

## Seedling Production at Bailey Nurseries

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Bailey Nurseries, Inc. is a large wholesale production nursery headquartered just south of St. Paul, Minnesota. Over 2500 acres, split between Minnesota and west coast growing areas, are dedicated to the production of nursery stock. In Minnesota, deciduous seedling production of almost 4 million plants is accomplished on approximately 25 acres of fine loamy soil located in the Mississippi River valley. We have a Zone 4A rating by the U.S.D.A. system. The propagation of trees and shrubs from seed has often been relegated second-class status in the nursery business. Indeed, it is a rather inexpensive and low-tech undertaking, but quite important because high quality seedlings are often not available on the market. Our goal is to produce an adequately sized, vigorous seedling in one year. To help actualize this goal, a comprehensive mix of soil building, collecting of hardy local seeds, pest control, watering and fertilization practices is imperative.

Currently we are growing about 110 species of trees and shrubs from seed. We make every effort to collect seed locally to insure hardiness, trueness-to-type, and a proper stage of maturity. An ambitious reevaluation of our seed sources is presently underway at Bailey's. We hope to improve our seedlings in the areas of hardiness, form, fall color, vigor, pest resistance, etc. through the evaluation and selection of superior "mother plants" and controlling these plants in seed producing orchards.

Following an annual chronology of seed maturation, seeds are collected as the species ripen. Our seed picking crews invade the Minnesota Landscape Arboretum, local golf courses, boulevard plantings, nursery seed orchards, public parks, wild areas and homeowner landscapes in search of seeds from needed species. Crews can hand pick, sweep or rake up, shake onto traps or vacuum up the seeds or fruits as the various species dictate. With most species there is an extended period during which the seed will be mature and can be collected successfully. Birds, rodents, wind and other natural agents can disrupt the collection process and their effects must be dealt with. Some species (e.g. *Tilia americana* and *Ostrya virginiana*) will germinate much better if collected on the green side. This requires the propagator to be knowledgeable of the eccentricities of each species to be successful. Fruits are kept in a refrigerated room and cleaned as quickly as possible. A Dybvig-type seed cleaner is employed and the clean seed is dried to the desired moisture content on screens. Cleaned seed is then stored in a freezer with low relative humidity and a constant 32°F temperature.

We promote soil improvement as an integral part of producing good seedlings. To this end an annual application of cattle manure is used, at the rate of 30 tons per acre, on all land scheduled for seedling production. In late spring a crop of sudan grass is sown, then chopped and plowed under at maturity. A high nitrogen complete fertilizer is utilized as needed and followed by subsoiling and other ground preparation. Raised beds are formed by use of a Fobro bedmaker. Vapam, a soil fumigant, is then applied to the beds through a tractor mounted spray boom at a rate of 90-gal per acre. Overhead irrigation is supplied to drive and hold the

fumigant in the soil. After two to three weeks to allow for dispersal of the chemical the beds are fit to be seeded.

Deciduous tree and shrub seeds often exhibit involved dormancies that can be perplexing to overcome. Regarding dormancy requirements, the seeds we deal with fall into one of these four categories:

1) Seeds which need little or no pretreatment to allow germination (e.g. *Betula*, *Catalpa*, and *Caragana*).

2) Seeds needing an extended cold period to break dormancy. (i.e. 60 to 120 days at 32 to 40°F.) Genera needing this cold period include *Malus*, *Pyrus* and *Sorbus*.

3) Seeds which benefit from 90 to 120 days of warm stratification (50 to 70°F) followed by 90 to 120 days of cold stratification at 32 to 40°F. These types, including the genera *Cotoneaster*, *Cornus* and *Rosa*, generally exhibit a tough impermeable seed coat and require the warm stratification period to sufficiently degrade their seed coats to allow the seed to become fully imbibed with water. Then the cold stratification period will be effective.

4) Seeds that require scarification of the seed coat by concentrated sulfuric acid or boiling water to break down the seed coat and permit germination (e.g. *Gleditsia*, *Gymnocladus*, and *Rhus*). These types have very formidable seed coats requiring these radical treatments to facilitate adequate and timely germination.

Knowing these requirements individual species are treated as needed to fulfill their needs. About 66% of our seeds are sown in early fall as they require only the cold period to germinate. About 20% of our species are sown in early July to fulfill the warm-cold stratification requirements. The remaining species are either scarified and spring sown or spring sown with no pretreatment.

Seedling density within the seedbed is arguably the single most important factor in producing useable seedlings. By starting with fresh viable seed and knowing the number of seeds per pound and average germination probability of a given species one can usually determine a sowing rate that will result in an acceptable seedbed population. We sow most of our seed by hand broadcasting onto the bed with the remainder sown with a lawn fertilizer spreader. A tractor drawn drum is pulled over the seed to insure good soil contact and a sand layer is applied. One-fourth to one-half inch of sand is applied depending on the size of the seed sown. A final mulch of about three inches of chopped sudan grass is applied on the beds and thoroughly watered.

All seedbeds having been labeled and plotted can be found easily in the spring to begin removing the hay mulch. Seeds are checked for progressing germination and when a particular species has its roots down about one-half inch the hay is promptly removed and placed into the aisle. This hay can then be used to recover the seedlings should they be threatened by nighttime radiational frosts that frequently occur at this time of year.

About two weeks after all seedlings have emerged, soil samples are taken and tested for nutrient levels. Beds are then fortified with an application of Scott's Pro Grow (24-7-8) fertilizer as needed. Supplemental irrigation is available and applied at the rate of one inch per week as needed. The bulk of our weed control is done with hand labor. Six to eight weeders are employed during the summer to keep the weeds under control. Poast herbicide has been invaluable in the control of grasses. Leafhoppers and aphids can be a real problem for us. A weekly spraying of malathion or orthene keeps the insect damage at a tolerable level. During the

summer, inventories and evaluations are done on the seedbeds to help determine if any practices, seed sources, sowing rates, etc. can be improved. Results are looked at to conclude what worked and what did not and what species need new trials to improve standards and or growth. In the St. Paul area we can commence digging seedbeds in mid to late October. We have normally had several killing frosts by then and seedlings are beginning to defoliate. We presently use a Fobro HD bed digger powered by a 60 h.p. tractor. We require about fifteen people for approximately twenty days to finish the harvesting in a timely manner. Generally we like to be finished digging by November 10th as winter freeze up can occur on any date thereafter. The harvested seedlings are loaded into pallets on a wagon and transported quickly to our humidified cold storage area. The coolers are maintained at approximately 34°F. and the relative humidity in storage is held at over 90% by use of a timed air-over-water mist system.

Grading takes place in a room heated to 55°F for the workers comfort. There is a timed humidity control system used to maintain a high relative humidity in the room. Pallets of seedlings are brought into the grading room by forklift. Two men grade from each pallet, placing the graded plants on a table in front of them. Grading is done by height with most shrub species, or by caliper on the shade tree and rootstock species. Each grader has one man that counts the plants into bundles and ties them. Great care is taken to align the root lines of the seedlings within the bundle so bundles can be root pruned on a band saw and still maintain uniformity in root length. After bundling, the plants are packed in pallets with moist shingle-tow placed on the roots to help maintain root viability during storage. Some harder to store genera including; *Betula*, *Celtis*, *Crataegus* and *Quercus*, are sealed in the pallets by what we call shrink-wrap, a cellophane film, that is wrapped around the pallet. This increases and maintains the relative humidity within the pallet and minimizes the "hardened buds" which often won't break when the seedlings are lined out in the spring. We required about 6,500 man hours to complete the grading, tying and packing away of roughly 3 1/2 million seedlings last winter.