

MODEL ANSWER

(AR-7901)

B. Sc. IVth Sem Examination, 2013

FORESTRY
Paper - IIIrd

Nursery Management & Silviculture of Indian Trees

Answer - 1

Fill in the blanks

- (i) Acacia nilotica / Albizia procera produces an excellent charcoal.
- (ii) A nursery that is maintained without irrigation is called — Dry nursery.
- (iii) Bidri is obtained from Tendu (Diospyros melanocylon).
- (iv) Leaf pots (cups) called Dons

Multiple choice

- (v) Katang Bamboo is known as
- (a) Dendrocalamus strictus
- (b) Bambusa vulgaris
- (c) Bambusa luddii
- (d) Bambusa arundinacea

Ans (d) Bambusa arundinacea

- (vi) Borer damage the wood
- (a) Sal
- (b) Teak
- (c) Palas
- (d) Eucalyptus

Ans. (a) Sal

Define the terms

- (vii) Phenology - Phenology is the study of periodic plant and animal life cycle events and how these are influenced by seasonal and interannual variations in climate. The time of leaf shedding and flowering depends largely upon the climatic conditions and the availability.

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ility of moisture in the soil.

- (viii) Orthodox seed - seeds which can be dried down to a low moisture content of around 5% (wet basis) and successfully stored at lower sub-freezing temperature for long periods of temperate species and some tropical species, eg. Acacia, Albizia, Eucalyptus, Pinus, Picea etc.
- (ix) Air layering - Layering is another common practice to induce rooting. Formation of roots on branches while they are still attached to the tree is known as layering. Two methods of layering commonly used, i.e. soil layering and air layering.
- (x) Callus - is a mass of unorganised parenchyma cells derived from plant tissue (ex-plant) for use in biological research and biotechnology. Callus formation is included plant tissues after surface sterilization and planting into in-vitro tissue culture medium. Plant growth regulators such as auxins, cytokinins and gibberellins are supplemented into the medium to initiate callus formation or somatic embryogenesis.

Answer 2. Define the need for establishing forest nursery.

Nursery is the pre-requisite for raising artificial plantations. The success or failure of plantations can be forecasted by the inspecting the site of nursery, composition of planting stock and health of seedling in the nursery. In the recent years, importance of nursery grown seedling has grown immensely because of heavy requirements of seedling both for supply to the public for planting under social forestry prog programme and for massive afforestation programmes taken up by the Government. A well planned nursery with

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abundant supply for field planting is, therefore, always essential.

Nursery is defined as an area where plants are raised for eventual planting out. From the forest nursery the following objectives will be fulfilled.

1. To prepare healthy and vigorous stock.
2. To prepare seedlings for distribution among the public, who have little knowledge about the techniques of raising plants.
3. To raise tall and sturdy seedlings to overcome the weed competition at the planting site, to suit to difficult site conditions such as road-side planting and to supplement slow growth by intensive care in the nursery for reducing the overall cost of plantations.
4. For introducing exotic species, i.e. tropical pines, eucalyptus, poplars so that their initial growth could be watched in the nursery.
5. Species which cannot be raised successfully by direct sowing for them nursery raised seedling perform better.
6. To raise nursery seedlings for poor and barren sites, which is the surest method for artificial regeneration.
7. To supplement natural regeneration and direct sowing methods, only healthy seedling can assure uniform stocking. Reclassification of casualties is always done by planting nursery raised plants.
8. Species which do not seed each year, or seed which are difficult to store or of which viability erodes quickly, nursery grown seedlings can ensure availability of stock in poor seed years.

Answer 3 - Why vegetative propagation is necessary
 vegetative propagation of multipurpose species can play an important role in maximising the yield in many cases. vegetative propagation has already assumed a great importance in horticulture and floriculture while a great deal has to be done in the forestry. It the main method of propagating economic plants which do not produce viable seeds. vegetative propagation is also largely employed to get the uniformity in the crops. Foresters have now realised that once an individual tree of a species with desirable characters of high growth, rate, branching habit, stem form, resistance to climatic factors, diseases and insects, wood quality, relative tolerance to drought and frost, photosynthetic response seed production, oil reproduction, fruit production etc is obtained by hybridization, it can be multiplied, by ^{far} vegetative propagation. In case of poplars, willows, mulberry, this has already been achieved and the clonal propagation is now the rule.

vegetative propagation can be further divided into two groups - auto-vegetative propagation to cover multiplication by cutting, layering etc. and hetero-vegetative propagation by grafting, budding etc.

The vegetative or asexual means of propagation involves plant regeneration by means of its vegetative parts. It circumvents seed generation and thereby, ensures a genetically uniform plantlet population identical to donor (mother) tree. In nature, some plant species also propagate themselves by special vegetative structures (propogules) such as runners, bulbs, corms, rhizomes, tubers etc.

The vegetative propagation consti-

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Intes a very important component of the tree improvement programme and helps to achieve the following objectives

- Conservation of selected superior genotypes i.e. establishment of germplasm banks.
- Establishment of clonal seed orchard.
- clonal multiplication of superior genotypes for clonal forestry, facilitating quick genetic gains.
- curtailing Long Seeding cycle and time of woody perennials for undertaking breeding work. i.e. creation of breeding populations.
- Propagation of special breeding material e.g. exceptional hybrids, etc.
- capturing physiological isolates such as early flower and fruit set for quick economic return.

Principles of vegetative propagation

The vegetative propagation encompasses following three ways of very important biological principles

1. Totipotency
2. Juvenility
3. Polarity.

Factors affecting vegetative propagation

There are several exogenous and endogenous factors which influence the regeneration from the excised organ or tissue. They are listed below:

- 1 Seasonal variation
- 2 Temperature
- 3 Humidity
- 4 Light
- 5 Plant growth regulators

Answer 4 Discuss the nursery practices of Tectona grandis.

Common name - Sagwan, Teak

Family - Verbenaceae

Trade name - Teakwood

Description - Tectona grandis is a large deciduous tree up to 30m high and 100 cm or more dbh, base often fluted, a long straight cylindrical bole up to 2/3rd of the height of the tree, quadron-
-gular branches. Benivral (1989) measured a teak tree having a height of about 45 m, girth 637 cm (b.h.) aged about 600 years and seed still viable (81% germination) in Sungam Range, Perambikulam wildlife Sanctuary (Kerala, India). Taproot deep, bark pale brown, grey, leaves large, opposite, or obovate, inflorescence terminal, flowers white, Placentation axile, fruit a hard bony drupe, seed 1-3, rarely 4 seeds.

Distribution - The teak tree is indigenous in both peninsulas of India. The natural habitat of teak is between 10°N and 25°N on the Indian subcontinent in South East Asia, especially in India, Burma, Thailand, Laos, Cambodia, Vietnam and Indonesia. It does not occur naturally in Malaysia.

In India, it has a discontinuous distribution from its western limit in the Western Ghats. In South, Travancore, Kerala, Annamalai etc. Nilambur man-made teak forests are known to the foresters throughout the world. It is also found in Maharashtra, Madhya Pradesh, Orissa, Rajasthan etc.

Forest Types - Champion and Seth (1968) have grouped teak-bearing forests into four groups 3B, South Indian moist deciduous forests and sub-group 5A - Southern Tropical Dry deciduous.

Three teak forest types are further recognized

- (1) Very moist teak forest
- (2) Moist teak forest
- (3) Slightly moist teak forest.

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Site factors - (Climate) - Teak naturally occurs only in monsoon climates, but under an extreme variety of the site conditions, dry deciduous forest of teak can be found.

(Soil) Teak grows well in limestone, granite, mica, sandstone, quartzite, etc.

(Topography) The majority of teak forests in India are found on hilly or undulating country up to 900m elevation.

Phenology - Teak is a deciduous tree, losing its leaves in November, December or in early January in dry and hot situations. The new foliage comes in May. It flowers from June to August or Sept depending upon the climatic conditions and locality. In southern part of Tamil Nadu flowers are seen in Dec - Jan and fruit ripen in April-May. The ripen fruit collected in the month of Feb to April.

Silvicultural characters

- (1) Strong light demander. Does not tolerate suppression at any stage.
- (2) Teak is sensitive to frost and drought
- (3) Teak shows remarkable power of resistance to the burning, hacking and grazing.

Natural regeneration

The factors affecting natural regeneration of teak are discussed under the following heads:

- (1) Seed - Teak usually seeds abundantly.
- (2) Light - The establishment of teak seedling depends on light
- (3) Frost - Seedlings are killed by frost.
- (4) Soil - Humus are suitable
- (5) Fire - Areas should be protected.
- (6) Weeds - Weed growth are obstacles to the establishment of natural regeneration.

Artificial regeneration - The first ever plantations were carried out on the banks of Chaliyar river in the Govt acquired land in Nilambur in 1842 under the guidance of Conolly.

- (1) Seed collection & storage: collection will be

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done during January to March, by sweeping.

(2) Seed Production Areas.

(3) Seed requirement

(4) Pre-sowing treatment of seed

(a) Natural weathering

(b) Artificial weathering

(c) Pit method

(d) Soaking in water

(e) Biological method

(f) Chemical treatment

Methods of raising plantation

(1) Direct sowing

(2) Entire transplanting

(3) Stump planting

(4) Polythene bag plants

(5) Vegetative propagation

Uses. Teak yields one of the world's most beautiful and heavy woods which is of excellent quality in every respect.

Answer - 5 Explain the following

(a) Flowering in Bamboo

Bamboos have a unique flowering behaviour among the plant kingdom. In some bamboos, the vegetative state shows signs of persisting indefinitely, the plants continue to grow and undiminished vigour year after year as is the case of *Bambusa vulgaris*, even since it was described in 1810, it has not been reported to flower gregariously.

Flowering in Bamboo occurs in two types

- (1) Sporadic flowering
- (2) Gregariously flowering

In sporadic flowering only a culm of bamboo flowers and rest are not flowered.

As far as gregarious flowering is concerned the whole clump of bamboo flowers and after this the flowered clumps die-off. Later the fallen seeds germinate and develop the floor as mat, and establish a bamboo forest.

The majority of bamboos fall between these two categories.

Flowering cycle in Bamboos

- (1) *Bambusa arundinacea* - 30-45 yrs
- (2) *Bambusa tulda* - 30-60 yrs
- (3) *Dendrocalamus strictus* - 20-65 yrs
- (4) *Bambusa polymorpha* - 35-60 yrs
- (5) *Phyllostachys bambusoides* - 60 yrs

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⑥ Methods of seed sowing

Usually three methods of seed sowing in nursery beds are adopted.

- (1) Broad cast sowing
- (2) Line sowing
- (3) Dibbling

In broadcast sowing, the minute seeds such as *Adina cordifolia*, *Arthrocephalus cadamba*, *Populus ciliata*, *Salix alba* and *Eucalyptus* species are sown. The seed should not be sown very dense because it results in poor germination, greater mortality, weak stock, difficulty in weeding and risk of damping off. The minute seeds are mixed with sand, ash or fine soil two or three times the volume of seeds to facilitate the uniform distribution of the seeds. After sowing the area is leveled to cover the seeds.

Line sowing is generally considered a good method of sowing and can be practiced for small and large size seeds. Seed should be sown in lines running across the width of the bed. Spacing of drills and seed drills (line) depends upon species and size of the plants required. Spacing of drills varies from 8 cm to 25 cm. Seeds of bamboo species, *Dalbergia sissoo*, *Tectona grandis* should be sown by line sowing. Irrigation in a day and line sowing of *Dalbergia sissoo* seed took less time for germination and plant percent (Maitani et al, 1990)

Large sized seeds can be easily be dibbled. Dibbling refers to sowing of seeds in shallow holes at definite intervals. It is good method as both spacing and depth are controlled at the time of sowing. Although it is difficult to practice on large scale. Seeds of *Acacia nilotica* are sown by dibbling method, Lal et al (1999) reported that dibbling or line sowing method with evening and morning irrigation took lesser time for germination of seeds, and resulted in higher germination and healthy growth rate.

Answer 6. Define the Silvicultural Characteristics of Acacia catechu.

Common name. Khair

Family - Leguminosae (mimosoideae)

General description - This is small to medium sized tree, with a light crown. The average height of Khair trees range from 12-15m with girth being 0.6 to 0.9m. There is a clear bole of 2-3 m. Small recurved, paired spines are found on the branchlets. The bark is dark grey to greyish brown.

The following varieties have been recognised:

1. Variety catechu - found in sub-Himalayan tract up to 9000 ft above elevation
2. Variety catechuoides - found in parts of eastern Himalayas.
3. Variety chundra - in peninsular India

Distribution: Khair is widely distributed in various parts of India. With the exception of perhaps the very cold, humid and very dry regions, Khair is found almost all parts of the country. The distribution is as follows

1. Sub Himalayan tract
2. Indo gange plains - Siwalik Hills
3. East and north east India - Assam, W.B.
4. Peninsular India - M.P. Bihar, Andhra Pradesh, Maharashtra, Gujarat, Orissa etc.

Forest types: Khair occurs as part of the forest types.

- (1) Northern tropical dry deciduous
- (2) Dun Sal forest
- (3) Dry Teak Forest
- (4) Very dry Teak Forest
- (5) Ravine Khair and Shisham forests.
- (6) Dry deciduous forests.

Associates - The main associates of Khair are listed below:

Acacia leucophylla, *Aegle marmelos*, *Bombax ceiba*, *Butea monosperma*, *Shorea robusta*, *Tectona grandis*, *Terminalia bellerica*, *Dalbergia sissoo*, *Terminalia tomentosa*, *Zizyphus jujuba*, etc.

For plantation - Khair is suited for raising as commercial plantation due to the following reasons.

- (1) The tree is relatively fast growing
- (2) It grows under a wide variety of conditions and does well on sites where other species are not suitable.
- (3) Khair is also commercially important giving quick return to the grower.

Khair has played an important role in the reclamation of stress sites, particularly in usar lands.

Phenology

- It is a deciduous tree which remains devoid of leaves during the early hot season.
- Leaf shedding takes place in late Feb. and new leaf appear in the end of April.
- Flowers appear with new leaves in July or even AUGUST.

- Pod development occur in Sept or Oct. They ripen by December to January.

Silvicultural Characters:

- Light demander,
- Frost hardy.
- Grow in harsh condition
- Good coppicer
- Root suckers produced when roots are exposed.

Natural regeneration - Moderate to high quantities of seed produced every year, which are disseminated by wind under normal condition. After the seeds lie on the ground for some time germination takes place during ~~year~~ rainy seasons. The seedling grows quickly on the loose soils which are free from weeds.

The seedlings of Khair are heavily grazed and hence they have to be protected against damage.

Artificial regeneration - There is profuse production

of seeds each year and this makes it easy for raising seedling in the nursery.

- (1) The pods collected in December or early January directly from the tree.
- (2) Direct sowing can be done in the field.
- (3) Root-shoot cutting of Khair are prepared from 15 months old seedling and planted in rainy season.

Uses - Khair is multipurpose tree species having a wide variety of uses.

- | | |
|---------------|--------------------------------|
| (1) Timber | (6) Katha or cutch |
| (2) Colluse | (7) Other uses as tannin, gum. |
| (3) Fuel | |
| (4) Fodder | |
| (5) Medicinal | |

Answer 7. why shading is important in nursery.

Shading to the seed beds is done with the following objectives.

1. To protect young seedling of shade-bearing species against sun.
2. To protect seedling of frost-tender species against frost. The covering should be removed after the soil temperature rises up in the morning and covered again in the evening.
3. To protect against hail storms or heavy rains during which the young seedlings are damaged due to splash action.

It has been found that young seedling of *Acacia nilotica*, *Dendrocalamus strictus*, *Prosopis juliflora*, *Tamarindus indica* do significantly better under 50% shade. While *Ailanthus excelsa*, *Albizia lebbek*, *Bombax ceiba* do not show any significant difference whether they are fully shaded. 50% shaded are not shaded at all. Pathak et al (1983) have shown that seedling of *Leucaena leucocephala* raised under 45% light conditions show better height and total dry matter thus giving early establishment and growth after transplantation in the field. Germination of seeds in this species is maximum (100%) under these conditions.

Artificial shading in the nursery is done with the locally available material such as thatching grass, para grass, bamboo mats, palm leaf mats, opaque polythene, agricultural waste etc. which can be rolled up easily. In the permanent nursery, provision should be made of shed or angle iron posts at required sites.

Natural shading is also provided to the nursery for which some trees may be planted in between the beds. Naturally growing trees should not be removed completely. If there are no trees, some fast growing trees as *Sesbania*

grandiflora and hybrid castor should be planted. They grow very fast and provide shade within 2 or 3 months (Dwivedi, 1993).

After shading the plants should be hardened off before planting out in the field. This can be done by gradually decreasing the period of shade and increasing the shade-less period. Unshading should be done during cloudy days, early in the rains. At the end of August, no shade is necessary for most species. Shade should be gradually thinned and removed at least two weeks before planting out along with reduction in watering regime to toughen the plants.

In Eucalyptus hybrid nurseries when sowing is done during October/November seed beds are covered with a layer of grass.

Answers Write notes on the following

(1) Root pruning - The terms undercutting, wrenching and root pruning have been used to describe root manipulation in the seed bed. Undercutting is the passing of a flat, thin, sharp blade beneath seed beds to sever seedling tap roots, reduce height growth and hopefully promote development of fibrous root system. The operation is usually performed only once in a bed of seedlings. Wrenching now denotes the passing of a thicker, broader, tined blade beneath seed bed repeatedly to prevent deep rooting and height growth. It is a renewal following undercutting, to recreate the root zone, and by this combination of actions to further promote fibrous root system. The term root pruning has also been used to describe these operations. A reciprocating undercutting, wrenching machine has been developed for the job formerly by hand.

Root pruning at the time of transplanting has been found to avoid root coiling of transpl.

ted silver fir seedlings. There are many types of pruning which help the seedling grow better.

1. under cutting and wrenching
2. spade wrenching
3. Lateral and bole pruning
4. Physical pruning
5. Chemical root pruning

Effect of root culturing:

- (a) changes in seedling morphology.
- (b) changes in seedling physiology.

(11) Weeding & Hoeing

Weeding and hoeing is an important operation in the nurseries which should be carried out timely. After germination of sown seeds, some ~~seed~~ weeds also come which share space, nutrients, and water, consequently suppressing the growth of desired plants. In the initial stages, when weeds are small, weeding can be accomplished by hand, but when the weeds become high, the top root of the weeds should be pulled out with the help of knives or kullis or simply a pointed stick.

Hoeing is also performed simultaneously when the top soil is worked up for mulching and aeration of seedlings. During weeding and hoeing, variable seedling also be pulled out for giving proper spacing to the seedlings. But precaution should be taken that desirable tiny seedlings are not pulled out as well as roots of the seedling are not damaged. While weeding the upper surface of the nursery bed should also be worked up to reduce evaporation. Weeding and hoeing should not be performed when the soil is wet to avoid removal of soil with the roots of weeds and consequent exposure of the roots of desired species. Line sowing of seed facilitates weeding operation manually as well as mechanically. Effort should also be taken at the time of sowing that only clean weed free seed is sown. Undecomposed

farm yard manure ¹⁷ is the major cause for
large infestation of weeds in the nurseries.
The pulled out weeds may be used as mulch.

-or-