

SEEDLING SEED ORCHARD OF SHISHAM

by

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Summary. *An experimental seedling seed orchard of shisham was planted in February, 1975 for production of genetically superior seed of shisham for planting. Each of 24 blocks in a 1.3 acres plantations contains one plant from each of 40 open-pollinated families of selected trees of this species. Seedlings within families were selected for straightness of stem and height growth. Selection thinning in the experimental plantation will leave only the best individual trees to produce seed. Seedling were assigned to blocks according to size ranking within the families, with a view to reduce the influence of nursery environment variation on the selection outcome.*

Introduction. The seed orchard plantation to be discussed here is part of a programme for genetic improvement of shisham (*Dalbergia sissoo* Roxb.) by Forest Genetics Branch of Pakistan Forest Institute, Peshawar. The principle activity of the programme during past 8 years involved selection of 138 phenotypically superior trees of this species in irrigated plantations in Punjab and N.W.F.P. and testing of open-pollinated progenies at four locations for determination of heritability of stem form and volume production in shisham. Interim results indicate that 10 to 65% of variation in stem form and volume production is genetically controlled (1,2). In order to achieve some tangible results from the programme, a seedling seed orchard relying upon phenotypic selection was established to produce genetically superior seed for planting.

Establishment of seed orchards on the basis of phenotypic selection of parent trees is a common practice in many countries of the world. However, it is first attempt of its kind in Pakistan. Despite our abundant knowledge about planting of shisham spread over last more than one hundred years, there is great need for data on seed production and response of seed producing trees to cultural manipulation. In addition, data are required about collection of seed from standing trees. Present practice of collecting seed of shisham from water courses is to say the least, highly defective. This experimental seed orchard of shisham as expected to provide seed, having a reasonable likelihood of genetic gain and also provide experience with phenotypic selection under controlled conditions and seed orchard management.

Design and Lay-out. In designing a seed orchard, several factors have to be recognized and provided for before planting. These are incidence of self- and cross-pollination, extent of seed orchard, clonal positioning to avoid as much self-pollination as possible, distance to and size of surrounding stands which may serve as a source of con-

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tminating pollen, etc. Shisham has papilionaceous and hermaphrodite flowers and both self as well as cross pollination is common in it. Because of small size and peculiar morphology of flowers, controlled pollination is not practicable in this species. Seed set in shisham is quite early, and occurs at the age of 3-4 years.

Planting design consisted of "balanced, single tree mixture" in the seed orchard (3,4). Selections of 2-years old seedlings was carried in the nursery. Stem form was given primary importance, followed by height growth of individual seedlings. For each of 40 families of original selected trees, seedlings were distributed to 24 blocks according to size ranking within the family. That is, block No. 1 has the largest selected seedling of every family, and block No. 24 the smallest seedling. This was done to reduce the influence of nursery environment variation on the selection outcome. 40 seedlings, one from each of 40 families were assigned randomly to "single tree plots" within a block at 6' x 9' spacing.

Benefits of Seed Orchard. The likelihood of genetic gain is perceived on the assumption that there will be positive genetic response to phenotypic selection among young planted trees of equal age from a genetically variable population (5). The plants selected for this orchard were the best individuals within half-sib open pollinated families of selected trees. Genetic variability among the trees on each block should be enhanced by the fact that each tree has a different seed parent. As shisham is mostly self-pollinated, sharing of a pollen parent among two or three trees in the block is unlikely although not impossible. Site-related environmental variation should be quite low among 40 trees planted at rectangular spacing with arrangement for uniform distribution of water by flood irrigation.

This experimental seed orchard is expected to start producing seed at useful rate 5-7 years after planting. Selection thinnings would be carried out in the meantime to remove individuals showing incidence of forking and excessive crookedness and branchiness of the main stem. This would be mainly based on visual judgement. Annual measurement of height and diameter growth of individual plants would be made to assess the performance of all families in this regard for determination of heritability of stem form and volume production. Establishment of this experimental seed orchard provides an opportunity to gain experience in application of this technique. Furthermore, reproductive behaviour of shisham will be observed and treatments intended to stimulate seed production will be applied upon the completion of selection thinning. Methods to collect seed from selected trees will also be worked out when these trees start producing seed.

Future Plans. Establishment of seed orchard is one way of gaining benefits of practical importance from genetic improvement programmes of trees species. This work will be continued by the Forest Genetics Branch of Pakistan Forest Institute for shisham as well as other tree species in the coming years. Additional seed orchards will be laid out in other localities. The objectives would of course, vary with each species. Whereas, straightness of stem form is of primary importance in shisham; frost hardiness is emphasised in kikar and high growth rate in kail and chirpine. The seed orchard of broad-leaved species will also differ from those of coniferous species. As seed set is quite late in coniferous species, clonal seed orchard instead of seedling seed orchard would be preferred for

kail and chirpine. Clonal seed orchard are raised by vegetative propagation of selected superior trees. On the other hand, as in the case of shisham seed orchard, seedlings are planted in seedling seed orchard.

References

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