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Production and Marketing of Woody Ornamentals in Alabama

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PRODUCTION AND MARKETING OF WOODY ORNAMENTALS IN ALABAMA

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INTRODUCTION

THE ALABAMA NURSERY INDUSTRY is a rapidly growing agricultural industry. Gross sales of woody ornamentals increased from approximately $3 million in 1949, to almost $5 million in 1959, and to more than $52 million in 1979 *(14)*. During the same period, other Southern States experienced similar growth in woody ornamental sales. Although this indicates a seller's market, there is keen competition within the industry.

Potential for growth of the industry should continue to be favorable. Future growth of subdivisions, shopping centers, industrial parks, recreational parks, highways, golf courses, and street municipal plantings, in addition to the relandscaping of existing homes, should continue to create considerable demand for woody ornamentals *(12)*. Public interest in ecology and pollution abatement should also increase the demand for plants of all types.

Little cost information is available to the nursery industry for planning and establishing production efficiency criteria for management. In fact, statistical information of all types is scarce for the United States nursery industry. In Alabama, no satisfactory data bases have been developed on cost relationships for nursery crops as have been developed for most other agricultural crops. It is for this reason this study was undertaken.[2]

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[2]Research for this study was initiated in support of Southern Regional Project S-103, "Economics of Producing and Marketing Woody Ornamentals in the South", with cooperators on the regional level in nine Southern States. This project began on July 1, 1975, and was terminated September 30, 1982.

Knowledge of production costs is important to nurserymen because these estimates can help answer pressing management questions. However, the use of such estimates requires recognition of their limitations. Production costs influence product availability and quantities offered for sale. These costs include land, labor, and capital (materials, equipment, and cash) that could have been used to produce other products. Thus, the cost of one unit of the product depends upon the value placed on these inputs. These values may be different for each producer. Actual costs vary from firm to firm for a given commodity as production techniques, size, efficiency of operations, accounting procedures, and prices of labor, supplies, utilities, interest on borrowed capital, taxes, and insurance vary. For these reasons, cost comparisons must be made with caution.

REVIEW OF PREVIOUS WORK

The Horticultural Research Institute has for many years compiled information about nurserymen that is useful to nursery businessmen as well as researchers *(5)*. In general, the Institute's reports provide a broad picture of the industry in terms of general resources, trends, operating costs, products, services, customers, and the market. Information is also provided on data processing and on how to establish bookkeeping systems. Such information is useful, but is not sufficient to answer production and marketing questions about locational differences, cultural practices, impact of changing factor prices, and the choice of shipping mode as prices change.

Results useful to this study were reported in 1972 by Aylesworth *(1)* and in 1974 by Scott *(11)*, who estimated the cost of producing six common species of woody ornamentals grown in Illinois *(1, 11)*. In that study, an attempt was made to determine the most profitable time to harvest the different species studied by analyzing input costs, length of the production period, and impact of changing interest rates.

Padgett and Frazier reported in 1962 the relationship between costs and pricing woody ornamental species in Georgia. Costs in this study were synthesized from several nursery operations for container-grown plants but were not identified for any given species *(6)*.

Coutu and Cohen, in a study of the market potential for native woody ornamentals in North Carolina, developed cost

comparisons of alternative cultural systems and illustrated preliminary applications of cost data on locational advantage *(2)*.

Cost figures for producing Pfitzer junipers, Kurume azaleas, dogwood, and pin oak have been estimated from 1977-1979 data within the Southern Region *(7, 8, 9, 10)*. A wide range in production cost for both container and field-grown stock was identified. These cost differences were primarily attributed to locational differences and variations in production practices.

A comparative business analysis by Gunter, for Florida container-grown crops, relating sales, costs, returns, and production efficiency measures, was valuable to the nurseryman in evaluating efficiency *(4)*. However, it did not provide detailed cost-price relationships for individual woody ornamental crops *(4)*.

OBJECTIVES

The general objective of this study was to estimate costs of producing selected woody ornamentals to provide producers a means to evaluate production alternatives. Woody ornamentals, for which costs were estimated, were the Pfitzer juniper, Kurume azalea, Burford holly, and crapemyrtle, all produced in 1-gallon containers, and for forsythia which was field-grown.

Specific objectives were to:
(1) describe a nursery production system for producing the Pfitzer juniper, Kurume azalea, Burford holly, and crapemyrtle in 1-gallon containers and for field grown forsythia, and to estimate costs for producing these plants under the system described for representative nursery producers in Alabama; (2) develop estimates of the effect of varying input costs on cost-price relationships of producing woody ornamentals grown in Alabama; and (3) estimate costs for shipping Alabama grown nursery stock in 1-gallon containers by standard sized carriers from production points to selected markets in the southern, midwest, mid-atlantic, and northeastern parts of the United States.

STUDY AREAS

Nursery production areas in Alabama are concentrated mainly in two geographical locations. These areas, one in the southern gulf coast part of the State and the other in the

northern part of the State near the Tennessee border, encompass two major plant hardiness zones, see figure. The south Alabama production area borders on Zone 8b (15°F-20°F) and Zone 9a (20°F-25°F average minimum temperature), while the north Alabama production area is entirely in Zone 7b (5°F-10°F) *(13)*. Minimum temperatures in the southern area can drop to 7°F, while in north Alabama, minimum temperatures can be several degrees below zero.

GENERAL PROCEDURES

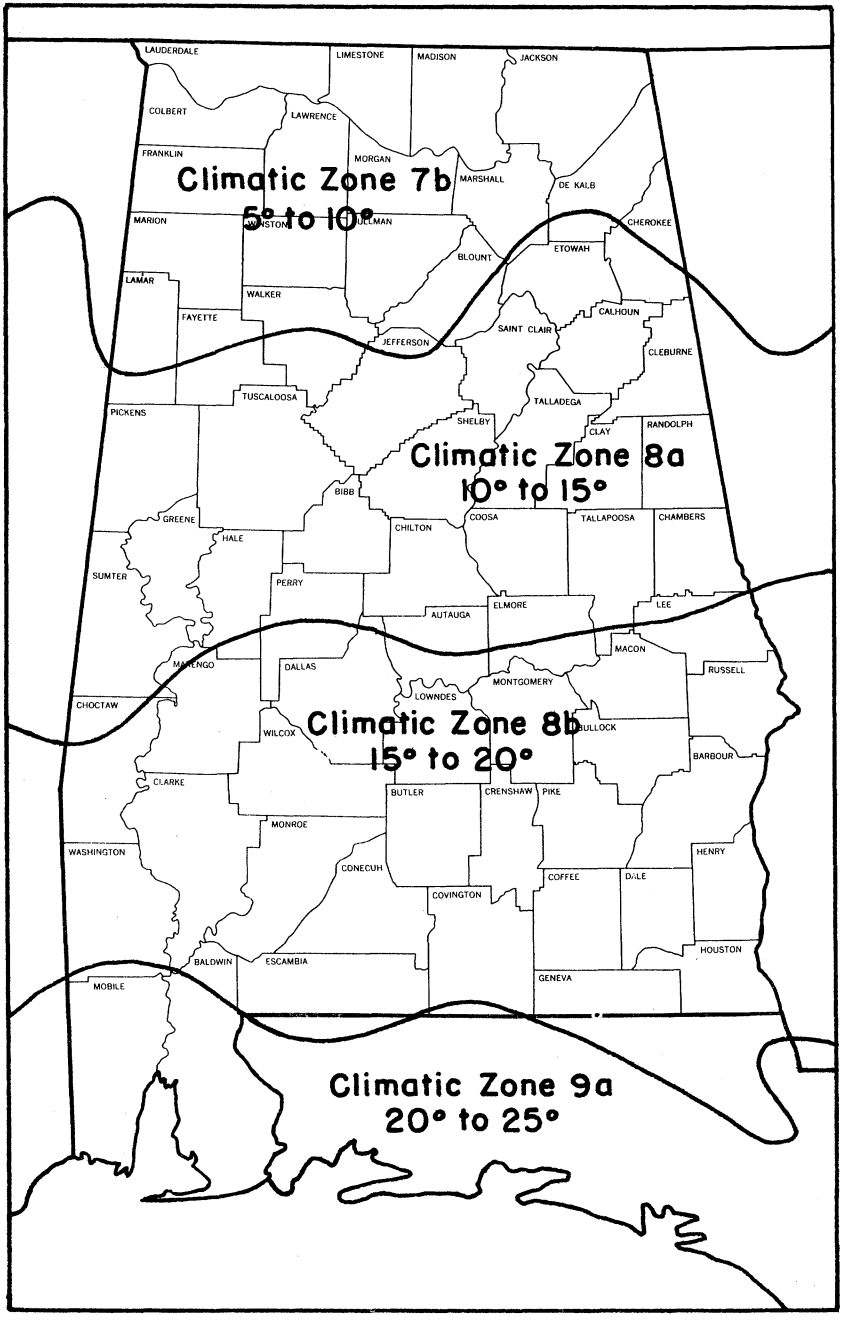
The technique employed in this study was enterprise budgeting, a device used in production planning involving the level and sequencing of necessary inputs and anticipated results. Budgets developed reflect capital requirements, production systems, input costs, and input-output coefficients for both container and field-grown plants which are appropriate to production areas in Alabama. The model budgets are intended only as guides. They are useful to nurserymen in identifying and changing production decisions, estimating capitalized values, supporting financial management programs, and planning alternative courses of action. Adjustments must be made in the budgets by users to include their actual input costs and production sequences.

To facilitate consistency in model budgets, basic guidelines were specified for the study. These related to production systems, standardization procedures, input costs, shipping costs, and fixed cost allocations.

PRODUCTION SYSTEMS

Production sequences, cultural practices, and costs were synthesized from data collected from managers of Alabama nurseries producing the crops studied. The assumed level of management for which data were collected was defined as "high level management." The level of management influences the level of technology employed, physical production responses, and, to a lesser degree, the level of input and output prices.

Specifying the level of technology does not mean that the same cultural practices, machinery, etc. will be found on all nurseries even in the same area. Technology that is applicable to large nurseries may not be economically justifiable for small nurseries. For example, topography, soil type, and field



Climatic zones (zones of plant hardiness) and average annual minimum temperatures.

layout may affect the type of machinery used in producing field-grown stock and may be quite different for nurseries of different sizes. Budgeted production sequences and associated technical coefficients may not exactly represent any one nursery firm, but it is believed the data are representative of production sequences for Alabama nurseries.

The main reasons for a detailed description of the steps in the production process were to obtain information about timing and amount of labor required; machinery required, when it was needed, and the amount it was used; materials required and when they were needed; and field space required and when it was needed. From the technical coefficients generated from studying these production steps, direct costs for labor, supplies, machinery, and other materials of production were estimated.

STANDARDIZATION PROCEDURES

The standardization procedure involved fixing some of the physical characteristics of nurseries such as nursery size, crop mix, finished plant sizes, and plant loss rates, tables 1 and 2. The number of salable plants was used as the basic unit for developing all requirements for production, allowing sufficiently for propagation and production losses. Also, basic input prices for land, interest rates, salaries, and hourly wage rates were fixed, table 3. However, in the latter case, input prices were varied to study their effect on production cost per plant. Loss rates were similarly studied.

In addition, overhead items such as license fees, bonds, advertising, general repairs and maintenance, utilities, taxes, and insurance were specified. However, in this case, quantities and prices were not specifically fixed.

TABLE 1. NURSERY STANDARDS FOR A 55-ACRE NURSERY WITH 5 ACRES DEVOTED TO CONTAINER PRODUCTION

Characteristics	Unit	Container production	Field production
Size of firm			
Total	Acres	5	50
Growing area	Acres	4	45
Bed size	Feet	8 × 40	—
Beds per acre	Number	80	—
Plants per acre	Number	32,000	4,500
Spacing, av.	Inches on center	12-14	30 × 44
Total plants	Number in production	128,000	202,500

TABLE 2. STANDARD ENTERPRISE MIX FOR A 55-ACRE NURSERY WITH 5 ACRES DEVOTED TO CONTAINER PRODUCTION

Enterprise mix		Total crop	Production cycle	Loss rate		Plants in production cycle	Finished size	Sales in fall[1]	Sales in spring
				Propagation	Growing				
	Acres	*Pct.*	*Months*	*Pct.*	*Pct.*	*No.*	*In.*	*Pct.*	*Pct.*
Container crop—1 gal.									
Kurume azalea	0.4	10	10	10	2.5	12,800	9-12	70	30
Pfitzer juniper	.4	10	18	10	2.5	12,800	9-12	25	75
Burford holly	.4	10	22-24	5	5	12,800	12-15	50	50
Crapemyrtle	.4	10	13	10	3	12,800	18-24	50	50
Forsythia	.4	10	24	50	10	12,800	24-36	25	75
Other species	2.0	50	18-24	10	4.6	64,000	12-15	50	50
Field crop									
B&B broadleaf and narrow leaf evergreens	45	100	24-30	10	5	202,500	12-15	25	75

[1]Percent sales in the fall are estimates. Where fewer actual sales are anticipated, increased winter protection costs would be involved.

TABLE 3. FACTOR PRICE ASSUMPTIONS FOR BASE AND COMPARATIVE COST ANALYSIS

Factor	Unit	Base conditions	Comparative cost analysis		
			Low	Medium	High
Land					
Value per acre	Dol.	2,000	1,000	3,000	—
Capital					
Investment					
Time	Months	12	12	12	12
Rate	Pct.	10	7	15	18
Operating					
Time	Months	6	6	6	6
Rate	Pct.	10	7	15	18
Labor					
Operator	Dol. per year	20,000	15,000	25,000	30,000
Supervisor	Dol. per year	12,000	9,000	15,000	18,000
Seasonal	Dol. per hour	3.50	2.50	3.50	4.50

SOURCE OF INPUT COSTS AND SHIPPING COSTS

Input Costs

All input costs were based on 1980 prices. Input costs considered were land, capital, labor, general overhead, machinery mix, variable operational inputs, and shipping cost.

Land. Land is a major component of capital investment in a nursery, so land values could have a considerable impact on the budgeting results. For budgeting purposes, land values were fixed at $2,000 per acre with land costs (property tax and interest) charged against the nursery in the analysis. Fixed value estimates included consideration of locational factors such as potential for residential developments, plant sites, and highway right-of-ways, and consideration of differences in productivity.

Capital. It was assumed a nursery grower could earn or obtain all the capital needed for investment and operating purposes at annual rates of 15 percent compounded over the time span required to grow the crop. Investment capital included the owner's own capital (his equity) and that which might have to be borrowed. The annual interest charge on operating capital was calculated for a time period of 6 months for each current year and compounded for previous years, which was considered representative of the average time the money was involved. Interest charges represent what could be earned by a nurseryman in an alternative investment.

Labor. It was assumed that seasonal unskilled labor was available in unlimited quantities as needed at a $3.50 hourly wage rate. Labor requirements and timing of each growing and harvesting operation were specified according to the production system. Performance rates outlined for production systems are reasonable and easily attainable. However, it is recognized that considerable labor (time) is required for activities not specifically listed. Some examples are machinery repairs; general repairs; hauling materials; losses caused by weather, especially rain; purchasing and storing inputs; banking requirements; time associated with selling; and time losses between activities. The labor requirement was increased 20 percent to allow adequately for these activities.

General overhead. General overhead in a nursery consists of large expense items often equal to the variable expenses for the nursery as an entire unit *(3)*. These costs were allocated to each budget based on survey results in actual nurseries.

Machinery mix. Types of machinery and equipment for each budgeted production sequence represented that which was actually being used in production nurseries. Costs for machinery were determined from suppliers in the area where used. Use of custom operators to perform various field tasks was assumed for crops when appropriate. Machinery input-output coefficients were obtained from the *Farm Planning Manual* prepared by Extension specialists at the University of Tennessee, as were published materials relating to nursery operations and time and motion studies of operations performed at nurseries *(15)*.

Operational inputs. Operational inputs included such items as liners (if not propagated by the nursery), plastic for greenhouses and under containers, materials for balling and burlapping, containers, chemicals (insecticides and herbicides), media components, and fertilizers.

Shipping Costs

Transportation costs from production points to selected market centers were investigated. Shipping cost estimates were based on standard sized carriers (semitractor trailer) moving plants to markets in Atlanta, Indianapolis, Washington, New York, and Boston.

Fixed Cost Allocations

Standard procedures were used to allocate fixed costs, those which were incurred regardless of the level of output once the

operation was established. Total fixed costs for the entire nursery were estimated on an annual basis. Taxes on land were estimated at the rate of 2 percent per year of the assessed value which was at full market value. Annual interest charge to land was at the rate of 10 percent per year of full market value.

Some costs, such as depreciation, were difficult to classify because some costs could have been caused by obsolescence (a fixed cost) or wear through use (a variable cost). For this reason, depreciation was included along with insurance and taxes as a fixed cost. Annual depreciation of buildings was estimated by dividing the initial value of the buildings, adjusted for salvage value, by years of useful life. Annual interest charges to buildings were at an annual rate of 6 percent of initial cost. Annual insurance and taxes were an estimated cost based on 2 percent of the initial cost of the buildings.

For machinery and equipment, depreciation, taxes, and insurance costs were adopted from the *Farm Planning Manual (15)*. Interest was charged at an annual rate of 7.5 percent of initial cost. A higher rate might more appropriately be charged in the future if interest rates continue to increase.

Included in fixed costs was a group of costs identified as general overhead. Items in this grouping were those which could not be tied specifically to other physical inputs, such as utilities, advertising, insurance, and management level salaries. Management level salaries, the largest overhead cost item, were estimated in terms of alternative employment opportunities facing nursery operators and supervisors. All overhead costs for which the budgets were prepared were cumulative by years (months), covering the time production began until time of sale.

RESULTS

Nurserymen in various Alabama nurseries utilized different combinations of resources to produce ornamental plants. Even within concentrated production areas, individual producers frequently used different resource combinations. Many factors, including similarities in weather, soil, transportation cost for inputs, etc. caused similar cost patterns within production areas. Variations in one or more of these key factors often resulted in a greater cost difference between production areas than within areas.

Nursery size for estimating production costs was standardized as a 55-acre nursery. Four acres were devoted to

TABLE 4. ESTIMATED CAPITAL REQUIREMENTS FOR A 55-ACRE ALABAMA NURSERY PRODUCING IN THE FIELD AND IN CONTAINERS, 1980

Item	Description	Unit	Number	Per unit	Total initial cost	Salvage value	Useful life in years
				Dol.	*Dol.*	*Dol.*	*Dol.*
Land		Acre	55	2,000	110,000	—	—
Buildings							
Office	25 × 60 ft.	Sq. ft.	1,500	20	30,000	—	20
Machinery storage	12 × 100 ft.	Sq. ft.	1,200	6	7,200	—	20
Packing and supply storage	24 × 50 ft.	Sq. ft.	1,200	10	12,000	—	20
Concrete slab	35 × 50 × .33 ft.	Cu. yd.	21.4	30	640	—	20
Propagation greenhouses	21 × 96 ft.	2,016 sq. ft.	6	1,500	9,000	—	10
Subtotal	—	—	—	—	168,840	—	—
Machinery and equipment							
Tractor	34 h.p.	Ea.	1	—	10,500	1,050	10
Tractor with front-end loader	50 h.p.	Ea.	1	—	19,000	1,900	10
Tractor	85 h.p.	Ea.	1	—	19,700	1,970	10
Plow	3-14 in. mounted	Ea.	1	—	940	94	10
Disk	8 ft. tandem, mounted	Ea.	1	—	1,175	118	10
Harrow	10 ft.	Ea.	1	—	1,000	100	10
Cultivator	2-row	Ea.	1	—	829	83	10
Rotovator for 50 h.p. tractor	50 ft.	Ea.	1	—	3,000	375	8
Sprayer	Hydraulic piston	Ea.	1	—	2,000	200	10
Sprayer, air blast	100 gal. pto	Ea.	1	—	4,300	430	10
Transplanter	2-row	Ea.	1	—	1,200	120	10
Fertilizer spreader	—	Ea.	1	—	386	38	6
Pickup truck	1/2-ton	Ea.	1	—	5,000	500	10
U-blade digger	—	Ea.	1	—	210	21	10
Forklift	pto	Ea.	1	—	3,500	350	10
Rotary mower	5 ft.	Ea.	1	—	1,150	115	10
Farm trailers	4-wheel	Ea.	2	750	1,500	150	10
Truck	1½-ton	Ea.	1	—	8,100	810	10
Sprayer, small	Backpack, solo	Ea.	1	—	375		5
Irrigation system	Pump, controls, line, nozzles, etc.	—	1	—	10,000	1,000	10
Hand tools	Miscellaneous	—	—	—	750	0	5
Subtotal	—	—	—	—	93,615	9,414	—
Total	—	—	—	—	262,455	—	—

container-grown stock, 45 acres to field production, and 6 acres to buildings, roadways, and holding areas. The standard enterprise mix consisted of Kurume azalea, Pfitzer juniper, Burford holly, crapemyrtle, forsythia, and other ornamental species grown in containers and in the field. This enterprise mix produced in one production cycle 128,000 1-gallon container-grown plants and 202,500 field-grown plants. For this study, enterprise budgets were developed for the container-grown crops and for field-grown forsythia.

Table 4 shows the estimated capital requirements (land, buildings, and equipment) for the 55-acre nursery. Capital requirements are $262,455, with $110,000 allocated to land, $58,840 to buildings, and the remaining $93,615 to machinery and equipment.

Data on labor and equipment requirements, to complete a production cycle for each of the five species studied, are detailed in appendix tables 1 through 5. The total cost per hour for operating various types of farm equipment is detailed in appendix table 6.

VARIABLE COSTS

Costs which varied with the quantity of crops produced (variable costs) amounted to $56,690 for container production, table 5. On an overall basis, variable costs were 73 cents per plant. However, when variable costs of each ornamental species produced were considered according to specific production requirements of each crop, more accurate production costs were ascertained. Variable costs for producing 1-gallon container nursery plants per salable plant were Pfitzer juniper, 93 cents; kurume azalea, 74 cents; Burford holly, 78 cents; crapemyrtle, 56 cents; and other representative evergreen crops, 89 cents. For the field-grown forsythia, variable cost per plant was 55 cents.

Propagation costs and the cost of purchasing liners are important variable cost items. For this container operation, liners were purchased for Pfitzer junipers, and cuttings were propagated for other species grown. Cost for each potted 6- to 7-inch Pfitzer juniper liner was 32.5 cents, thus requiring $4,267 to produce 12,800 salable plants. Cost of propagating cuttings and growing them to container sizes, producing 12,800 salable plants for each species were: Kurume azalea, $2,229 or 17.4 cents each; Burford holly, $2,305 or 18.0 cents each; crapemyrtle, $2,244 or 17.5 cents each; forsythia, $2,396 or 18.7

TABLE 5. ESTIMATED VARIABLE COSTS OF PRODUCING 12,800 1-GAL.-CONTAINERS OF EACH OF THE SELECTED CROPS IN A 55-ACRE NURSERY WITH 4 ACRES CONTAINER GROWING AREA, ALABAMA

Materials	Description	Unit	Cost per unit	Pfitzer juniper		Kurume azalea		Burford holly		Crapemyrtle		Forsythia		Other crops
				Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	(64,000) cost
Propagation														
Containers	3 in. plastic pots	Ea.	.04	—	—	14,588	583.12	14,183	567.32	14,662	439.86	—	—	—
Medium	Peat, vermiculite, perlite	Cu. ft.	.75	—	—	162	121.50	—	—	—	—	—	—	—
Rooting hormone	IBA in talc, .3 pct.	Lb.	8.00	—	—	.5	4.00	.5	4.00	.5	4.00	—	—	—
Pine bark mix	Pine bark, sand, and nutrients	Cu. ft.	.50	—	—	—	—	162	81.00	175	87.50	(.16A)	38.40	—
Chemicals														
Fertilizer	12-6-6	50 lb.	10.35	—	—	1.2	12.42	2	20.70	—	—	—	—	—
Osmocote	18-6-12	1 lb.	.56	—	—	—	—	—	—	—	—	—	—	—
Ammonium nitrate	33.5-0-0	50 lb.	8.50	—	—	—	—	—	—	3.50	29.75	—	—	—
Muriate of potash	0-0-62	50 lb.	4.20	—	—	—	—	—	—	1.56	6.55	5	21.00	—
Diammonium phosphate	18-46-0	50 lb.	7.50	—	—	—	—	—	—	.56	4.20	5	37.50	—
Chelated iron	Soluble Fe	5 lb.	11.35	—	—	1	11.35	.22	2.50	.50	5.68	—	—	—
Diazinon	Insecticide	Gal.	30.00	—	—	.75	22.50	—	—	4.13	123.75	.75	22.50	—
Disyston	Insecticide	Gal.	18.45	—	—	.75	13.84	1.12	20.66	—	—	1.12	20.66	—
Dexon	Fungicide	3 lb.	27.30	—	—	4	109.20	—	—	—	—	—	—	—
Benlate	Fungicide	2 lb.	19.00	—	—	—	—	1.25	23.75	.63	11.97	.63	11.97	—
Banrot	Fungicide	2 lb.	29.80	—	—	3	89.40	1.00	29.80	—	—	—	—	—
Captan	Fungicide	4 lb.	5.45	—	—	—	—	—	—	.38	2.07	.38	2.07	—
Chlorox	Sterilization	Gal.	1.50	—	—	1	1.50	1	1.50	1	1.50	—	—	—
Greenhouse cover, plastic		Sq. ft.	.025	—	—	4,000	100.00	4,000	100.00	4,000	100.00	—	—	—
saran		Sq. ft.	.130	—	—	3,000	390.00	3,000	390.00	—	—	—	—	—
Min. winter heat	Greenhouse	25' x 96'	496.00	—	—	.5	248.00	.5	248.00	—	—	—	—	—
Ronstar	Herbicide	50 lb.	33.00	—	—	—	—	—	—	.14	4.62	.06	2.00	—
Subtotal	—	—	—	—	—	1,706.83	1,099.23	—	—	—	821.45	—	156.70	—
Machinery and equipment	Trailer with front loader 50 h.p.	Hr.	6.12	—	—	.25	1.53	.25	1.53	.25	1.53	.88	5.39	—
	Tractor 34 h.p.	Hr.	4.34	—	—	12.25	53.16	17.50	75.95	32.25	139.97	.08	.35	—
	Trailer, 4-wheel	Hr.	1.11	—	—	.25	.28	.25	.28	.25	.28	.25	.28	—
	Sprayer	Hr.	2.70	—	—	12	32.40	19	51.30	32	86.40	.04	.11	—
	Irrigation system	Hr.	1.66	—	—	90	149.40	100	166.00	100	166.00	—	—	—
	Mist	Hr.	.04	—	—	200	8.00	100	4.00	100	4.00	—	—	—
	Hand tools		2.40	—	—	1	2.40	1	2.40	1	2.40	—	2.40	—
Subtotal	—	—	—	—	—	—	1,954.00	—	1,790.69	—	1,222.03	—	164.63	9,360.00
Field production in containers														
Containers	6 in. plastic cans	Ea.	.13	13,129	1,706.77	13,129	1,706.77	14,474	1,751.62	13,196	1,715.48	14,222	1,848.86	—
Soil mix	Pine bark mix with nutrients	Cu. yd.	6.25	50	312.50	50	312.50	55	343.75	51	318.75	54	337.50	—

Continued

TABLE 5. *(Continued)*. ESTIMATED VARIABLE COSTS OF PRODUCING 12,800 1-GAL. CONTAINERS OF EACH OF THE SELECTED CROPS IN A 55-ACRE NURSERY WITH 4 ACRES CONTAINER GROWING AREA, ALABAMA

Materials	Description	Unit	Cost per unit	Pfitzer juniper		Kurume azalea		Burford holly		Crapemyrtle		Forsythia		Other crops
				Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	(64,000) cost
Field plot cover	6 mil. black polyethylene	Sq. ft.	.02	10,500	210.00	10,500	210.00	10,500	210.00	10,500	210.00	10,500	210.00	—
Liners	6-7 in. potted	ea.	.325	13,129	4,266.93	—	—	—	—	—	—	—	—	
Chemicals					6,496.20		2,229.27		2,305.37		2,244.23		2,396.36	18,385.00
Osmocote	18-6-12	lb.	.56	144	80.64	144	80.64	—	—	—	—	—	—	—
Ammonium nitrate	33.5-0-0	50 lb.	8.50	450	38.25	900	76.50	—	—	6.69	56.86	—	—	—
Muriate of potash	0-0-62	50 lb.	4.30	—	—	—	—	—	—	3.22	13.52	—	—	—
Diammonium phosphate	18-46-0	50 lb.	7.50	—	—	—	—	—	—	1.16	8.70	—	—	—
Ammonium sulfate	21-0-0	50 lb.	3.00	—	—	—	—	—	—	.84	2.52	—	—	—
Fertilizer, urea form	38-0-0	50 lb.	21.00	.25	5.25	—	—	.25	5.25	.25	5.25	.25	5.25	—
Complete fertilizer	5-20-20	50 lb.	3.25	—	—	—	—	—	—	—	—	90	5.85	—
Complete fertilizer	12-6-6	50 lb.	10.35	--	—	17	176.00	25	258.75	—	—	—	335.34	—
Chelated iron	Soluble fe	5 lb.	11.35	2.50	28.38	1	11.35	0.72	8.75	—	—	1	11.75	
Lime	Dolomite	50 lb.	1.50	8	12.00	8	12.00	8	12.00	8	12.00	8	12.00	
Superphosphate	0-20-0	50 lb.	3.50	3	10.50	2	7.00	3	10.50	3	10.50	3	10.50	
Pesticides, growing														
Routine spray program														
Meta systox R, kelthane and tedion	Insecticide	—	—	—	60.00	—	—	—	—	—	—	—	—	
Diazinon	Insecticide	Gal.	30.00	—	—	.75	22.50	—	—	3.38	101.40	3.38	101.40	
Disyston	Insecticide	Gal.	18.45	—	—	—	—	5	92.25	—	—	—	—	
Sevin 50 WP	Insecticide	2 lb.	4.40	—	—	—	—	—	—	—	—	—	—	
Chlorodane	Insecticide	5 lb.	2.60	—	—	1	2.60	1	2.60	1	2.60	1	2.60	
Kelthane	Miticide	Pt.	3.20	—	—	—	—	4	12.80	—	—	4	12.80	
Karathane	Fungicide, mildew	Gal.	15.50	—	—	—	—	—	—	1	15.50	—	—	
Banrot	Fungicide	2 lb.	29.80	—	—	—	—	—	—	—	—	1	29.80	
Benlate	Fungicide	2 lb.	19.00	—	—	—	—	—	—	.57	10.83	—	—	
Dexon, 35 pct. W	Fungicide	3 lb.	27.30	—	—	—	—	—	—	—	—	1	27.30	
Captan, 50 WP	Fungicide	4 lb.	5.45	—	—	—	—	—	—	.28	1.53	.28	1.53	—
Truban, 30 WP	Fungicide	2 lb.	25.90	—	—	—	—	—	—	—	—	1	25.90	—
Manzate	Fungicide	3 lb.	6.00	—	—	—	—	—	—	1	3.00	1	3.00	—
Ronstar	Herbicide	50 lb.	30.00	—	—	—	—	—	—	.16	4.80	.16	4.80	—

Continued

TABLE 5. (*Continued*). ESTIMATED VARIABLE COSTS OF PRODUCING 12,800 1-GAL. CONTAINERS OF EACH OF THE SELECTED CROPS IN A 55-ACRE NURSERY WITH 4 ACRES CONTAINER GROWING AREA, ALABAMA

Materials	Description	Unit	Cost per unit	Pfitzer juniper		Kurume azalea		Burford holly		Crapemyrtle		Forsythia		Other crops
				Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	(64,000) cost
Princep 4 g.	Herbicide	50 lb.	30.50	20	12.20	—	—	—	—	—	—	20	12.20	—
Princep 80 WP	Herbicide	5 lb.	22.50	—	—	—	—	—	—	—	—	1	22.50	—
Paraquat	Herbicide	gal.	40.00	o20	8.00	—	—	.20	8.00	.20	8.00	.20	8.00	—
Enide 50 W	Herbicide	1 lb.	16.00	—	—	—	—	—	—	—	—	—	—	—
Treflan 5 pct.	Herbicide	40 lb.	25.50	—	—	—	—	—	—	.20	5.10	—	—	—
Roundup	Herbicide	Gal.	65.00	—	—	.10	6.50	.10	6.50	.10	6.50	.10	6.50	—
Lasso 50 WP	Herbicide	50 lb.	36.45	—	—	—	—	.10	3.64	.10	3.64	—	—	—
Subtotal	—	—	—	—	255.22	—	395.05	—	421.04	—	205.26	—	611.72	—
Machinery and equipment														
Tractor	34 h.p.	Hr.	4.34	108	468.72	84.80	368.03	114	494.76	97	420.98	97	420.98	—
Tractor with front end loader	50 h.p.	Hr.	6.12	42	257.04	17	104.04	17	104.04	17	104.04	17	104.04	—
Tractor	85 h.p.	Hr.	10.03	—	—	—	—	—	—	—	—	.3	3.01	—
Plow	8-14 in. mounted	Hr.	2.10	—	—	—	—	—	—	—	—	.30	.63	—
Disc	8 ft. tandem, mounted	Hr.	1.78	—	—	—	—	—	—	—	—	.12	.21	—
Harrow	10 in.	Hr.	.68	—	—	—	—	—	—	—	—	.06	.04	—
Cultivator	2-row	Hr.	2.35	—	—	—	—	—	—	—	—	.07	.16	—
Rotovator, for 50 h.p. tractor	50 in.	Hr.	10.16	—	—	—	—	—	—	—	—	.03	.30	—
Sprayer	hydraulic	Hr.	2.70	8	21.60	8	21.60	21	56.70	12	32.40	.02	32.40	—
Sprayer, air blast	100 gal. pto	Hr.	9.25	—	—	—	—	—	—	—	—	—	—	—
Transplanter	2-row	Hr.	3.93	—	—	—	—	—	—	—	—	.70	2.75	—
Fertilizer spreader	—	Hr.	1.81	2	3.62	—	—	—	—	—	—	.2	3.62	—
Pickup truck	1/2-ton	Hr.	4.38	50	218.50	50	218.50	50	218.50	50	218.50	50	218.50	—
U-blade digger	—	Hr.	.80	—	—	—	—	—	—	—	—	—	—	—
Fork lift	pto	Hr.	5.15	6	30.90	6	30.90	6	30.90	6	30.90	6	30.90	—
Rotary mower	5 ft.	Hr.	4.50	—	—	—	—	—	—	—	—	—	—	—
Farm trailer	4-wheel	Hr.	1.11	106	117.66	89.20	99.01	104	115.44	71.50	79.36	—	—	—
Truck	1 1½-ton	Hr.	7.10	—	—	—	—	—	—	—	—	—	—	—
Sprayer	Backpack, solo	Hr.	.83	—	—	—	—	—	—	8	6.64	—	—	—
Irrigation system	Pumps, controls, pvc pipe complete	Hr.	1.66	240	398.40	240	398.40	345	572.70	273	453.18	240	398.40	—
Hand tools	Miscellaneous	Hr.	1.20	1	1.20	1	1.20	1	1.20	1	1.20	1	1.20	—
Conveyor 20 ft.	—	Hr.	.06	20	3.62	20	3.62	20	3.62	20	3.62	20	3.62	—
Manure spreader	—	Hr.	1.33	2	2.66	2	2.66	2	2.66	2	2.66	2	2.66	—
Subtotals	—	—	—	—	1,529.74		1,643.05		2,021.56		1,104.08		1,835.14	8,660.00

Continued

TABLE 5. (*Continued*). ESTIMATED VARIABLE COSTS OF PRODUCING 12,800 1-GAL. CONTAINERS OF EACH OF THE SELECTED CROPS IN A 55-ACRE NURSERY WITH 4 ACRES CONTAINER GROWING AREA, ALABAMA

Materials	Description	Unit	Cost per unit	Pfitzer juniper		Kurume azalea		Burford holly		Crapemyrtle		Forsythia		Other crops
				Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	(64,000) cost
Labor														
Propagation	Man	Hr.	3.50	—	—	159.00	556.50	194.25	679.88	202.00	707.00	226.30	792.05	3,420.00
Growing	Man	Hr.	3.50	789	2,761.50	696.50	2,437.75	727.50	2,546.25	377.90	1,322.65	380.00	1,330.00	12,910.00
Subtotal	—	—	—	—	11,036.84	—	8,820.57	—	9,343.75	—	6,600.08	—	6,518.18	52,735.00
Interest on operating capital at 15 pct., 6 mo.	—	—	—	—	827.76	—	661.54	—	700.78	—	495.00	—	488.86	3.955.00
Total variable cost	—	—	—	—	11,864.60	—	9,482.11	—	10,044.53	—	7,095.09	—	7,007.04	56,690.00
Average variable cost per plant ..	—	—	—	—	.93	—	.74	—	.78	—	.56	—	.55	.89
Total fixed cost	—	—	—	—	4,433.01	—	3,549.35	—	5,962.85	—	4,877.78	—	4,137.66	20,212.00
Average fixed cost per plant	—	—	—	—	.34	—	.28	—	.47	—	.38	—	.32	.31
Total cost per plant	—	—	—	—	1.27	—	1.02	—	1.25	—	.94	—	.87	1.20

cents each; and other evergreen species, $3,677 or 28.7 cents each. Liner costs were about 35 percent of the total variable costs for the Pfitzer junipers and propagation costs were about 24 percent of the variable costs for Kurume azaleas.

In terms of the total costs for producing these plants, variable costs comprised 73 percent of the total costs for Pfitzer junipers; 72 percent for Kurume azaleas; 62 percent for Burford holly; 60 percent for crapemyrtle; 63 percent for forsythia; and 74 percent for other container-grown evergreens.

Fixed Costs

Table 6 shows the annual ownership cost (fixed costs) for the various capital items required. Costs per unit were estimated using the total annual fixed cost for the nursery and the total number of plants of the various species being grown in the nursery for sale in a given year. Thus, the fixed cost per plant could be determined regardless of the length of the production cycle for a given species. Where the crop was grown for more or less than a year, an adjustment was made in the number of plants available for sale, reflecting the time period required to complete a production cycle.

Total fixed costs for the 55-acre nursery included $13,200 for land, $7,511 for buildings, $13,353 for machinery and equipment, and $44,468 for general overhead, or a total fixed cost of $78,532. Fixed cost per 1-gallon container-grown plant grown on the 4 acres devoted to container production was 34 cents per plant for Pfitzer junipers; 28 cents for Kurume azaleas; 47 cents for Burford holly; 38 cents for crapemyrtle; and 31 cents for the other species of evergreen. For field-grown forsythia, fixed cost per plant was 32 cents.

Total Costs

Total cost per 1-gallon container-grown plant varied considerably by species. Cost estimates per plant for the Pfitzer juniper were $1.27; the Kurume azalea, $1.02; the Burford holly, $1.25; and the crapemyrtle, $0.94. The cost per plant of field-grown forsythia was $0.87. Variation in production practices among growers of the same species was common. Wide variations occurred in man-hours of labor used to produce the crop, type of equipment used, and the kind, amount, and value of chemicals used in the production process. The length of time in the production cycle also had an important effect on the total cost per plant.

TABLE 6. ESTIMATED ANNUAL FIXED COSTS FOR BUILDINGS, EQUIPMENT, AND GENERAL OVERHEAD FOR A 55-ACRE ALABAMA NURSERY PRODUCING IN THE FIELD AND IN CONTAINERS, 1980

Item	Description	Depreciation[2]	Interest[3]	Insurance and taxes[4]	Total	
		Dol.	*Dol.*	*Dol.*	*Dol.*	
Land	taxes[1]	—	—	2,200	2,200	
	Interest, 10 pct.	—	11,000		11,000	
Subtotal	—	—	11,000	2,200	13,200	(16.8 pct.)
Buildings						
Office	25 x 60 ft.	1,500	1,500	600	3,600	
Machinery storage	12 x 100 ft.	360	360	144	864	
Packing and supply storage	24 x 50 ft.	600	600	240	1,440	
Concrete slab	35 x 50 x .33 ft.	32	32	13	77	
Propagation greenhouses	6 houses, 21 x 96 ft.	900	450	180	1,530	
Subtotal	—	3,392	2,942	1,177	7,511	(9.6 pct.)
Machinery and equipment						
Tractor	34 h.p.	945	525	45	1,515	
Tractor with front end loader	50 h.p.	1,710	950	81	2,741	
Tractor	85 h.p.	1,773	985	84	2,842	
Plow	3-14 in. mounted	85	47	4	136	
Disk	8 ft. tandem, mounted	106	59	5	170	
Harrow	10 ft.	46	26	2	74	
Cultivator	2-row	75	41	4	120	
Rotovator for 50 h.p. tractor	50 in.	262	328	13	603	
Sprayer	Hydraulic piston	180	100	8	288	
Sprayer	Air blast—100 gal. pto	387	215	18	620	
Transplanter	2-row	108	60	5	173	
Fertilizer spreader	—	58	19	2	79	
Pickup truck	½-ton	450	250	21	721	
U-blade digger	—	19	11	1	31	
Forklift	pto	315	175	15	505	
Rotary mower	5 ft.	104	58	5	167	
Farm trailers	4-wheel	135	75	6	216	
Truck	1½-ton	729	405	34	1,168	
Sprayer	Backpack, solo	75	19	2	96	
Irrigation system	Pumps, control, pvc pipe, nozzles, etc.	450	450	0	900	

Continued

TABLE 6 *(Continued).* ESTIMATED ANNUAL FIXED COSTS FOR BUILDINGS, EQUIPMENT, AND GENERAL OVERHEAD FOR A 55-ACRE ALABAMA NURSERY PRODUCING IN THE FIELD AND IN CONTAINERS, 1980

Item	Description	Depreciation[2]	Interest[3]	Insurance and taxes[4]	Total
		Dol.	*Dol.*	*Dol.*	*Dol.*
Hand tools	Miscellaneous	150	38	0	188
Subtotal	—	8,162	4,836	355	13,353 (17.0 pct.)
General overhead					
Electricity	—	—	—	—	1,800
Telephone	—	—	—	—	1,200
General repairs and maintenance (buildings, roads, etc.)	—	—	—	—	2,500
License and bonds	—	—	—	—	250
Advertising	—	—	—	—	1,000
Insurance (general, health, workmens comp.)	—	—	—	—	2,600
Travel	—	—	—	—	1,000
Operator's salary	—	—	—	—	20,000
Supervisory salary	—	—	—	—	12,000
Interest on av. (½) overhead	—	—	2,118	—	2,118
Subtotal	—	—	—	—	44,468 (56.6 pct.)
Total annual fixed cost	—	—	—	—	78,532 (100.0 pct.)

[1]Property taxes were estimated at the rate of 2 pct. per year at full market value.
[2]Annual depreciation on buildings was estimated by dividing the initial value adjusted for salvage value by years of useful life.
[3]Annual interest on land was at the rate of 10 pct. per year of full market value; on buildings at an annual rate of 6 pct. of initial cost; and on machinery and equipment at an annual rate of 7.5 pct. of initial cost.
[4]Annual insurance and taxes were an estimated cost based on 2 pct. of the initial cost of the buildings.

EFFECT ON PRODUCTION COST DUE TO VARIATION IN INPUT FACTOR PRICES

Variations in production techniques are often caused by differences in input costs which affect nursery growers' decisions on cultural practices and investment in production facilities. To study the effect of changes in selected input costs on production cost estimates, a comparative analysis using different prices for land, labor, and capital was completed. Data on the production costs of the 1-gallon container-grown Kurume azaleas were used to illustrate the cost differences. It was assumed in the analysis that when the price of one input varied, prices of the other inputs remained constant. Further, for example purposes, it was assumed that as prices of various inputs changed, there was no change in the proportions of the inputs used.

LAND

Land values have a small effect on the cost of producing a 1-gallon container-grown Kurume azalea—about 1 cent per plant per $1,000 per acre change in land value, table 7.

LABOR

Salary paid the nursery operator, cost of supervisory labor, and wage rate for hired seasonal labor comprise labor cost. Total labor cost per plant varied considerably with different production systems for growing plants. Hired labor cost (variable costs) for 1-gallon container-grown plants ranged between 20 and 30 percent of the total variable costs, and operator and supervisory labor cost (fixed costs) ranged from 40 to 50 percent of total fixed cost.

If the salary of a nursery grower operating a 55-acre nursery with 4 acres devoted to growing Kurume azaleas and other plants in 1-gallon containers were increased (decreased) by $5,000 annually, the cost per azalea would increase (decrease) about 4 cents per plant.

Changes in supervisory labor costs also affect total cost per plant. When the cost of supervisory labor was increased (decreased) by $3,000 per year for 1-gallon container-grown plants in the nursery, the total cost per plant increased (decreased) between 2 and 3 cents.

An increase in the hourly wage of 50 cents for hired seasonal labor resulted in an increase of just over 3 cents to the cost of a 1-gallon container-grown plant.

TABLE 7. ESTIMATED EFFECTS OF LAND, LABOR, CAPITAL, AND FACTOR PRICES ON AVERAGE UNIT COST PER CONTAINER-GROWN PLANT, KURUME AZALEA PRODUCTION COST USED IN THE EXAMPLE, ALABAMA, 1980

	Average cost per 1-gal. container-grown azalea	Difference in cost per Kurume azalea	Cost per plant difference by months in production cycle			
			10	13	18	24
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Land value per acre (base value)						
$1,000	101.2	−0.8	−0.8	−1.0	−1.4	−1.9
2,000	102.0	—	—	—	—	—
3,000	102.8	0.8	0.8	1.0	1.4	1.9
Labor costs[1]						
Operator's salary per yr. (base rate)						
$15,000	98.1	−3.9	−3.9	−5.07	−7.0	−9.4
20,000	102.0	—	—	—	—	—
25,000	105.9	3.9	3.9	5.07	7.0	9.4
30,000	109.8	7.8	7.8	10.1	14.0	18.8
Supervisory salary per yr. (base rate)						
$ 9,000	99.7	−2.3	−2.3	−3.0	−4.1	−5.5
12,000	102.0	—	—	—	—	—
15,000	104.3	2.3	2.3	3.0	4.1	5.5
18,000	106.6	4.6	4.6	6.0	8.2	11.0
Seasonal labor per yr. (base rate)						
$ 3.00	98.7	−3.3	−3.3	−4.3	−5.9	−7.9
3.50	102.0	—	—	—	—	—
4.50	105.3	3.3	3.3	4.3	5.9	7.9
5.00	108.6	6.6	6.6	8.6	11.8	15.8
Interest rate variable and fixed costs						
7 pct.	101.1	−0.9	−0.9	−1.2	−1.6	−2.2
10 pct.	102.0	—	—	—	—	—
15 pct.	103.5	1.5	1.5	2.0	2.7	3.6
18 pct.	104.4	2.4	2.4	3.1	4.3	5.8

[1]The amount of labor required to produce the Kurume azaleas was assumed to be consumed at the same rate during the production cycles of different lengths as it was for the 10-month azalea production cycle.

CAPITAL

The cost of money—or interest rate—charged to fixed and variable production costs, is an important cost item. Raising the interest rate from 10 to 15 percent for growing Kurume azaleas in 1-gallon containers would increase the cost of producing a plant about 1.5 cents.

LOSS RATES

Growing and harvesting loss rates vary by plant species grown. In this study, these losses were incorporated in the production cost per salable plant. It is quite common, however, that all salable plants are not actually sold. If these were carried over to another market season, additional costs would

TABLE 8. ESTIMATED EFFECT OF CHANGES IN THE PERCENTAGE OF PLANTS SOLD ON THE TOTAL COST PER 1-GAL. CONTAINER-GROWN PLANT BASED ON 12,800 SALABLE PLANTS OF DIFFERENT SPECIES, ALABAMA, 1980

1-gal. container-grown plants (except forsythia)	Total production cost per 12,800 salable plants[1]	Pct. of plants sold			
		100 (0)[2]	90 (10)[2]	80 (20)[2]	70 (30)[2]
	Dol.	*Cost per plant, dol.*			
Pfitzer juniper	16,298	1.27	1.41	1.59	1.82
Kurume azalea	13,031	1.02	1.13	1.27	1.45
Burford holly	16,007	1.25	1.39	1.56	1.79
Crapemyrtle	11,973	.94	1.04	1.17	1.34
Forsythia (field-grown)	11,145	.87	.97	1.09	1.24
Other evergreens ...	15,360	1.20	1.33	1.50	1.71

[1]Losses in growing and harvesting plants vary by species grown. The cost of these losses was incorporated in the production cost of the 12,800 salable plants produced for each species.

[2]The number in the parentheses expresses the data in terms of loss rates. All plants not sold were considered lost; therefore, the percentage not sold comprises the loss rate.

be incurred. The carryover costs were not included here. However, plants which were not sold are frequently considered as plant losses. When the costs to produce these unsold plants (losses) were subtracted from the total costs of producing all plants available for sale, the cost per plant actually sold increased considerably, table 8. Taking Kurume azaleas as an example, cost per 1 gallon of salable plant was $1.02 when all plants were sold. When only 90 percent of these plants were sold, cost per plant was $1.13, or 11 cents more; when only 70 percent were sold, cost per plant was $1.45, or 43 cents more.

SHIPPING COSTS

Plant species, size and type of truck, type of load, backhaul, loading and unloading rates, and transport charge per mile are sources of shipping cost variation. Informal surveys of trucking firms in 1980 indicated the following cost per mile for a loaded truck according to truck size:

Truck size	*Cost per mile (dol.)*
2-ton	.65-.75
10-wheeler	.85-1.00
5-axle	1.10-1.25

Variations in estimates differed according to guarantee of backhaul, number of stops, type of cooling, and type of plant protection.

Shipping cost for nursery plants marketed in 1-gallon containers were estimated using shipping points in Huntsville and

TABLE 9. SHIPPING COST PER 1-GAL. CONTAINER-GROWN PLANT FROM SHIPPING POINTS IN HUNTSVILLE AND MOBILE TO DESTINATION POINTS IN ATLANTA, INDIANAPOLIS, WASHINGTON, NEW YORK, AND BOSTON, 1980

Shipping points	Atlanta	Indian-apolis	Wash-ington	New York	Boston	Shipping cost per plant pyramid type load[1]									
						Atlanta		Indianapolis		Washington		New York		Boston	
						$1.10 per mile	$1.25 per mile	$1.10 per mile	$1.25 per mile	$1.10 per mile	$1.25 per mile	$1.10 per mile	$1.25 per mile	$1.10 per mile	$1.25 per mile
	Miles					*Dol. per plant*									
Huntsville ...	176	485	678	911	1,117	.03	.04	.09	.10	.12	.14	.16	.18	.20	.23
Mobile	335	716	943	1,176	1,382	.06	.07	.13	.15	.17	.19	.21	.24	.25	.28

[1]Based on 5-axle conventional semitractor trailer, 40,000 pounds maximum load at $1.10 and $1.25 per mile, one-way with no drop charges included. Also, based on 6,200 1-gal., 8 in.-10 in. container plants with a pyramid-type load.

Mobile and consuming centers in Atlanta, Indianapolis, Washington, New York, and Boston, table 9. It was assumed plants were shipped by 5-axle, semitractor trailer trucks with a 40,000-pound maximum load limit. Shipping costs at $1.10 and $1.25 per mile, one-way, with no drop charges, were used in making the estimates.

The semitractor trailer could carry 4,350 or 6,200 1-gallon containers, respectively, depending on whether the containers were loaded as a "racked"-type load or as a pyramid stack-type load. Under the assumptions stated and using a pyramid-type load, shipping cost per plant with a transport cost of $1.25 per mile from Mobile to Atlanta would be 7 cents; Indianapolis, 15 cents; Washington, 19 cents; New York, 24 cents; and Boston, 28 cents. Similarly, the shipping cost from Huntsville to Atlanta would be 4 cents; Indianapolis, 10 cents; Washington, 14 cents; New York, 18 cents; and Boston, 23 cents. Shipping cost per plant increased almost 45 percent when 1-gallon plants were placed on racks rather than the pyramid-loading method, table 9.

Some observations about shipping costs, regardless of loading method, can be made. In general, from Mobile, shipping costs more than double when the consuming center shifts from Atlanta to Indianapolis and quadruple from Mobile to Boston. Shipping costs from Huntsville increased 28 percent when the destination point was moved from Washington to New York and 36 percent when it moved to Boston. There are only minor differences in shipping costs from Mobile to either Indianapolis or Washington although these costs are about four times what they would be from Mobile to Atlanta.

SUMMARY

Cost estimates were developed for producing four woody ornamental species grown in 1-gallon containers and for one species field-grown. The four species, Kurume azaleas, Pfitzer junipers, Burford holly, and crapemyrtle, comprised about half of the woody ornamental mix grown on 4 acres devoted to container production, which was part of a 55-acre nursery operation. Forty-five acres of the nursery were devoted to field-grown plants and 6 acres were devoted to buildings, roadways, and holding areas.

Estimates were based on cultural practices commonly found in Alabama nurseries. Estimates of the effect of selected factor price differences on cost-price relationships were also made. The effect of loss rates on cost per plant was ascertained.

Shipping costs for plants shipped from Huntsville and Mobile to consuming centers in Atlanta, Indianapolis, Washington, New York, and Boston were estimated.

Total costs for producing the four different species in 1-gallon containers were Kurume azaleas, $1.02; Pfitzer juniper, $1.27; Burford holly, $1.25; and crapemyrtle, $0.94. The cost per plant of the field-grown forsythia was $0.87.

Variation in production practices among growers of the same species was more common than was homogeneity of production practices among growers. Wide variations occurred in man-hours of labor used to produce the crop, in the type of equipment used, and in the kind, amount, and value of chemicals used in the production process.

Land values have only a small effect on the cost of producing 1-gallon container-grown plants—about 1 cent per plant per year per $1,000 per acre change in land value.

The cost of money—or interest rate—charged to fixed and variable production costs is an important cost item. Raising the interest rate from 10 to 15 percent for growing a 1-gallon container-grown plant for 1 year would increase the cost per plant about 1.5 cents.

A 50-cent increase in the hourly wage for hired seasonal labor resulted in an increase of just over 3 cents for the annual cost of a 1-gallon container-grown plant.

If the annual salary of the operator of the nursery producing a 1-gallon container-grown plant in 1 year was increased by $5,000, the cost per plant would increase about 4 cents per plant. If the cost of supervisory labor increased $3,000 annually, the increased cost per plant would be between 2 and 3 cents.

Growing and harvesting loss rates vary by plant species grown. In this study, with Kurume azaleas taken as an example, the cost per salable plant would increase by 11 cents per plant if only 90 percent of the plants offered for sale were actually sold. If only 70 percent were actually sold, the cost per salable plant would increase by 43 cents.

Variations in shipping cost estimates per plant occur because of size of container, kind of plant, size and type of truck, type of load, backhaul, loading and unloading rates, and shipping charge per mile. Typical shipping costs for moving 1-gallon container-grown plants from Mobile to Atlanta would be 7 cents; Indianapolis, 15 cents; Washington, 19 cents; New York, 24 cents; and Boston, 28 cents.

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APPENDIX

TABLE 1. LABOR AND EQUIPMENT REQUIREMENTS FOR 1-GAL., CONTAINER-GROWN PFITZER JUNIPERS, 12,800 PLANTS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
January	Prepare soil mix, mix 50 cu. yd.	Tractor, 50 h.p.-front end loader	2.00	6.00
		Tractor, 34 h.p.-manure spreader	2.00	6.00
April	Clear beds, place plastic down	Hand	—	18.40
		Tractor trailer, 4-wheel	18.60	18.60
	Fill 13,120 1-gal. containers, pot liners, move to field, 2½ pct. death loss	Tractor, 50 h.p.-front end loader	40.00	131.00
		Tractor, 34 h.p.	40.00	—
		Trailer	40.00	—
April-August	Fertilize	Hand	—	19.00
	Osmocote (18-6-12)	—	—	—
	Weeding, 4x	Hand	—	140.00
	Herbicide application (¾ lb. Princep, 4 gal. per acre), 4x	Hand, cyclone spreader	—	8.00
	Insecticide application, 5x	Hydraulic sprayer	4.00	5.00
	Watering	Irrigation system	12.00	12.00
December	Winterize, if necessary	Labor and materials	—	—

Continued

TABLE 1 *(Continued)*. LABOR AND EQUIPMENT REQUIREMENTS FOR 1-GAL., CONTAINER-GROWN PFITZER JUNIPERS, 12,800 PLANTS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
April-August	Respacing for 2nd year growth	Hand	—	40.00
	Fertilize	Hand	—	19.00
	Osmocote (18-6-12)			
	Supplemental soluble fertilizer NH_4NO_3 in irrigation	—	—	—
	Pruning, 1x	Hand	—	50.00
		Tractor trailer	2.00	—
	Weeding, 4x	Hand	—	140.00
		Tractor trailer	4.00	—
	Herbicide application (¾ lb. princep, 4 gal. per acre), 4x	Hand-cyclone spreader	—	8.00
	Insecticide application, 5x	Hydraulic sprayer	4.00	5.00
	Watering	Irrigation system	12.00	12.00
October	Harvesting			
	Select 12,800 plants and haul to shipping area and load on semitrailer 4,350 1-gal. containers per load	Tractor trailer	37.75	151.00
		Conveyors	20.00	—

TABLE 2. LABOR AND EQUIPMENT REQUIREMENTS FOR PRODUCING 1-GAL., CONTAINER-GROWN KURUME AZALEAS, 12,800 PLANTS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
Propagation				
June 1	Cover greenhouse, 1 layer 6 mil. plastic plus Saran	Hand	—	3.00
	Prepare soil (6 cu. yd.)	Tractor, 52 h.p.-front end loader	.25	1.00
	Sterilize house and containers	Hand	—	4.00
	Fill 3 in. pots (14,578 pots) 10 pct. death loss	Hand	—	7.00
	Move to greenhouse	Tractor, 34 h.p. Trailer	.25 .25	1.00 —
	Take cutting, trim, dip, and stick	Hand	—	29.00
July-April	Checking, observing, and watering plants (2 hr./wk. for 36 wk.)	Overhead sprinklers (irrigation system)	90.00	72.00
	Mist		200.00	
	Fungicide: Dexon 3x, 4 lb./600 gal.	Tractor, 34 h.p.	9.00	18.00
	Banrot 3x, 36 oz./600 gal.	Hydraulic sprayer	9.00	—
	Insecticide application 3x-summer	Tractor, 34 h.p. Hydraulic sprayer	3.00 3.00	6.00 —
	Fertilize 6x, nursery special, 12-6-6	Cyclone seeder	6.00	6.00
	Pruning 1x	Electric shears	12.00	12.00
Subtotal	—	—	—	159.00

Continued

TABLE 2 *(Continued)*. LABOR AND EQUIPMENT REQUIREMENTS FOR PRODUCING 1-GAL., CONTAINER-GROWN KURUME AZALEAS, 12,800 PLANTS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
Field production				
January	Prepare soil mix (mix 50 cu. yd.)	Tractor, 50 h.p.-front end loader	2.00	6.00
April	Clear beds, blade field	Tractor, 34 h.p. with blade	1.00	1.00
	Fill 13,120 1-gal. containers	Tractor, 50 h.p.-front end loader	15.00	156.00
	Pot liners, move to field, 2.5 pct. death loss	Tractor 34 h.p. Trailer	23.00 34.50	— —
April-October 15	Fertilize 12-6-6, nursery special 7x	Hand	—	122.50
	Iron 1x	Tractor, 34 h.p. Hydraulic sprayer	2.00 2.00	4.00
	Pruning 1x	Electric shears	—	8.00
	Weeding 5x	Hand Tractor, 34 h.p. Trailer	— 5.00 5.00	160.00 — —
	Roundup 1x around beds	Tractor, 34 h.p. Trailer	3.00 3.00	6.00 —
	Insecticide application, 5x	Tractor, 34 h.p. Hydraulic sprayer	4.00 4.00	5.00 —
	Watering	Irrigation system	180.00	18.00

Continued

TABLE 2 *(Continued)*. LABOR AND EQUIPMENT REQUIREMENTS FOR PRODUCING 1-GAL., CONTAINER-GROWN KURUME AZALEAS, 12,800 PLANTS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
October	Harvesting, 70 pct. Select 8,960 plants and haul to shipping area and load on semitrailer	Tractor, 34 h.p.	33.00	140.00
		Trailer	33.00	—
October-February	Watering and observing	Irrigation system	45.00	10.00
February	Harvesting, 30 pct. Select 3,840 plants and haul to shipping area and load on semitrailer	Trailer	14.00	—
Subtotal	—	—	—	696.00
Total	—	—	—	855.50

TABLE 3. LABOR AND EQUIPMENT REQUIREMENTS FOR 1-GAL., CONTAINER-GROWN BURFORD HOLLY, 12,800 PLANTS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
Propagation				
June	Cover greenhouse, 1 layer plastic	—	—	3.00
	Prepare soil (6 cu. yd.)	Tractor, 50 h.p.-front end loader	.25	1.00
		Tractor, 34 h.p.	.25	—
		Trailer	.25	—
	Sterilize house and containers	Hand	—	4.00
	Fill 3-in. pots (14,183 pots) (5 pct. death loss)	Hand	—	7.00
	Move pots to greenhouses	Tractor, 34 h.p.	.25	1.00
June 15	Take cuttings, strip, dip and stick	Hand	—	36.25
June-June (1 yr.)	Checking and observing (42 wk. at 2 hr. per wk.)	—	—	84.00
	Mist	Mist system	50.00	—
	Watering	Overhead sprinkler (irrigation system)	200.00	—
	Drench with Benlate and Truban 2x	Hydraulic sprayer	6.00	12.00
		Tractor, 34 h.p.	6.00	—
	Pentac spray 2x	Hydraulic sprayer	6.00	12.00
		Tractor, 34 h.p.	6.00	—
	Di-syston spray 2x	Hydraulic sprayer	6.00	12.00
		Tractor, 34 h.p.	6.00	—
	Fertilize with 12-6-6	Cyclone seeder	—	12.00
	Iron 1x	Hydraulic sprayer	1.00	2.00
		Tractor, 34 h.p.	1.00	—
	Shearing 2x	Electric shears	12.00	12.00
Subtotal	—	—	313.00	198.25
Field Production				
June	Prepare soil (50 cu. yd.)	Tractor, 50 h.p.-front-end loader	2.00	6.00
	Clear beds	Tractor, 34 h.p.	1.00	1.00

Continued

TABLE 3 *(Continued)*. LABOR AND EQUIPMENT REQUIREMENTS FOR 1-GAL., CONTAINER-GROWN BURFORD HOLLY, 12,800 PLANTS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
July	Fill 13,474 1-gal. containers, pot liners, move to field	Tractor, 50 h.p.-front-end loader	15.00	156.00
		Tractor, 34 h.p.	23.00	—
		Trailer	35.00	—
	Fertilize with 12-6-6 8x	Hand	—	155.00
	Iron 2x	Hydraulic sprayer	4.00	8.00
		Tractor, 34 h.p.	4.00	—
	Pentac spray 5x	Hydraulic sprayer	6.00	12.00
		Tractor, 34 h.p.	6.00	—
	Di-syston spray 5x	Hydraulic sprayer	6.00	12.00
		Tractor, 34 h.p.	6.00	—
	Weed 5x	Hand	—	88.00
		Tractor, 34 h.p.	5.00	—
		Trailer	5.00	—
	Round up around beds	Hydraulic sprayer	3.00	6.00
		Tractor, 34 h.p.	3.00	—
	Prune 2x	Electric shears	24.00	24.00
	Watering	Irrigation system	240.00	24.00
October	Harvest 50 pct. of 12,800 plants (6,400) and haul to shipping area and load	Tractor, 34 h.p.	32.00	78.50
		Trailer	32.00	—
October-April	Fertilize with 12-6-6 2x	Hand	—	35.00
	Iron 1x	Hydraulic sprayer	2.00	4.00
		Tractor, 34 h.p.	2.00	—
	Watering and observing	—	105.00	—
	Push up containers	Hand	—	40.00
April 15	Harvest 6,400 plants, haul to shipping area and load	Tractor, 34 h.p.	32.00	78.00
		Trailer	32.00	—
Subtotal	—	—	460.00	727.50
Total	—	—	773.00	1,120.00

TABLE 4. LABOR AND EQUIPMENT REQUIREMENTS FOR 1-GAL., CONTAINER-GROWN CRAPEMYRTLES

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
Propagation				
April	Cover greenhouse, 1 layer 6 mil. plastic plus Saran	Hand	—	3.00
May	Prepare soil (6.5 cu. yd.)	Tractor, 50 h.p.-front-end loader	.25	1.00
	Sterilize house and containers	Hand	—	4.00
	Fill 3 in. pots (14,662 pots) 10 pct. death loss	Hand	—	8.00
	Move to greenhouse	Tractor, 34 h.p. Trailer	.25 .25	1.00 —
June 1	Take cuttings, trim, dip, and stick	Hand	—	32.00
June-November	Checking, observing, watering, and fertilizing plants (2 hr. per wk. for 23 wk.)	Mist system	57.50	46.00
	Constant feed fertilizer 150 p.p.m.	Injector system	57.50	—
	Insecticide: Diazinon 11x	Tractor, 34 h.p. Hydraulic sprayer with insecticide	11.00 11.00	22.00 —
	Fungicide: Captan 6x Benlate 5x		—	—
	Chemical weeding: (herbicide)	Cyclone seeder	1.00	1.00
Propagation				
November-March	Checking, observing, watering, and fertilizing plants (2 hr. per wk. for 21 wk.)	Mist system	52.50	42.00
	Constant feed fertilizer 75 p.p.m.	Injector system	52.50	—
	Fungicide: Captan 5x Benlate 5x	Tractor, 34 h.p. Hydraulic sprayer	10.00 10.00	20.00
Subtotal	—	—	—	180.00
Field Production				
March	Prepare soil mix (51 cu. yd.)	Tractor, 50 h.p.-front-end loader	2.00	6.00

Continued

TABLE 4 *(Continued)*. LABOR AND EQUIPMENT REQUIREMENTS FOR 1 GAL., CONTAINER-GROWN CRAPEMYRTLES

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
March	Clear beds, blade fields	Tractor, 34 h.p.-blade	1.00	1.00
	Fill 13,196 1-gal. containers 3 pct. death loss	Tractor 50 h.p.-front-end loader	15.00	130.00
April 1	Pot liners, move to field, can tight	Tractor, 34 h.p.	23.00	—
		Trailer	34.50	—
April-July	Watering and fertilization	Irrigation system	126.00	12.40
	Fertilize: constant feed—150 p.p.m.	Injector system	126.00	—
	Fungicide: Captan 3x	Tractor, 34 h.p.	6.00	6.00
	Benlate 3x	Hydraulic sprayer	6.00	—
	Insecticide: Diazinon 6x	Tractor, 34 h.p. Hydraulic sprayer with fungicide	—	—
	Chemical weeding: herbicide	Cyclone seeder	2.00	2.00
June	Space plants	Hand	—	13.00
July-October	Harvest 25 pct. Select 3,200 plants, haul to shipping area and load on semi-trailer	Tractor, 34 h.p.	12.00	30.00
		Trailer	9.00	—
November	Shove up 9,600 plants	Hand	—	15.00
	Cover for winter	Tractor, 34 h.p.	.50	18.00
		Trailer	.50	
November-March	Water, observe, and fertilize (75 p.p.m.)	Irrigation system	147.00	14.50
		Injector system	147.00	—
March	Remove winter cover	Tractor, 34 h.p.	.50	9.00
		Trailer	.50	—
	Respace 9,600 plants	Hand	—	9.00
April	Harvest 75 pct. Select 9,600 plants, haul to shipping area, and load on semi-trailer	Tractor, 34 h.p.	—	112.00
		Trailer	27.00	—
Subtotal	—	—	—	377.90
Total	—	—	—	650.90

TABLE 5. LABOR AND EQUIPMENT REQUIREMENTS FOR FIELD-GROWN FORSYTHIA, 12,800 PLANTS, SLEEVE PACKED WITH WOOD SHAVINGS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
Propagation				
July-October	Land preparation for propagation plot plow 2x	Tractor-plow (3-14 in. mounted)	0.30	0.60
	Disk 2x	Tractor-disk (8 ft. mounted)	.12	.15
	Harrow	Tractor-harrow (10 ft.)	.06	.08
	Apply fertilizer (5-20-20 at 500 lb. per a.)	Tractor-fertilizer spreader	.04	.06
	(Nursery plot consists of 0.16 a., 17 rows 100 ft. long and 3 ft. between rows)	—	—	—
November	Collect cuttings (25,600 6 in. cuttings), assuming 50 pct. survival rate producing 14,222 plants for transplanting	Hand tools	—	75.00
	Stick cuttings	Hand	—	38.00
April-October	Apply herbicide	Tractor-sprayer	.04	.06
	Cultivation 6x	Tractor-cultivator, 2-row	.70	.85
	Weeding	Hand	—	61.00
	Spray insecticide 3x	Backpack	12.00	14.40
	Fertilize (12-6-6) 3x	Spreader	1.50	2.40
	Prune rooted cuttings	Tractor, 34 h.p. and mower	.40	.60
November	Dig rooted cuttings (undercut, lift, pull, select)	Tractor-digger (U-blade)	1.35	10.80
	Move plants to packing-storage	Pickup	.55	.70
	Grade rooted cuttings		—	75.00
Field production				
January	Prepare soil mix (54 cu. yd.)	Tractor, 50 h.p.-loader	2.12	6.35
	Clear beds, blade fields, place plastic	Tractor, 34 h.p.-blade	1.00	16.00

Continued

TABLE 5 *(Continued).* LABOR AND EQUIPMENT REQUIREMENTS FOR FIELD-GROWN FORSYTHIA, 12,800 PLANTS, SLEEVE PACKED WITH WOOD SHAVINGS

Month	Description	Equipment	Hr. per 12,800 plants	
			Machine	Man
February	Fill 14,222 1-gal. containers	Tractor, 50 h.p.-loader	15.00	—
	Pot liners, move to field, place plastic	Tractor, 34 h.p.-trailer	43.00	142.00
April-September	Watering and fertilization	Irrigation system-injector	126.00	42.40
	Fungicide-insecticide 6x	Tractor, 34 h.p.-hydraulic sprayer	6.00	6.00
	Chemical weeding: herbicides 3x	Cyclone seeder, backpack	2.00	2.00
	Space plants	Hand	—	14.00
July-March	Harvest plants	Tractor trailer	38.00	151.00
		Conveyors	20.00	—

TABLE 6. ESTIMATED MACHINERY FIXED AND VARIABLE COSTS FOR AN ESTIMATED ANNUAL USE ON A PER HOUR BASIS, PLUS MACHINE AND LABOR TIME REQUIREMENTS PER ACRE, 1980

Type of machine	New cost	Expected life	Est. annual use	Total cost[1] per hour	Hr. per acre	
					Machine	Man
	Dol.	*Yr.*	*Hr.*	*Dol.*		
Tractor, 34 h.p.	10,500	10	600	4.34	—	—
Tractor with front-end loader, 50 h.p.	19,000	10	600	6.12	—	—
Tractor, 85 h.p.	19,700	10	600	10.03	—	—
Plow, 3-14 in. mounted	940	10	100	2.10	.75	.83
Disc, 8 ft. tandem, mounted	1,175	10	70	1.78	.30	.38
Harrow, 10 ft.	514	10	70	.68	.28	.35
Cultivator, 2-row	829	10	60	2.35	.60	.75
Rotovator, 50 in. for 50 h.p.	3,000	8	110	10.16	1.00	1.25
Sprayer, hydraulic, piston	2,000	10	140	2.70	.20	.25
Sprayer, 100 gal. air blast, pto	4,300	10	140	9.25	.10	.12
Transplanter, 2-row	1,200	10	40	3.93	2.00	6.00
Fertilizer spreader	386	6	60	1.81	.20	.25
Pickup truck, ½-ton	5,000	10	500	4.38	—	—
U-blade digger	210	10	40	.80	.35	13.00
Fork lift, pto	3,500	10	100	5.15	—	—
Rotary mower 5 ft.	1,150	10	60	4.50	.50	.62
Farm trailers, 4-wheel, 3 ea.	1,500	10	280	3.33	—	—
Truck, 1½-ton	8,100	10	300	7.10	—	—
Sprayer, back-pack, solo	375	5	40	.83	—	—
Irrigation system	10,000	10	730	1.66	—	—
Hand tools, miscellaneous	750	5	1880	1.20	—	—

[1]Annual fixed cost includes depreciation, interest, and insurance. Depreciation = less salvage value divided by expected life. Insurance rate = average value times $8.5 per $1,000.