HARDWOOD NURSERY MANAGEMENT - PROBLEMS THAT CAN AND DO OCCUR IN THE NURSERY AND HOW THESE PROBLEMS CAN BE AVOIDED AND SOLVED.

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The objective of every forest tree nurseryman is to produce the best planting stock possible, the most planting stock possible, and to produce planting stock as economically as possible. It is in the accomplishments of this objective that the complexities reveal themselves to the nursery manager as he strives to grow planting stock having capacities for survival and growth after planting.

Hardwoods as a group are more difficult to grow than conifers because the hardwoods include many species that differ in seeding habits and nursery requirements.

SOIL FACTORS

Numerous factors control the production of hardwood seedlings. One of the first factors to consider is the soil. Since hardwood seedlings are more exacting in their soil requirements, the best land on the nursery in terms of soil texture, surface and internal drainage and soil PH should be used to produce hardwood seedlings. To take the guesswork out of it, obtain a large scale soils map or get a soil scientist to make a detailed soil survey. Hardwood seedlings grow best on sandy loam and loam soils.

The soil management program in a tree nursery will directly affect the yield, size and quality of seedlings. Soil management practices vary within the same nursery.

Soil samples must be taken each year to be sent to a soil testing laboratory for a complete analysis. The needed chemicals should be applied before planting a cover crop.

Organic matter in a soil influences the chemical and physical properties. Sandy soil should contain from 1.5 to 2.0 percent and heavier soils from 2.0 and 3.0 percent organic matter in the plow layer.

Maintenance of soil organic matter can be accomplished by making small, frequent additions of materials that will decay rapidly and benefit one or two crops.

Green manure crops such as rye, sudan sorghum, soybeans and crotalaria and soil amendments, such as sawdust and bark, can be used along with a crop rotation.,

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Soil PH for most hardwoods should be maintained near 6. Seedlings may be grown over a wide range if PH in the proper concentrations of essential mineral elements are maintained.

Soil fertility must be near optimum and in balance to grow balanced seedlings. Large seedlings produced by heavy applications of fertilizer often have unbalanced top-root ratio which will affect field survival.

An over supply of nitrogen will cause soft, "sappy" leaves and the seedlings will be more susceptible to disease and mature so late in the fall they often suffer frost damage.

SEED COLLECTION AND STORAGE

Another factor in the production of hardwood seedlings is the availability of quality seed for the desired species of trees.

Collecting good quality hardwood seed is often a problem. Collectors need to know how and when seed are produced for collecting viable seed. It is helpful to know how long the seed collecting period will last in some species. (Cottonwood is the best example; otherwise you may get immature seed.

Many freshly collected seed will heat if piled or sacked and left for any appreciable length of time. Some seed need to be put in cold storage and others can be stored in a shady, dry place.

SEEDBED PREPARATION AND FUMIGATION

Seedbed preparation should start by breaking the plow pan with a chisel plow, then plow the soil to a depth of 8 or 9 inches to permit good root development.

Fumigation will control soil-borne insects, nematodes, fungi, diseases and weeds in one operation; thus eliminating many nursery problems. But weed control alone often will justify the cost of fumigation. The beneficial effects of fumigation decrease with time, because fumigated areas become contaminated from outside sources. Therefore, seed sowing should follow fumigation as soon as possible after the required aeration period.

Because fumigants temporarily inhibit the nitrifying bacteria, nitrate fertilizers should be used for fumigated soils, especially acid soils low in nitrates.

SOWING AND SEED GERMINATION

Because seed size and shape vary so much among species, mechanical sowing equipment has been developed for a few species only. Thus, most hardwood seeds are planted by hand.

Seeding depth will vary with the size of seed, season of sowing and soil texture. Large seeds may be sown deeper than small seed. Fall sown seed should be sown slightly deeper than spring sown seed. Beds should be mulched

after sowing.

Irrigation is extremely important during the germination period, thereby providing a haven for damping-off fungi. Damping-off has been controlled by fumigating the seedbeds. Water can be withheld for a time, then used sparingly until the seedlings are past the danger stage. Excessive watering causes the leaching of nutrients and encourages the development of fungus diseases. Captan, Benlate and Truban have been used to control fungi.

PEST CONTROL

Weeds are a problem in hardwood seedbeds. Fumigants help, but more complete control is needed. Some pre-emergence weed control chemicals like Treflan, Eptam and Dacthal are used. Contact herbicides will kill most species of hardwood. Sweetgum and baldcypress are resistant to herbicidal oil. So this leaves mainly expensive hand-weeding for most species.

Some species such as cottonwood and sycamore are reproduced by cuttings. Plant nursery trees about 1 foot apart in rows 3 feet apart for cultivation.

Seed-eating birds can be excluded by coating acorns with Anthraquinone bird repellent. Repellents are not effective for squirrels and other rodents, but can be excluded by hardware cloth screens.

Insects damage hardwoods in various ways: leaf eaters strip the foliage, aphids or scale insects drain leaves and stems of sap, causing wilt or normal growth and grubs and nematodes damage the root system. Defoliators cause the most obvious damage. Early detection and prompt control will keep losses to a minimum.

Chemical use registration is changing rapidly. The user can determine registration by a study of the chemical label.

The list of insects is too long to attempt a control for all of them.

For most insects, Dieldrin, Chiorodane, Malathion, Sevin, Lindane, Dursban, and Furadan have been used. Fumigation is a common and effective control of nematodes.

Disease control is usually a matter of prevention rather than cure. Careful management of the nursery soil is one of the first requirements for protecting the stock from disease. Soil fumigation, application of Captan, Banrot, Truban, and lime sulfur have been used.

INVENTORY AND LIFTING

Nurserymen must know with some degree of accuracy how many trees of each species they will have available for shipment. The number of seedlings is estimated by sampling in the spring and again in the fall. The fall inventory should determine within 5% the number of plantable seedlings that will be available for shipment.

Some seedlings will be lost during lifting. Lifting losses may be estimated from experience if accurate inventory and shipping records have been maintained.

Seedlings may be lifted either in the fall as soon as they are safely hardened off or in the spring.

Soil moisture affects seedling lifting. Ideally the soil should be slightly dryer than what is considered best for plowing. Lifter should not be run under the beds more than 2 hours before the seedlings are to be pulled. The lifter blade should be run at a depth of 10 inches to preserve as much of the root system as possible.

Normal practice is to lift seedlings with a mechanical lifter on the back of a large tractor or a seedling harvester.

GRADING, PACKAGING, STORAGE AND SHIPPING

Grading should start in the seedbed as seedlings are pulled by leaving small, diseased or damaged seedlings.

Each nurseryman has his own method for grading, counting and bundling seedlings. Most use a conveyor belt to carry the seedlings from the grading tables to the packers.

Hardwood seedlings can be stored safely for long or short periods. It is imperative that seedlings be hardened off before lifted for storage.

Bales of different species of hardwood may contain different amounts per bale due to seedling size variance.

When shipping, seedlings should be in transit as short a time as possible. The number of seedlings in an order will often govern the mode of transportation, pickups, 2 ton or van trucks and cars.

The nurseryman must work with the means of transportation available to get seedlings to the planting site in good physiological condition.

The success 'of the nurseryman's efforts are not measured by the number of seedlings he ships, but rather by the number of seedlings that survive to make a worthwhile contribution in some aspect of the multiple use of the forest.