What Does It Cost to Grow Seedlings in Containers?

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More containerized tree seedlings are being planted in the South. The Forest Service has found they are no more costly to grow in some circumstances than bare-root seedlings.

Firms and agencies across the South are turning to container-grown seedlings to regenerate tough sites. Two southeastern firms are planting container-grown loblolly pine on pocosins and river-bottom sites, which are too wet to plant during the wintertime bare-root planting season. Good survival and initial weight growth are obtained when container seedlings are planted in April, May, and June after the sites dry out sufficiently for mechanical site preparation. Two public agencies are planting container-grown longleaf pine on droughty sites where prior bare-root plantings have met repeated failures. A firm is using container-grown loblolly pine to revegetate strip mine sites in central Arkansas where "soil" pH fluctuates between 2 and 11 in short distances. Another firm in the West Gulf is using containers to extend their limited supply of genetically improved seed.

These firms and agencies committed themselves to growing seedlings in containers despite the perceived high cost, because container-grown seedlings provided more consistent results than conventional regeneration methods. Early cost estimates were high, causing many firms to shelve plans for operational reforestation and relegate containers to the research laboratory. Yet, as the six firms and agencies standardized their individual growth procedures and boosted seedling production to between 500,000 and 1 million seedlings annually, each organization saw costs fall.

In 1979, a study was begun at the Southern Forest Experiment Station to determine the cost of growing large quantities of seedlings in containers. The cost records of firms and agencies growing southern pine seedlings in containers for operational reforestation formed the basis of the study. Costs were divided between outlays to build nursery facilities and expenses to grow seedlings once a nursery was built. Composite nurseries were designed to capitalize on the best features of existing facilities. Comparable costs for constructing equivalent bare-root nurseries were also estimated. Costs were based on price quotations solicited for nursery components and on actual bid prices of newly constructed, bare-root and container facilities.

A major conclusion was that elaborate glass greenhouses are not needed for a southern pine container nursery. Simple timber-truss greenhouses or pole shadehouses can produce high-quality seedlings in 12 to 16 weeks. Either of these two nursery options can be constructed for considerably less than the cost of a new bare-root nursery (fig. 1). At outputs up to 3 million seedlings per year, the pole shadehouse option is slightly less expensive than the timber-truss option and half as expensive as a bare-root nursery. Above 3 million seedlings per year, the timber-truss option becomes more economical, because several rotations may be grown each year compared to a single rotation in the pole shadehouse or the bare-root nurseries. If these total construction costs are converted to annual costs per thousand seedlings, the three nursery options have similar costs, because the bare-root nursery has a 20-year lifespan compared to the 10-year lifespan assumed for both container nursery options (table 1).

Container Nursery Design

The container nurseries were designed around the capacity of a headhouse to fill and seed

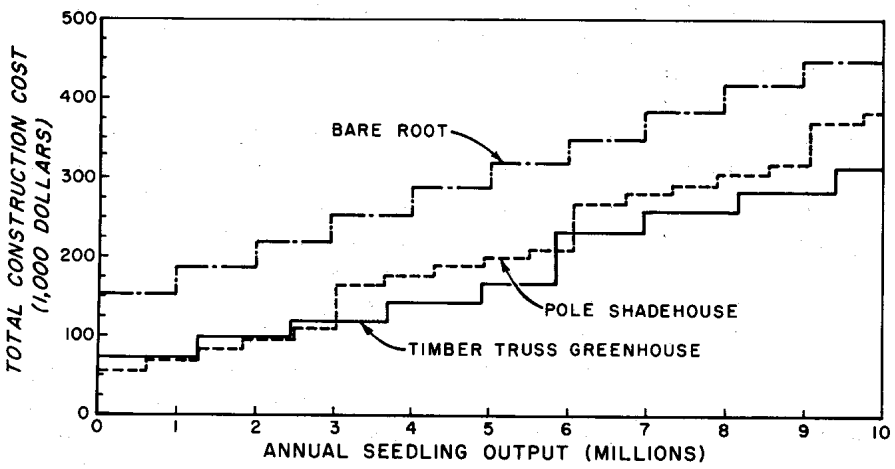

Figure 1.—*Construction costs vary with nursery size.*

containers. Five timber-truss greenhouses, each 34 by 150 feet, can be serviced by one headhouse. The same headhouse can serve six 44- by 240-foot pole shadehouses becuse only one rotation per year is grown. The wood-frame headhouse contains flat-filling and seed-sowing equipment, nursery offices, main utility service station, and container and media storage. Also included in headhouse costs is a forklift truck for pallet handling.

A timber-truss greenhouse is constructed of common dimension lumber, poles, and plastic sheeting. First, two rows of chromated copper arsenate treated (CCA type C) poles are set in the ground, 34 feet apart. Poles are placed 4 feet apart within each 150-foot-long row. A double top plate of 2- by 4-inch lumber ties each pole wall together. Trusses built on-site out of 2- by 6-inch lumber are set atop the two pole walls. The trusses are tied together with enough 1- by 4-inch lumber to make the structure wind-firm for the locality. The top is then covered with 2-inch galvanized poultry mesh and a single layer of 6 mil, ultraviolet-resistant polyethylene sheeting. Plastic for the walls is needed only from fall through spring. Enough pallets to fill the greenhouse are included in the greenhouse costs. The pallets are made of CCA type C treated

Table 1.—*Nursery construction costs*[1]

	Annual Nursery output (millions of seedlings)						
	1	2	3	4	5	7.5	10
	Dollars per thousand seedlings						
Bare-root nursery	17.15	9.66	7.83	6.67	5.97	5.05	5.28
Timber-truss greenhouse							
Spencer-Lemaire Rootrainer "Fives"	11.40	8.35	7.33	6.82	8.51	7.09	7.37
Number 2 Styroblocks	11.40	8.35	7.33	6.82	6.23	6.38	5.85
Spencer-Lemarie Rootrainer "Ferdinands"	11.40	8.35	5.56	5.50	5.46	5.68	4.78
Kys-Tree-Starts	10.96	8.13	5.42	5.39	4.31	3.58	4.17
Pole-shadehouse nursery							
Spencer-Lemaire Rootrainer "Fives"	11.40	7.99	6.98	7.99	7.38	7.38	7.38
Number 2 Styroblocks	11.40	7.99	6.15	7.38	6.89	6.72	6.68
Spencer-Lemaire Rootrainer "Ferdinands"	11.40	6.76	5.33	5.23	5.90	4.92	5.29
Kys-Tree-Starts	10.60	6.54	5.18	4.50	4.10	4.15	3.85

1 Converted to an annual equivalent cost at 10-percent interest over a 20-year project life for the bare-root nursery and a 10-year project life for the container nursery.

lumber with stainless steel fasteners for long life in a constantly wet environment. PVC plastic pipe irrigation system and lights for photoperiod control complete the greenhouse.

A pole shadehouse is constructed of shadecloth stretched over a rope network supported on a CCA type C treated pole grid. Shadehouses also have a PVC plastic pipe irrigation system. The shadehouse costs also include sufficient pallets to fill it. A 34- by 300-foot shadehouse accompanies each timber-truss greenhouse and is used to harden off seedlings before outplanting. Germination and early seedling growth in the greenhouse take 6 to 8 weeks. Then, the succulent young seedlings are moved to the shadehouse to spend 6 to 8 weeks "hardening off" before outplanting. Meanwhile, another rotation is germinating in the greenhouse. By holding twice as many seedlings as the greenhouse, the shadehouse functions as a temporary storage facility between the greenhouse and field-planting crews. A pole shadehouse nursery can only reliably germinate one rotation per year without a greenhouse. In the warmer parts of the South, two rotations per year may be possible.

Seedling Growing Costs

The type of nursery constructed and the climate at the nursery location combine to determine how many seedlings can be grown each year. However, the type of nursery has little effect on the cost per thousand of growing the seedlings. This cost depends heavily on the type of container selected (table 2). The container purchase price, its reusability, and the labor required to fill and seed the container cells are the prime determinants of the cost of growing seedlings. The cost of growing bare-root seedlings was obtained from the Forest Service's W. W. Ashe Nursery, Brooklyn, Miss.

The No. 2 Styroblock was the least expensive container for growing seedlings of the four examined. Although more bulky to ship and store than the two Spencer-Lemaire products, it can be used more often and takes less labor for flat filling as pensive initially and not reusable, although no labor is required to fill cells.

Planting Costs

No difference was found between the costs of transporting bare-root and container-grown seedlings from the nursery to the planting location. By using pallet racks for the container stock, seedling transporation costs can be reduced to $1.15 per thousand within a 100-mile radius of the nursery.

At the planting site, container-grown seedlings need no special handling other than being spread out, uncovered, and watered as needed. During hot weather, placing seedlings in shade will reduce watering needs. One firm planting in the Coastal Plain seeks the nearest

Table 2.—*The cost of growing seedlings, exclusive of construction costs*

Type of seedling	Cell density	Cost of growing seedlings	
		Loblolly[1]	Longleaf
	Per square foot	*Dollars per thousand*	
Bare-root	25	20.73	20.73
Spencer-Lemaire Rootrainer "Fives"	82	36.17	38.32
No. 2 Styroblock	96	20.25	22.40
Spencer-Lemaire Rootrainer "Ferdinand"	118	29.09	—[2]
Kys-Tree-Start	150	35.83	—[2]

[1] Slash pine costs are the same as loblolly pine costs.

[2] The cell density per square foot of these containers is too dense for consistently good longleaf pine results.

roadside ditches and borrow pits with water in them and then floats seedlings in No. 2 Styroblocks on the water. The water gets to the seedlings through the hole in the bottom of each seedling cavity.

The firms and agencies using container-grown seedlings presently perform the same type of site preparation for container stock as bare-root seedlings, with one notable exception. The North Carolina Forest Service does not burn old fields before planting container-grown longleaf pine. The black ash on the soil surface raises temperatures past the lethal level for the young longleaf seedlings' root collars.

No difference was discovered in contract-planting costs between bare-root and container-grown seedlings, whether planted by hand or machine. However, the handplanting speed of company crews has been up to 25 percent faster if dibbles are used that are shaped like the root plug. The increased speed reduces company planting cost per acre.

Summary

Container-grown southern pine seedlings are no more costly to grow and plant than bare-root seedlings. The initial cost of constructing a new container seedling nursery is approximately half that of developing a new bare-root facility. When the longer life of the bare-root facility is considered, the average construction cost per thousand seedlings is the same. Similarly, the cost of growing seedlings after the nursery is built is essentially the same for No. 2 Styroblock seedlings compared to bare-root seedlings. No significant transportation, site preparation, or planting cost differences were uncovered.