic samples of forest seed and forest reproductive materials, registration of tested clones, supply of approved basic reproductive material for multiplication of clonal planting stock meant for certification and DNA finger prints of registered clones. NBFGR shall also perform all other related functions as may be assigned to it by the Designated Authority for the purpose of this Act.

23. Functions Of the National Forest Reproductive Material Development Committee-(1) The functions of the Committees shall be:

- a. To formulate innovative plans and to help implement time bound programmes at the Central and State levels to develop adequate seed sources and clones of species amenable to vegetative propagation for all important plantation species supported with sound breeding strategies.
- b. To assist and guide similar committees to be set up at the State level by formulating suitable policies and to implement time bound programmes for achieving self-sufficiency in genetically improved sources of forest seed and tested clones of species of high importance to the State concerned.
- c. To guide and assist State level committees for scientific collection, processing, grading and storage of forest seed and maintain healthy and pure germplasm of tested and registered clones.
- d. Development and production of Forest Reproductive Material to achieve self sufficiency in genetically improved and certified seed / FRM soonest possible.
- e. Establishment of guidelines and effective mechanism for the collection, processing, testing, certification, storage and distribution of FRM;
- f. Establishment of an information network on the availability of certified planting materials with links to seed and planting materials collection, production and certification bodies in the country.
- g. To establish and maintain the National Register of Approved Basic Material.
- h. Establishment of an effective monitoring and evaluation system and protocols, complete with the necessary computer hardware and software manned by well-trained personnel.
- i. Organize standardized training for production, collection, processing, testing, certification, packaging and storage of Forest Reproductive Material.
- j. Maintain regular liaison with the Designated Authority and the Regional FRM Certification Committees and State FRM Development Committees.

- k. To perform such other functions as may be assigned to it by the Central Government.

(2) The National Forest Reproductive Material Development Committee may, subject to the previous approval of the Central Government, make regulations for the purpose of regulating its own procedure and the procedure of any other sub-committee formed there under.

24. State Forest Reproductive Material Development Committee :- (1) Every State Government shall, as soon as may be after the commencement of this Act, constitute State Forest Reproductive Material Development Committee for the purpose of this Act.

(2) The State Government shall provide State Forest Reproductive Material Development Committee with such technical and other officers, employees and infrastructure, as it may deem necessary for the effective performance of its functions.

(3) The committee may, subject to the previous approval of the State Government, make by-laws fixing the quorum and regulating its own procedure and conduct of all business to be transacted by it.

25. Functions of the State Forest Reproductive Material Development Committees:- The State Forest Reproductive Material Development Committee shall-

- a. prioritize species for large scale development of seed Forest Reproductive Material for each State in consultation with State Forest Reproductive Material Development Committees;
- b. develop and implement suitable policies and strategies for development of adequate sources of genetically improved Forest Reproductive Material of all notified species and species under priority list supported with appropriate breeding strategies.
- c. develop and produce Forest Reproductive Material;
- d. establish seedling and clonal seed orchards as appropriate and feasible for selected species.
- e. work for production of clonal planting materials (ramets through CMAs or tissue culture).
- f. assist the National Forest Reproductive Material Development Committee to organize, standardized training for collection, processing, testing, certification, packaging and storage of Forest Reproductive Material.
- g. carry out other functions assigned to it, by or under this Act by the State Government.
- h. establish clonal multiplication areas or tissue culture capacity for selected and appropriate species adopting experience already present in private forest companies, state forest development corporations and state forest departments.
- i. work for collection, processing, and storage of Forest Reproductive Material.

- j. maintain, in each district, a list of Forest Reproductive Material dealer, Forest Reproductive Material producing units, Forest Reproductive Material processing units and forest nurseries
- k. seek information from persons engaged in the production, supply, distribution, trade or commerce in Forest Reproductive Material of the notified species regarding stock, prices, sales and other information in the manner as may be prescribed

CHAPTER VI
Implementation and Enforcement

26. Establishment Of Forest Reproductive Material Laboratories:- (1) The Central Government may, by notification, establish a Central Laboratory for testing of Forest Reproductive Material or declare any laboratory as the Central Laboratory for testing of Forest Reproductive Material to carry out the functions entrusted to such laboratories in the manner prescribed in this Act.

(2) The State Government may, by notification, establish a State laboratory for testing of Forest Reproductive Material or declare any other laboratory as the State laboratory for testing of Forest Reproductive Material to carry out the functions entrusted to such laboratories in the manner prescribed in this Act.

(3) Every laboratory for testing of Forest Reproductive Material referred to in subsection (1) and (2) shall have as many Forest Reproductive Material Analysts and other employees as the Central or the State Government, as the case may be, may consider necessary.

27. Forest Reproductive Material Analyst:- (1) The Central Government may, by notification, appoint such persons, as the Government thinks fit and having the prescribed qualifications to act as Forest Reproductive Material Analysts to carry out the functions entrusted to them for the purpose of this Act and define the local limits of their jurisdiction.

(2) The State Government may, by notification, appoint such persons, as the Government thinks fit and having qualifications prescribed by the Central Government to act as Forest Reproductive Material Analysts to carry out the functions entrusted to him for the purpose of this Act and define the local limits of their jurisdiction.

28. Authority for Inspection of Forest Reproductive Material: - (1) The State Government may, by notification, appoint authorized officers, having the prescribed qualifications, as it thinks fit, to be Authority for Inspection of Forest Reproductive Material and define the areas within which they shall exercise jurisdiction.

(2) Every such authority shall be subordinate to such other authority as the State Government may specify in this behalf.

29. Powers of Authorized Officer: - (1) The authorized officer may-

- (a) take samples of any Forest reproductive material of any category of species notified by the National Forest Reproductive Material Development Committee from time to time.
 - (i) any person selling such Forest Reproductive Material; or
 - (ii) any person who is in the course of conveying, delivering or preparing to deliver such Forest Reproductive Material to a purchaser or a consignee; or
 - (iii) a purchaser or a consignee after delivery of such Forest Reproductive Material to him;
- (b) send such sample for analysis to the Forest Reproductive Material Analyst of the area within which such sample has been taken;
- (c) enter and search, at all reasonable times, with such assistance, if any, as he may consider necessary, any place in which he has reason to believe that an offence under this Act has been or is being committed and order in writing the person in possession of any seed in respect of which the offence has been or is being committed, not to dispose of any stock of such Forest Reproductive Material for a specific period not exceeding thirty days or, unless the alleged offence is such that the defect may be removed by the possessor of the Forest Reproductive Material, seize the stock.
- (d) examine any record, register, document or any other material object found in any place mentioned in clause (c) and seize the same if he has reason to believe that it may furnish evidence of the commission of an offence punishable under this Act; and
- (e) exercise such other powers as may be necessary for carrying out the purposes of this Act or any rule or regulation made there-under.

(2) The power conferred by this section includes the power to break-open any container in which any seed or Forest Reproductive Material of any category or species may be contained or to break-open the door of any premises where any such Forest Reproductive Material may be kept for sale:

Provided that the power to break-open the door shall be exercised only after the owner or any other person in occupation of the premises, if he is present therein, refuses to open the door on being called upon to do so.

(3) Where the authorized officer takes any action under clause (a) of sub-section (1), he shall, as far as possible, call not less than two persons to be present at the time when such action is taken and take their signatures on a memorandum to be prepared in such form and manner as may be prescribed.

(4) The provisions of the Code of Criminal Procedure, 1973, or in relation to the State of Jammu and Kashmir, the provisions of any corresponding law in force in that State, shall, so far as may be, apply to any search or seizure under this section as they apply to any search or seizure made under the authority of a warrant issued under Section 94 of the said Code, or, as the case may be, under the corresponding provisions of the said law.

30. Withdrawal, amendment and cancellation of registration:- (1) The Designated Authority or the Regional or State level Forest Reproductive Material Certification Committee, as the case may be, may withdraw, cancel or amend any registration made and certification done under section 12 or section 14 on any one or more of the following grounds, namely:-

- (a) that the holder of the certificate has violated any of the terms and conditions of the registration; or
- (b) that the registration has been obtained by misrepresentation or concealment of essential data; or

(2) No order of cancellation, modification or withdrawal of registration under this section shall be made unless the holder thereof or the affected person concerned has been given a reasonable opportunity of showing cause in respect of the grounds for such cancellation and after considering his reply. The appropriate authority ordering the withdrawal, amendment or cancellation of the registration or certification shall pass a speaking order.

31. Notification of cancellation of registration of Forest Reproductive Material: - The Designated Authority, shall notify the cancellation or modification of registration of the approved basic Forest Reproductive Material approved under this Act. However, reasons for such cancellation or modification shall invariably be specified in the notification under intimation to the person, natural or legal, concerned.

32. Appeal: - (1) Any person aggrieved by any decision of the National Forest Reproductive Material Development Committee or the Regional Forest Reproductive Material Certification Committees or the State Forest Reproductive Material Certificate Committee, as the case may be, may, within thirty days from the date on which the decision is communicated to him prefer an appeal to such authority (hereinafter referred to as the Appellate Authority) as the Central Government may constitute:

Provided that the Appellate Authority may entertain an appeal after the expiry of the said period of thirty days if it is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.

(2) An Appellate Authority shall consist of one or more persons not exceeding three, as the Central Government may think fit, to be appointed by that Government.

(3) The form and manner in which an appeal may be preferred under sub-section (1), the fee payable for such appeal and the procedure to be followed by the appellate authority shall be such as may be prescribed.

(4) On receipt of an appeal preferred under sub-section (1), the Appellate Authority shall, after giving the appellant and the other party an opportunity of being heard, dispose of the appeal as expeditiously as possible.

CHAPTER VII
Offences and Penalties

- 33. Offences And Punishments :** - If any person –
- (a) contravenes any provision of this Act or any rule made there-under; or
 - (b) imports, sells, stocks or exhibits for sale or barter; and or otherwise supplies any certified Forest Reproductive Material of Scheduled category and notified species not conforming to the specified standards or deemed to be misbranded, or spurious; or
 - (c) imports, sells, stocks or exhibits for sale or barter, or otherwise supplies any certified Forest Reproductive Material without a certificate of registration; or
 - (d) obstructs the Designated Authority, Regional Forest Reproductive Material Certification Committee or State Forest Reproductive Material Certification Committee, an Authorized Officer, Forest Reproductive Material Analyst or any other authority appointed or duly empowered under this Act in the exercise of its powers or discharge of their duties under this Act or the rules made there-under, he shall, on conviction, be punishable with a fine which shall not be less than five thousand rupees but which may extend to fifty thousand rupees.

(2) If any person sells any Forest Reproductive Material which does not conform to the standards defined in the Appendices, does not maintain any records required to be maintained under this Act or the rules made there-under he shall, on conviction, be punishable with fine which shall not be less than five thousand rupees but which may extend to fifty thousand rupees.

(3) If any person furnishes any false information relating to the standards of genetic purity, misbrands any Forest Reproductive Material or supplies any spurious Forest Reproductive Material or spurious transgenic variety, sells any non-registered Forest Reproductive Material as certified Forest Reproductive Material, he shall, on conviction be punishable with fine which shall not be less than five thousand rupees but which may extend to fifty thousand rupees.

34. Forfeiture of property:- When any person has been convicted under this Act for the contravention of any of the provisions of this Act or the rules made there-under, the Forest Reproductive Material, containers and other apparatus or machinery used in the processing in respect of which the contravention has been committed shall be forfeited to the State Government.

35. Offences by the companies: - (1) Where an offence under this Act has been committed by a company, every person who at the time the offence was committed was in charge of, and was responsible to the company for the conduct of the business of the company, as well as the company, shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly:

Provided that nothing contained in this sub-section shall render any such person liable to any punishment under this Act if he proves that the offence was

committed without his knowledge and that he exercised all due diligence to prevent the commission of such offence.

(2) Notwithstanding anything contained in sub-section (1), where an offence under this Act has been committed by a company and it is proved that the offence has been committed with the consent or connivance of, or is attributable to any neglect on the part of, any director, manager, secretary or other officer of the company, such director, manager, secretary or other officer shall also be deemed to be guilty of that offence and shall be liable to be proceeded against and punished accordingly.

Explanation. – For the purpose of this section,-

- (a) “company” means any body corporate and includes a firm or other association of individuals; and
- (b) “director”, in relation to a firm, includes a partner in the firm

CHAPTER VIII

Power to make rules

36. Powers of the Central Government to give directions to the State Governments: - The Central Government may give such directions to any State Governments as may appear to the Central Government to be necessary for carrying into execution in the State any of the provisions of this Act or of any rule made there under.

37. Power of the Central Government to make rules: - (1) The Central Government may, by notification in the official gazette, make rules to carry out the provisions of this Act.

(2) In particular and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters, namely:-

- (a) the terms of office of members other than those who are members ex officio; the matter of filling vacancies, the procedure to be followed by the Designated Authority and allowances of those members of the Designated Authority and sub-committees formed for the purpose of carrying out the provisions of this Act.
- (b) the method of appointment, their qualification and other service conditions of Secretaries, technical and other officers and employees of various committees and sub committees constituted by the Central Government for the purpose of this Act.
- (c) the specifications which shall be maintained in the National Register of Forest Reproductive Material of Scheduled categories and notified species.
- (d) the form of application and the particulars which should be furnished in such application under sub-section (1) of section 13;
- (e) the eligibility requirement which an organization shall fulfill for accreditation under section 43 and the form in which a certificate for maintaining a Forest Reproductive Material producing or seed processing unit may be granted under section 43;

- (f) the form in which and time within which periodic returns shall be filled under sub-section (6) of section 42;
- (g) the information which an application for dealership in Forest Reproductive Material shall be furnished under sub-section (2) of section 21;
- (h) the form and manner in which an application for registration as seed dealer under sub-section (1) of section 21 shall be made and the fee which shall accompany such application under sub-section (3) of that section;
- (i) the form in which a certificate of registration as a dealer in seed shall be granted under sub-section (4) of section 21;
- (j) the information and return which a registered dealer shall furnish to the State Government under sub-section (5) of section 21;
- (k) the form in which an application for registration of a forest nursery shall be made, the particulars which such application shall contain and fee which shall accompany such application under sub-section (2) of section 41;
- (l) the information on production, stocks, sales and prices of planting material in a nursery shall be furnished to the State Government under section 42;
- (m) the criteria to be fulfilled under clause (a) and the manner of carrying out self-certification under clause (b) of sub-section (1) of section 43;
- (n) the inspection and control of the Designated Authority, the committee, the concerned State Government and the Regional and State Seed Certification Committees for accrediting individuals and seed producing organizations under sub-section (2) of section 43;
- (o) the form and manner in which an appeal shall be preferred and the fee which such appeal shall accompany under sub-section (3) of section 32;
- (p) the manner in which a Central Seed Testing Laboratory established or declared under sub-section (1) of section 26 shall carry out its functions;
- (q) the qualifications which a person to be appointed as Forest Reproductive Material Analysts shall possess under section 27;
- (r) the form and manner in which the memorandum shall be prepared under sub-section (3) of section 33;
- (s) the grounds on which the Central Government may restrict export of seed under section 46;
- (t) any other matter which is to be or may be prescribed.

(3) Every rule and regulation made under this Act shall be laid as soon as may be after it is made, before each House of Parliament, while it is in session, for a total period of thirty days which may be comprised in one session or in two or more successive sessions, and if, before the expiry of the session immediately following the session or the successive sessions aforesaid, both Houses agree in making any modification in the rule or regulation or both Houses agree that the rule or regulation should not be made, the rule or regulation shall, thereafter, have effect only in such modified form or be of no effect, as the case may be; so, however, that any such

modification or annulment shall be without prejudice to the validity of anything previously done under that rule or regulation.

38. Power of the State Government to make rules:- (1) The State Government may, by notification, make rules for carrying out the provisions of this Act in respect of matters which do not fall within the purview of section 37.

(2) In particular and without prejudice to the generality of the foregoing power, such rule may provide for all or any of the following matters, namely: -

- (a) the term of office of the members other than those who are members, ex-officio, the manner of filling vacancies in the committees or sub committees and the procedure to be followed by such committees
- (b) the method of appointment, their qualification and other service conditions of various technical and other officers and employees of various committees and sub committees constituted by the State Government for the purpose of this Act.
- (b) the forms to be used for any application, certificate, declaration, registration, return or other document, made, granted or submitted under the provisions of this Act and the fees, if any, therefore,
- (c) the conditions subject to which any registration may be granted under this Act,
- (d) specify the qualification for the Forest Reproductive Material analyst and the Authorized officer and also to appoint authorized officer for the purpose of this Act provided that the qualification do not in any case be inconsistent with the qualification fixed by the central government.
- (e) the conditions subject to which the officers will be authorized to deal with cases of violation of the provisions of this Act.
- (f) any other matter which has to be, or may be, prescribed under this Act.

39. Power of Designated Authority to make regulations : - (1) The Designated Authority may, with the previous approval of the Central Government, by notification, make regulations not inconsistent with the provisions of this Act and the rules made there-under, to provide for all matters for which provision is necessary or expedient for the purpose of giving effect to the provisions of this Act.

40. Powers of the Central Government to give directions to the Designated Authority: - (1) Without prejudice to the foregoing provisions of this Act, the Designated Authority shall, in the discharge of its functions and duties under this Act, be bound by such directions on questions of policy as the Central Government may give in writing to it from time to time.

(2) The decision of the Central Government whether a question is one of policy or not shall be final.

CHAPTER IX
Miscellaneous Regulations

41. Registration of Forest Nurseries: - (1) No person shall conduct or carry on the business of nursery for production of forest reproductive material unless such nursery is registered with the State Government.

(2) Every application for registration under sub-section (1) shall be made in such form and contain such particulars and shall be accompanied by such fee as may be prescribed.

42. Duties of the Registered Owner of Forest Nurseries: - (1) Every person who is a holder of a registration of a forest nursery for production of certified Forest Reproductive Material under section 41 shall-

- (a) keep a complete record of the origin or source of every forest reproductive material and performance record of mother trees in the nursery;
- (b) keep a layout plan showing the position of the root-stocks and scions used in raising the forestry plants;
- (c) keep the nursery plants as well as the parent trees used for the production or propagation of forestry plants free from infectious or contagious insects, pests or diseases affecting plants.
- (d) furnish such information to the State Government on the production, stocks, sales of planting material in the nursery as may be prescribed.
- (e) shall employ at least one person for the nursery who has undergone training as a gardener from any Agriculture University, Forest Department and Registered Nurseries or such other institute as may be specified by the State Government for this purpose

43. Accreditation of Forest Reproductive Material Certification Agencies: - (1) The Designated Authority may in consultation with the Central Government and the Regional or State Forest Reproductive Material Certification Committee, accredit

—

- (a) organizations to carry out certification, on the fulfillment of such criteria, as may be prescribed by the Committee.
- (b) individuals or Forest Reproductive Material producing organizations to carry out self-certification, in such manner as may be prescribed.

(2) The accredited individuals and Forest Reproductive Material producing organizations shall be subject to such inspection and control of the Designated Authority, the concerned State Government and National Forest Reproductive Material Development Committee and Regional Forest Reproductive Material Certification Committees, as may be prescribed.

(3) The accreditation may be withdrawn by the Designated Authority, for reasons to be recorded in writing and after giving to the concerned organization or individual, as the case may be, a reasonable opportunity of being heard.

44. Evaluation of performance: - The Designated Authority may, for conducting trials to assess performance, accredit centers of the Indian Council of Forestry Research & Education, State Agricultural Universities and such other organizations fulfilling the eligibility requirements as may be prescribed, to conduct trials to evaluate the performance of any kind, category and species of Forest Reproductive Material.

45. Import of Forest Reproductive Material: - (1) All import of Forest Reproductive Material –

- (a) shall be subject to the provisions of the Plants, Fruits and Seed (Regulation of Import into India) Order, 1989, or any corresponding order made under section 3 of the Destructive Insects and Pests Act, 1914 or any other law for the time being force;
- (b) shall conform to the standards set by the Designated Authority in the Appendices and conditions laid down in the import permit issued by the Designated Authority.
- (c) shall be subject to registration as may be granted on the basis of information furnished by the importer on the results of multi-locational trials for such period as may be prescribed to establish performance.

(2) The Central Government may, by notification; permit import of an unregistered variety in such quantity and subject to fulfilling such conditions as may be specified in that notification for research purposes.

46. Export of Forest Reproductive Material: - (1) The Central Government may, on the advice of the Designated Authority, restrict, by notification, the export of Forest Reproductive Material of any category or species if it is deemed that such export may adversely affect the environment in the country, or if it is felt that the reasonable requirements of the public will not be met, or on such other grounds as may be prescribed.

(2) Export of Forest Reproductive Material shall be subject to regulations and conditions laid down in the export permit to be issued by the Designated Authority.

47. Exemption from registration:- The Central Government may, by notification, and subject to conditions, if any, as it may specify therein, exempt from all or any of the provisions of this Act or the rules made there-under, any educational, scientific or research or extension organization.

48. Protection of action taken in good faith: - No suit, prosecution or other legal proceeding shall lie against the Government or any person for anything which is done in good faith or intended to be done under this Act.

49. Power to remove difficulties:- (1) If any difficulty arises in giving effect to the provisions of this Act, the Central Government may, by order published in the

Official Gazette, make such provisions not inconsistent with the provisions of this Act as may appear to be necessary for removing the difficulty:

Provided that no order shall be made under this Section after the expiry of two years from the date of commencement of this Act.

(2) Every order made under sub-section (1) shall be laid before each House of Parliament.

SCHEDULE
(See section 2)
CATEGORIES OF FOREST REPRODUCTIVE MATERIAL

Forest Reproductive Material shall be categorized as follows:

- a) **Source-Identified Reproductive Material :**
The two requirements of this category are (i) the seed zone where the reproductive material is collected and the origin of the basic material (which may be indigenous or non-indigenous) shall be defined and registered by a Designated Authority. (ii) the seed shall be collected processed and stored and plants shall be raised under the control of a Designated Authority.
- b) **Selected Reproductive Material:**
The three requirements of this category are (i) the seed zone where the reproductive material is collected and the origin of the basic material (which may be indigenous or non indigenous) shall be defined and registered by a Designated Authority. (ii) The reproductive material shall be derived from basic material which conform to the requirements given in Appendix I and has been approved and registered by a Designated Authority: (iii) the seed shall be collected processed and stored and plants shall be raised under the control of a Designated Authority.
- c) **Reproductive material from Untested Seed orchards:**
The three requirements of this category are (i) the seed zone from which the components of the seed orchard came and the origin of these components (they may be indigenous or non-indigenous) or breeding records shall be defined and registered by a Designated authority. (ii) the reproductive material shall be derived from the basic material which conforms to the requirements given in Appendix I and has been approved and registered by a Designated Authority; (iii) the seed shall be collected, processed and stored and plants shall be raised under the control of a Designated Authority.
- d) **Tested Reproductive Material:**
The four requirements of this category are (i) the place where the reproductive material is collected and the origin of the basic material (which may be indigenous or non indigenous) shall be defined and registered by a Designated Authority. (ii) the genetic superiority of the basic material shall be proved by test (see Appendix II: (iii) the result of the tests shall be registered by a Designated Authority; (iv) the seed shall be collected, processed and stored and plants shall be raised under the control of a Designated Authority.

MINIMUM REQUIREMENTS FOR THE APPROVAL OF BASIC MATERIAL

Part A

AS SELECTED

1. Origin

Selected stands may consist of trees that are indigenous or non-indigenous, which have the characters listed below:

2. Isolation

Selected stands will be situated at a sufficient distance from poor stands of the same species or from stands of a related species or variety, which can form hybrids with the species in question. The requirement is particularly important when the stands surrounding indigenous stands are not indigenous.

3. Uniformity

The stands must show a normal degree of individual variation in morphological characters.

4. Volume production

Volume production of wood normally is an essential criterion for the acceptance of selected stands. Volume production of wood must normally be superior to the accepted mean under similar ecological conditions.

5. Wood Quality

The quality of the wood shall be taken into account and, in some cases, may become an essential criterion.

6. Form or Growth Habit

The trees in selected stands must show particularly good morphological features, especially straightness and circularity of stem, favourable branching habit, small size of branches and good natural pruning. In addition, the proportion of forked trees and those showing spiral grain should be low.

7. Health and Resistance

The trees in selected stands must in general be free from attacks by damaging organisms and show resistance to the adverse climatic and site conditions in the place where they are growing.

8. Effective Size of the Population

Selected stands must consist of one or more groups of trees well distributed and sufficiently numerous to ensure adequate inter-pollination. To avoid the unfavourable effects of inbreeding, selected stands will consist of a sufficient number and density of individuals on a given area.

9. Age and Development

Selected stands will consist of trees of such an age, height or stage of development that the criteria given for the selection can be clearly judged.

10. Before a selected stand is approved for collection of reproductive material of "selected" category it shall be treated (i) to removal all unwanted inferior trees and (ii) to provide space for crown development of retained seed bearers.

Part B.

SEED ORCHARDS

1. The objective, design, components, isolation and location must be approved and registered with the Designated Authority. Any subsequent significant changes must also be approved and registered with the Designated Authority.
2. The component clones or progenies shall be planted according to a plan which has been approved by the Designated Authority and established in such a way that each component can be identified.
3. Thinnings carried out in progeny seed orchards will be described together with the selection criteria used for such thinning.
4. The seed orchards shall be managed and seed harvested in such a way that the objectives of the orchards are attained.

Part C.

CULTIVARS

1. Cultivars shall be identifiable by distinctive characters as prescribed in the international code of nomenclature for cultivated plants.
2. The value of cultivars shall be established by experience or demonstrated by sufficiently prolonged experimentation.
3. Single trees used for production of clones shall be selected for their outstanding character and special consideration should be given to the statements made under heads 4, 5, 6, 7, and 9 of Part A.

MINIMUM REQUIREMENTS FOR THE APPROVAL OF BASIC MATERIAL INTENDED FOR PRODUCTION OF TESTED REPRODUCTIVE MATERIAL

1. CHARACTERS TO BE EXAMINED

- (a) Tests must be designed to assess specified characters and these must be indicated for each tests.
- (b) Weight is usually given to growth and resistance to pests and diseases of known economic importance. In addition, other characters, considered important in view of the economic objective sought , are considered and evaluated in relation to the ecological conditions of the region in which the test is carried out.
- (c) Where the aim of the test is to assess survival under extreme ecological conditions, growth may be less important.

2. GENERAL

- (a) Comparative tests set up for the approval of basic material are to be prepared, laid out, conducted and their results interpreted in such a way as to give an objective comparison, both the material under test and with reference to one or preferably several pre-chosen standards.
- (b) All care is to be taken to ensure that the reproductive material under test, including the standards is representative of the basic material being studied.

3. SETTING UP THE TESTS

- (a) Reproductive material under study is to be both raised and planted in the tests in a replicated random layout.
- (b) Each experimental unit is to contain a sufficient number of trees in order that the individual characteristics of each material under examination can be evaluated.
- (c) The number of basic materials represented and the number of replicates must be sufficient to give a satisfactory degree of statistical accuracy in measurement of differences, depending on the uniformity of the test site, difference expected and so on.

4. MANAGEMENT OF TESTS

- (a) Reproductive material and standards must be treated in an identical way throughout the test. This includes treatment in the nursery whether seed, rooting, cuttings or vegetative production of rootstocks, and the establishment and management of the forest tests themselves.
- (b) As concerns thinning the method used should take account of the development of each reproductive material.

5. PROCUREMNT OF REPRODUCTIVE MATERIAL FOR TESTING

- (a) The basic material for testing is to be;
 - (i) Well defined as regards provenance, constitution composition and isolation against foreign pollen.
 - (ii) Of such age and development that reasonable stability of the main features of the offspring can be expected.

- (b) Sexual reproductive material for testing is to be:
 - (i) Harvested in years of good flowering and good fruit setting unless artificialpollination is used.
 - (ii) Harvested by methods that ensure that the samples obtained are representative.
