

COMPARISON OF COSTS OF PRODUCING CONTAINER AND FIELD GROWN
PLANTS IN U.S.D.A. PLANT HARDINESS ZONES FIVE AND SIX
DIFFERENTIATED BY SIZE OF NURSERY

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INTRODUCTION

To make more informed decisions as to whether to enter, leave, or expand field production, nurserymen require production, marketing and financial information. Changes and competition in the industry make it imperative that nurserymen systematically determine production costs. An important aspect of cost analysis is "economies of scale" or how do costs vary according to size?

Comprehensive cost models, including differentiation by size of nursery, have recently been developed for container grown crops in U.S.D.A. Plant Hardiness Zone 6 (4), for field grown crops in U.S.D.A. Plant Hardiness Zones 7 and 8 (1), and for field grown crops in U.S.D.A. Plant Hardiness Zones 5 and 6 (3). This paper presents a small portion of the information provided in the studies on Zones 5 and 6 (3,4). Information provided by these studies provide a basis for decision-making for those evaluating the profitability of either establishing new nurseries, expanding an existing nursery or phasing out of production.

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OBJECTIVES

The general objective of the complete studies (3,4) was to develop the resources and costs associated with model nurseries differentiated by species of plant and size of nursery, including the delineation of representative production systems. Specific objectives were to:

1. Model a series of production systems that would accommodate a majority of nursery plant species being grown in U.S.D.A. Plant Hardiness Zones 5 and 6.
2. Analyze the important species of plants commonly grown in U.S.D.A. Plant Hardiness Zones 5 and 6, and assign each of them to one of the systems based on similarities of growing and production requirements.
3. Choose one species from each of the systems as representative of that group for detailed cost analysis.
4. Design physical facilities including land areas, land improvements, irrigation systems, buildings, machine and equipment components, for two sizes of both commercial container and field nurseries based on the model production systems.

This paper summarizes analyses of the above studies with emphasis on cost differentials due to size of operation.

MATERIALS AND METHODS

Model firms were synthesized using the conceptual framework of economic engineering wherein the "best proven practice" was

included for the models. The complete models included developing appropriate production cycles; schematic drawings of physical layouts, including buildings and irrigation systems; lists of equipment and other items; a complete sequence by month and year of nursery operational steps beginning with land preparation and ending with loading the finished product for wholesale distribution; and budgets for fixed and variable costs.

Nursery stock commonly grown in containers was divided into five cultural groups: spreading evergreens, spreading deciduous shrubs, slow growing evergreens, upright deciduous shrubs, and broadleaf evergreens. Field grown nursery stock was divided into: slow growing evergreens, fast growing evergreens, deciduous shrubs, shade trees, and ornamental trees. While not all inclusive, the groups do permit a range of per unit costs to be developed as they relate to input costs and cultural factors.

Data for this study were obtained from wholesale nurseries and nursery suppliers in the North Central region. Container data were obtained during 1982 for 1882. Data for the field study were obtained during the late Autumn and Winter of 1984 and the Spring of 1985. Price quotations obtained for field production were for the 1985 production season. Due to the different periods of obtaining price quotations, differences in sizes of nurseries and cultural practices, data for container operations are not directly comparable to data for field production.

The basic goals in synthesizing production facilities were

to minimize labor expenses, flow and movement of plant material and equipment, maximize the number of salable plants and allow future expansion. Model container facilities were synthesized for both a small and large nursery (340,000 sq ft and 680,000 sq ft of growing space respectively). Model field facilities were synthesized for both a 50 and 200 acre nursery. Twenty percent of the growing space in each of the nurseries was assigned to each of the cultural groups.

Costs were established for all factors of production including management and invested capital. Since most nurseries use cash rather than accrual procedures, the analyses were completed on a "cash" basis. Capital requirements for establishing the nursery were first determined. Second, physical factors associated with the nursery and annual shipment requirements were established. Third production systems for the enterprises budgeted were described. Fourth, fixed costs were calculated. Fifth, estimated variable costs for each of the groupings of plants were determined. Sixth, summaries were made of fixed and variable costs for each nursery (Tables 1 and 2).

RESULTS AND DISCUSSION

Fixed Costs

Containers. On a per salable plant basis, there was a considerable difference in fixed costs when they were differentiated by plant group (Table 1). In the small nursery, they were: \$1.90 for Group I (Juniperus), \$2.34 for Group II

(Contoneaster), \$2.42 for Group III (Taxus), \$3.00 for Group IV (Viburnum), and \$3.72 for Group V (Rhododendron). The average for all groups was \$2.53. Fixed costs for Group V were more than double those for group one. These costs were proportionate to the number of salable plants per annum produced in allocated space. Fixed costs as a percentage of total costs ranged from 42% to 51% in the small nursery and averaged 46% for the five groups (Table 1). In the large container nursery fixed costs per salable plant, were \$1.50 for Group I, \$1.89 for Group II, \$1.95 for Group III, \$2.42 for Group IV, and \$3.00 for Group V and averaged \$2.04 for all groups. Fixed costs as a percent of total costs were lower than for the small nursery ranging from 37% to 46% and averaged 42% for all groups (Table 1).

Field. As in the case of containers, there was a considerable difference in fixed costs on a per salable plant basis when they were differentiated by plant group (Table 2). In the 50 acre nursery, they were: \$11.31 for Group I (Taxus), \$8.08 for Group II (Juniperus), \$7.56 for Group III (Viburnum), \$25.09 for Group IV (Acer rubrum), and \$17.16 for Group V (Malus). The average for all groups was \$11.29. Fixed costs for group IV plants were more than three times as much as for group III. These costs were proportionate to the number of salable plants per annum produced in allocated space. Fixed costs as a percentage of total costs ranged from 46% to 65% in the 50 acre nursery and averaged 55% for the five groups (Table 2). For the 200 acre field nursery fixed costs per salable plant were: \$4.90

for Group I, \$3.48 for Group II, \$3.27 for Group III, \$10.87 for Group IV, and \$7.43 for Group V and averaged \$4.88 for all groups (Table 2). Fixed costs as a percent of total costs were considerably lower than for the 50 acre nursery ranging from 30% to 52% and averaged 39% for all groups (Table 2).

While many nurserymen and/or others concerned with the industry might feel that the reported fixed cost figures ranging from 30% to 65% of total costs depending upon method of production, size of firm and species of plant might be high, these percentages would be in line with those for similar industries when considering new facilities (2).

Variable

Variable costs differentiated by size of firm and plant group are detailed in Tables 1 and 2. There were substantial differences between type of nursery and plant group, but little difference by size of nursery.

Container. On a per salable plant basis, variable costs were \$2.60 for Group I (Juniperus), \$2.70 for Group II (Cotoneaster), \$3.16 for Group III (Taxus), \$2.84 for Group IV (Viburnum), and \$3.64 for group V (Rhododendron) and averaged \$2.93 for all groups. Variable costs for the small nursery ranged from 49% to 58% of total costs and averaged 54% for all groups (Table 1). For the large container nursery variable costs on a per salable plant basis were \$2.57 for Group I, \$2.67 for Group II, \$3.13 for Group III, \$2.80 for Group IV, and \$3.60 for Group V and averaged \$2.88 for all groups (Table 1). Variable

costs for the large container nursery ranged from 54% to 63% of total costs and averaged 58% for all groups. While fixed costs differed substantially between sizes of container nurseries, this was not the case with variable costs. The difference for Groups I, II, and III was \$0.03 and for Groups IV and V \$0.04.

Field. On a per salable plant basis, variable costs for the 50 acre field nursery were \$6.16 for Group I (Taxus), \$4.44 for Group II (Juniperus), \$4.44 for Group III (Viburnum), \$29.50 for Group IV (Acer rubrum), and \$20.06 for Group V (Malus) and averaged \$9.11 for all groups. Variable cost for the small nursery ranged from 35% to 58% of total costs and averaged 45% for all groups (Table 2). For the 200 acre field nursery variable costs, on a per-salable-plant basis, were \$4.49 for Group I, \$3.59 for Group II, \$3.79 for Group III, \$24.74 for Group IV, \$17.30 for Group V and averaged \$7.55 for all groups (Table 2). Variable costs for the large nursery ranged from 48% to 70% of total costs and averaged 61% for all groups.

While fixed cost differed substantially between sizes of nursery, the differential was less with variable costs. The difference for Group I was \$1.67, for Group II \$0.85, for Group III \$0.65, for Group IV \$4.76, and for Group V \$2.76 and averaged \$1.56 for all groups.

Total

Total costs are the summation of fixed and variable.

Containers. For the small container nursery total costs, on a per salable plant basis, were \$4.50 for Group I (Juniperus),

\$5.04 for Group II (Cotoneaster), \$5.58 for Group III (Taxus), \$5.84 for Group IV (Viburnum), and \$7.36 for Group V (Rhododendron) and averaged \$5.46 for all groups (Table 1). For the large container nursery, they were \$4.07 for Group I, \$4.56 for Group II, \$5.08 for Group III, \$5.22 for Group IV, and \$6.60 for Group V and averaged \$4.92 for all groups. Differences in total costs per salable plant between the two sized nurseries were \$0.43 for Group I, \$0.48 for Group II, \$0.50 for Group III, \$0.62 for Group IV, and averaged \$0.54 for all groups. Note that of the total differential, all but three or four cents per group resulted from differences in fixed costs. This means that fixed costs accounted for over 90% and variable costs less than 10% of the cost differentials per salable plant between the two sized container nurseries.

Field. For the 50 acre field nursery total costs for "B&B" plants, on a per salable plant basis, were \$17.47 for Group I, \$12.52 for Group II, \$12.00 for Group III, \$54.58 for Group IV, and \$37.22 for Group V and averaged \$20.40 for all groups (Table 2). Total costs for the 200 acre nursery, on a per salable plant basis, were \$9.39 for Group I, \$7.07 for Group II, \$7.06 for Group III, \$35.61 for Group IV, and \$24.73 for Group V and averaged \$12.43 for all groups (Table 2). Differences in total costs per salable plant between the two sized nurseries were \$8.08 for Group I, \$5.45 for Group II, \$4.94 for Group III, \$18.97 for Group IV, and \$12.49 for Group V and averaged \$7.97 for all groups. Note that of the total differential, the

majority was caused by differences in fixed costs. Overall, it was 39% less expensive to produce plants in the 200 acre nursery compared to the 50 acre (Table 2). Fixed costs accounted for approximately 80% and variable costs about 20% of the cost differentials per salable plant between the two sized nurseries. For nurseries of the sizes analyzed, economies of size are achieved primarily in fixed rather than variable costs.

SUMMARY

Large-sized commercial nurseries use buildings, equipment, and machinery more efficiently than small-sized nurseries. As a result large nurseries have a lower cost per salable plant.

Total costs per salable plant in the small container nursery differentiated by species ranged from \$4.50 to \$7.36 averaging \$5.46 for all species. In the large nursery comparable values were \$4.07, \$6.60, and \$4.92. Over 90% of the differential noted between the two sizes of container nurseries can be attributed to differences in fixed costs.

Total costs per salable plant in the 50 acre field nursery differentiated by species ranged from \$12.00 to \$54.58 averaging \$20.40 for all species. In the large nursery comparable values were \$7.06 to \$35.61 and averaged \$12.43 for all species. Approximately 80% of the differential noted between the two sizes of nurseries can be attributed to differences in fixed costs.

These figures demonstrated that variable costs per salable plant, while having wide variations among species, remain

reasonably constant when comparisons are made between the two sized nurseries. The smaller nurseries could purchase materials and other variable items almost as cheaply as could the larger ones. Large nurseries were, however, able to use "production" labor considerably more efficient than could the smaller nurseries. Fixed costs on a per salable plant basis, in contrast, changed significantly as size of nursery increased. This occurred because most of the fixed factors required to operate the smaller nurseries such as management, buildings, and most machinery and equipment were also adequate to operate the larger nurseries. As the size of nursery increased, costs for fixed items of production were spread over more salable units, thereby reducing the fixed cost per salable plant.

LITERATURE CITED

1. Badenhop, M.B., and T.D. Phillips and S-103 Technical Committee. 1985. Costs of Establishing and Operating Field Nurseries Differentiated by Size of Firm and Species of Plant in USDA Climatic Zones 7 and 8. Southern Coop. Ser. Bull. 311.
2. Brumfield, Robin G., Paul V. Nelson, Arthur J. Coutu, Daniel W. Willits, and Robert S. Sowell. 1981. Overhead Costs of Greenhouse Firms By Size of Firm and Market Channel. North Carolina Agr .Res .Ser .Tech. Bul. 269.

3. Taylor, Reed D., Harold H. Kneen, Elton M. Smith, David E. Hahn, and Stanley Uchida. 1985. Costs of Establishing and Operating Field Nurseries Differentiated by Size of Firm and Species of Plant in U.S.D.A. Plant Hardiness Zones Five and Six. ESO 1171, Dept. of Agr. Econ. & Rur. Soc., The Ohio State University.
4. Taylor, Reed D., Harold H. Kneen, David E. Hahn, Elton M. Smith and the S-103 Technical Committee. 1983. Costs of Establishing and Operating Container Nurseries Differentiated by Species of Plant in U.S.D.A. Climatic Zone Six. Southern Coop. Ser. Bull. 301.

TABLE 1.--Summary of Fixed, Variable, and Total Costs (Dollars) per Salable Plant of Operating a Small* and Large** Container Nursery in U.S.D.A. Plant Hardiness Zones Five and Six, 1982.

Item	Group I (Juniperus)		Group II (Cotoneaster)		Group III (Taxus)		Group IV (Viburnum)		Group V (Rhododendron)		Average	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost
----- Small Container Nursery* -----												
Fixed Costs	1.90	(42)	2.34	(46)	2.42	(43)	3.00	(51)	3.72	(51)	2.53	(46)
Variable Costs	2.60	(58)	2.70	(54)	3.16	(57)	2.84	(49)	3.64	(49)	2.93	(54)
Total Costs	4.50	(100)	5.04	(100)	5.58	(100)	5.84	(100)	7.36	(100)	5.46	(100)
----- Large Container Nursery** -----												
Fixed Costs	1.50	(37)	1.89	(42)	1.95	(38)	2.42	(46)	3.00	(46)	2.04	(42)
Variable Costs	2.57	(63)	2.67	(58)	3.13	(62)	2.80	(54)	3.60	(54)	2.88	(58)
Total Costs	4.07	(100)	4.56	(100)	5.08	(100)	5.22	(100)	6.60	(100)	4.92	(100)
----- Cost Differences Between the Small and Large Container Nurseries -----												
Fixed Costs	0.40	(93)	0.45	(94)	0.47	(94)	0.58	(94)	0.72	(95)	0.49	(94)‡
Variable Costs	0.03	(07)	0.03	(06)	0.03	(06)	0.04	(06)	0.04	(05)	0.05	(06)‡
Total Cost Difference	0.43	(100)	0.48	(100)	0.50	(100)	0.62	(100)	0.76	(100)	0.54	(100)

*17.04 acres, 340,000 sq ft of growing space, 204,000 sq ft of polyhouse space.

**33.04 acres, 680,000 sq ft of growing space, 408,000 sq ft of polyhouse space.

‡Simple average of groups. Normal computation would have produced inconsistency due to rounding.

TABLE 2.--Summary of Fixed, Variable, and Total Costs (Dollars) per Salable Plant of Operating a 50* and 200** Acre Field Nursery, U.S.D.A. Plant Hardiness Zones Five and Six, 1985.

Item	Group I (Taxus)		Group II (Juniperus)		Group III (Viburnum)		Group IV (Acer rubrum)		Group V (Malus)		Average	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost	per Salable Plant	of Total Cost
----- 50 Acre Field Nursery -----												
Fixed Costs	11.31	(65)	8.08	(65)	7.56	(63)	25.09	(46)	17.16	(46)	11.29	(55)
Variable Costs	6.16	(35)	4.44	(35)	4.44	(37)	29.50	(58)	20.06	(54)	9.11	(45)
Total Costs	17.47	(100)	12.52	(100)	12.00	(100)	54.58	(100)	37.22	(100)	20.40	(100)
----- 200 Acre Field Nursery -----												
Fixed Costs	4.90	(52)	3.48	(49)	3.27	(46)	10.87	(30)	7.43	(30)	4.88	(39)
Variable Costs	4.49	(48)	3.59	(51)	3.79	(54)	24.74	(70)	17.30	(70)	7.55	(61)
Total Costs	9.39	(100)	7.07	(100)	7.06	(100)	35.61	(100)	24.73	(100)	12.43	(100)
----- Cost Differences Between the 50 and 200 Acre Field Nurseries -----												
Fixed Costs	6.41	(80)	4.60	(84)	4.29	(87)	14.22	(75)	9.73	(78)	6.41	(80)
Variable Costs	1.67	(20)	0.85	(16)	0.65	(13)	4.76	(25)	2.76	(22)	1.56	(20)
Total Cost Difference	8.08	(100)	5.45	(100)	4.94	(100)	18.98	(100)	12.49	(100)	7.97	(100)

*Total Nursery - 50 acres, 40 acres of growing space, 10 acres production facilities, holding & field bed area, roads, etc.

**Total Nursery - 200 acres, 175 acres of growing space, 25 acres production facilities, holding & field bed area, roads, etc.

