

Class Lecture on Plus Tree Selection

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Objective

- To obtain significant amounts of genetic gain quickly and inexpensively while maintaining a broad genetic base.
- Selection is normally the first step in a tree improvement programme and will determine how much gain will be obtained, both in first and succeeding generations.
- Occasionally, where there is little urgency for production of improved propagules for reforestation and when time permits the establishment of genetic tests, such methods as progeny test selection or family and within family selection may be used to establish seedling seed orchard or clonal seed orchard.

Definitions

Candidate tree

- ❖ A tree that has been selected for grading because of its desirable phenotypic qualities but has not been graded or tested.

Plus tree / Select / Superior

- ❖ A tree that has been recommended for production or breeding following grading.
- ❖ It has a superior phenotype for growth, form, wood quality or other desired characteristics and appears to be adaptable.
- ❖ It is yet to be tested for its genetic superiority, although the chance of it having a good genotype is high with a reasonable heritability.

Elite tree

- ❖ The selected trees that have proven to be genetically superior by means of progeny testing.
- ❖ An elite tree is the "winner" from a selection programme and is most desired for use in mass production of seeds or vegetative propagules.

Comparison or check tree

- ❖ Trees that are located in the same stand, which are of the same age growing on the same or better site as the plus tree and against which the plus tree is graded.
- ❖ Trees chosen as comparison trees are the best in the stand, with characteristics similar to "crop" trees that would be chosen in a silvicultural operation.

Selection criteria

The ideal plus tree has the following characteristics.

- ❖ Straight, cylindrical, non-forking, non-twisting bole
- ❖ Fast growth
- ❖ Narrow crown
- ❖ Thin branches with wide branch angles
- ❖ High wood density and long fiber
- ❖ Resistance to pests and diseases

Effects of the Environment

- a) A tree in a stand may be tall and voluminous because,
 - It is older than the other trees in the stand
 - It is growing on a better micro site than the surrounding trees
 - It has more space i.e. less competition from other trees

- c) A tree may have a large, wide crown if it,
 - Overgrows the other trees
 - It grows with wide spacing, i.e. little competition

- d) A tree may have a poor bole form because of,
 - Adverse light conditions and competition during juvenile growth
 - Mechanical or other damage to top shoot during juvenile growth
 - Damage of bole by adverse environmental factors

- e) High wood density may be due to slow growth

Where to select?

- Selection is carried out in natural stands or preferable in plantations.
- Selection should be made from stands that are as pure in species composition as possible.
- Selection should be concentrated on stands or plantations that are average or better in traits of interest.
- Selection work is better in an even aged stand, since age difference can then be eliminated from the evaluation.
- Selection is best carried out in a nature stand, i.e. near to maximum height
- Selection in natural forests where selective logging has taken place should be avoided since that may imply that the best trees have been logged, leaving the poorer (genetic material) behind. Logging may also have influenced crown competition.

Criteria of selection for non-wood Products

- Tannin content
- Resin content
- Gum yield
- Seed oil content
- Seed protein content

Criteria of selection for wood characters

- Specific gravity
- Lumen diameter
- Cell wall thickness
- Fiber length
- Cellulose
- Hemi cellulose
- Lignin

(Tewari, 1994)

How many trees per stand?

- ❖ The number of plus trees in a stand is evaluated after grading.
- ❖ The candidates should not be selected too close to each other,
since closely growing trees may be related, e.g. same parents.
- ❖ A rule of thumb suggests 1 tree/hectare, i.e. one per 1000 trees with initial spacing of 3x3 m.

Steps in plus tree selection

a) Preliminary reporting

- The preliminary reporting of the candidate trees serves the purpose of screening of trees as large as possible.
- This initial survey for candidate trees can be done even by the junior staffs who are more familiar with the field and plantation with in their jurisdictions.

The criteria for screening trees are as follow,

Age: More than half the rotation age

Growth:

- Vigorous, healthy and showing superiority in height and diameter when compared with surrounding trees.
- Dominants / codominants, having height \geq 15 m

Stem form

- Straight stem
- Stem cylindrical, circular in cross section, without excessive taper
- Absence of spiral grain
- Free from pronounced buttress and fluting

Crown and Branching

- Narrow to intermediate in width
- Not suppressed either from the top or from the sides any time
- Light and spreading branches
- Good natural pruning, none or few epicormic branches
- Dense mass of healthy foliage.

Free from insect and disease attack

Moderate to good flowering and fruiting

Marking of candidate trees

The selected trees are marked with **yellow** band of 5cm width, 5 cm above the breast height and given a candidate tree number of the range.

b. Final phenotypic appraisal

- ❖ The final phenotypic appraisal is done jointly by the Forest Geneticist, Silviculturist and other members of tree improvement group, so that the candidate's superiority of the phenotypic expression is critically analyzed and discussed without any bias going in favour or against the selection.
- ❖ For height, clean bole and diameter the actual measurement are taken but for other characteristics scoring is done with the help of ocular estimates.
- ❖ The details of scoring are provided in the plus tree scoring form and the data are entered in plus tree identification data sheet

Methods of plus tree selection

- There are basically two methods applied for the selection.

a) Comparison tree method

- The comparison tree selection or check tree selection is commonly used in **even aged stands for a pure species** (Cech, 1959, Pitcher and Dorn, 1967).
- The first step is the **selection of the candidate trees**. Once the candidate trees are selected, they are screened for traits as **in relation to few surrounding trees called comparison tree or check tree**.
- If the **candidate tree exceeds the comparison tree, it is selected as " PLUS TREE."** The objective behind comparison tree is to adjust or correct the phenotypic value of the candidate tree for environmental effects common to that particular stand.
- The environmental check through the use of comparison trees is believed to result in an improvement in the accuracy of recognizing **individuals with good genotypes and not good phenotypes**.

b) Base line selection

- ❖ While selecting plus tree in an uneven aged stand with mixed species, the method adopted is the base line selection.
- ❖ In this method the individuals are located and their value for traits of interest is compared to the average of the region in which the selection is made.
- ❖ The average is a "base line" giving the system its more common name "base line selection".
- ❖ If the candidate tree exceeds the base line by a considerable amount, it is selected and incorporated in the breeding population.
- ❖ The base may take the form of a regression equation that takes into account physical factors of the site.
- ❖ The tree in this case is not compared to surrounding trees.

c) Other method

i) Regression selection system

- The regression selection is employed for grading of uneven aged or mixed species type stands. A regression selection is built by sampling a number of trees for a desired character, such as volume growth on a given site, and then plotting them against age. A reliable regression curve for height or volume can be made with about 50 trees, if there is a reasonable age-class distribution.
 - A candidate tree is chosen, based on the judgment of the selector and measured for the characteristics desired, such as height or volume.
 - The trait is plotted on the regression graph using the proper age and site. If the candidate tree falls above the curve, it has the desired growth for its age whereas some may fall on the line i.e. average, therefore, its use depends on other characteristics and some fall below the curve, therefore it has inferior growth for its age and should not be used.

ii) Mother tree system

- Where there is no immediate urgency to obtain large amounts of improved seed, the mother tree system of selection may be the best.
- It consists of locating "good" trees that are usually not as good as plus trees in the comparison tree or regression system. Then, one must obtain seed from these and establish seedlings in genetic tests.
- After this, either the best parent trees or the best trees of the best families can be used in a vegetative orchard.
- If suitably laid out, the progeny test may be thinned to create a seedling seed orchard.
- The main disadvantage of the mother tree system is that time is lost before commercial quantities of seed are needed for planting programmes. However, this can be used for hardwoods for which planting programmes are small and seeds are not immediately needed.

iii) The subjective grading system

The subjective grading system is frequently used for hardwoods but is successful only if the grader is experienced and dedicated to find out the best tree possible. Here the times spend for seeking the candidate trees is less, which results in choosing less outstanding trees with smaller selection differentials.

Marking of plus trees

When the candidate trees are finally approved as plus tree, another yellow band as 5 cm width, 5 cm below the breast height is marked. In between the yellow bands plus trees number is written, for example TN NS C2. here the first set of two letters indicates State (Tamilnadu), the second set of two letters indicates division (Nilgiris South), the third letter represents the range (Coonoor) and the number represents the plus tree number in the range.

The genetic gain expected from such selection is 15 or 20 percent. The seeds collected from these plus trees can be considered under " Selected reproductive material" of seed certification scheme.

THANK YOU...