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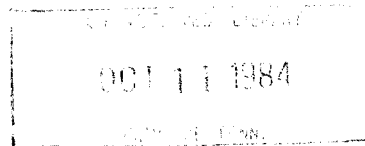


University of Tennessee Agricultural Experiment Station

Estimated Costs of Producing Container-Grown Nursery Plants

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and
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ESTIMATING COSTS OF PRODUCING CONTAINER-GROWN NURSERY PLANTS*

by

M. B. Badenhop and Travis D. Phillips**

INTRODUCTION

The purpose of this report is to summarize a process for estimating the costs of producing container-grown nursery plants. The Southern Regional Research Technical Committee (S-103) composed of horticulturists and agricultural economists from the land-grant universities of the South, has developed cost of production budgets for several representative container-grown plants produced in the South.¹ These budgets in each case represent one or two specific production systems.

The budgets were developed to aid producers in estimating their production costs. The ideal would be for nurserymen to keep sufficient records to estimate their costs in the same details that were used by the researchers in developing the budgets. However, few are likely to do so.

The objective then is to discuss some alternatives. However, before doing that, the question of why it is necessary to know the cost of producing individual plants should be addressed. Some nurserymen might say that they

*Presented to the Mississippi Nurserymen Association, Jackson, Mississippi, January 12, 1981.

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¹The project is S-103, Economics of Producing and Marketing Woody Ornamentals in the South. The research is a cooperative effort of the State Agricultural Experiment Stations in nine Southern states and the Tennessee Valley Authority. The nine cooperating states are: Alabama, Arkansas, Florida, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia.

don't particularly care about knowing the cost of producing particular crops; they just want to know how to make the maximum profit.

There are at least two reasons for needing cost information for each crop in order to maximize profits. First, if cost is not known, how can prices be determined? Second, if all prices cannot be fully adjusted to cover all costs, what combination of crops should be produced to maximize profits? In other words, what is the profit from each crop and which crop should be dropped or its production reduced and which should be expanded? Detailed records of costs and activities are required for answering such questions.

Many nurserymen do not keep records beyond those required to pay taxes. That is, no attempt is made to keep any records beyond the Schedule F of Form 1040 required by the Internal Revenue Service for paying federal income taxes. However, if a nurseryman thinks the bottom line on which he pays taxes represents a true measure of his performance as a manager and the return on his investment, he should have another thought. Assuming the nursery is not incorporated, this taxable income represents the return to unpaid labor, management, and investment. How does this return compare with what the operator could earn elsewhere and what the capital could earn if invested elsewhere? Thus, even if there is no interest in estimating costs for individual plants, consideration should be given to further analysis of taxable income as described above.

The ultimate in cost estimation represents a situation where so much detail has been kept that when the cost of producing each crop is added up, the total for all crops is equal to the numbers appearing on the Schedule F. Such a situation requires that records be kept daily assigning all labor, equipment usage, and materials to the appropriate crops or general overhead activities such as repairs and general maintenance.

Farm Income and Expenses

▶ Attach to Form 1040, Form 1041, or Form 1065.
▶ See Instructions for Schedule F (Form 1040).

1979

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Social security number

Farm name and address ▶

Employer identification number (see instructions)

Part I Farm Income—Cash Method

Do not include sales of livestock held for draft, breeding, sport, or dairy purposes; report these sales on Form 4797.

Sales of Livestock and Other Items You Bought for Resale

a. Description	b. Amount	c. Cost or other basis
Livestock ▶		
Other items ▶		
Totals		
Profit or (loss), subtract line 3, column c, from line 3, column b		

Sales of Livestock and Produce You Raised and Other Farm Income

Kind	Amount
Cattle	
Calves	
Sheep	
Swine	
Poultry	
Dairy products	
Eggs	
Wool	
Cotton	
Tobacco	
Vegetables	
Soybeans	
Corn	
Other grains	
Hay	
Straw	
Fruits and nuts	
Machine work	
Patronage dividends	
Per-unit retains	
Nonpatronage distributions from exempt cooperatives	
Agricultural program payments: a Cash	
b Materials and services	
Commodity credit loans under election (or forfeited)	
Federal gasoline tax credit	
State gasoline tax refund	
Other (specify)	
Add lines 5 through 30	
Gross profits* (add lines 4 and 31)	

Part II Farm Deductions—Cash and Accrual Method

F

Do not include personal or living expenses (such as taxes, insurance, repairs, etc., on your home), which do not produce farm income. Reduce the amount of your farm deductions by any reimbursement before entering the deduction below.

Items	Amount
33 a Labor hired	112,370
b Jobs credit	
c WIN credit	
d Total credits	
e Balance (subtract line 33d from line 33a)	112,370
34 Repairs, maintenance	2,450
35 Interest	
36 Rent of farm, pasture	
37 Feed purchased	
38 Seeds, plants purchased	
39 Fertilizers, lime, chemicals	12,410
40 Machine hire	
41 Supplies purchased	3,780
42 Breeding fees	
43 Veterinary fees, medicine	
44 Gasoline, fuel, oil	2,335
45 Storage, warehousing	
46 Taxes	750
47 Insurance	3,825
48 Utilities	4,750
49 Freight, trucking	
50 Conservation expenses	
51 Land clearing expenses	
52 Pension and profit-sharing plans	
53 Employee benefit programs other than line 52	
54 Other (specify) ▶	
Advertising	985
Containers	35,420
License, bonds, dues	390
Soil mix materials	7,520
Travel expense	1,240
Plastic & shade cloth	4,310
55 Add lines 33e through 54	
56 Depreciation (from Part III, line 62)	3,950
57 Total deductions (add lines 55 and 56)	196,485

Net farm profit or (loss) (subtract line 57 from line 32). If a profit, enter on Form 1040, line 19, and on Schedule SE, Part I, line 1a. If a loss, go on to line 59. (Fiduciaries and partnerships, see the Instructions.)

58

If you have a loss, do you have amounts for which you are not "at risk" in this farm (see Instructions)? Yes No

See amount on line 32 for optional method of computing net earnings from self-employment. (See Schedule SE, Part I, line 3.)

The concept of assigning labor, equipment, and materials by crops is a good idea because it makes people more conscious of how the day was used. Not much time is required to record data. The real work in the process has to do with all the summary work in the office.

Regardless of the above details, many cost items fall into the category of general overhead and must be allocated to crops. However, once a realistic procedure has been developed, the process becomes a repetitive one. Few nurseries now keep such records. This may change with the availability of the microcomputer to reduce the tedious paper work. However, the computer only speeds up the calculations; it will not eliminate the records which must be fed into it.

A third alternative represents modifying the budgets developed by the agricultural experiment station researchers. The big problem is that a particular nursery may not resemble closely the one described by the budgets. If not properly used, the procedure might lead to inaccurate cost estimates.

The fourth alternative is a hybrid of the others. Budgets are used to estimate some performance rates and costs while an allocation scheme is devised to distribute the actual overhead cost items to crops.

It is this latter approach that is illustrated here. Major emphasis will be on a method of estimating the cost of an individual one-gallon Kurume azalea which is propagated in midsummer, potted out in the spring with 30 percent of the azaleas marketed in the fall and the remaining 70 percent marketed the following spring.

PRODUCTION COST ESTIMATES

For purposes of illustration, data for a hypothetical 10-acre container nursery were developed from the type of data contained in Southern Cooperative

Series Bulletin 241, Factors Affecting Southern Regional Production Advantages for Kurume Azaleas published August, 1979 [1].

Suppose all the nurseryman has initially by way of summary records is the Schedule F, which is the usual income statement for tax purposes. From this data and with the help of a budget in the azaleas bulletin, the costs of producing an acre block of azaleas and the average cost per plant can be estimated.

Description of the Nursery

Before getting down to cost estimating, the nursery must be fully described including land usage, buildings, equipment, and labor. The hypothetical 10-acre nursery consists of 8 acres in nursery beds with the other 2 acres devoted to buildings, propagation greenhouses, and roads. The common denominator, of course, is the 8 acres of production because all the overhead costs associated with the other 2 acres must be covered.

Administration and labor consists of a full-time owner-manager, another full-time supervisor, a full-time bookkeeper-secretary, and unskilled laborers. The manager devotes 20 percent of his time directly to plant production with the remaining 80 percent in management activities. Since the nursery is not incorporated, there is not a charge in the Schedule F for the owner-manager's salary. The supervisor splits his time equally between production and management. Eighty percent of unskilled labor is associated directly with production with the other 20 percent involved with general maintenance, repairs, slack time between jobs, weather losses, and other activities which cannot be allocated to a particular crop.

The details of total investment are contained in Table 1. An initial investment of more than \$108,000 is involved with about 20 percent being land. Interest is a considerable cost if the investment is totally financed,

Table 1. Estimated capital requirements for a 10-acre nursery of container-grown plants

Item	Description	Total initial cost or value ---dollars---
<u>Land</u>	10	20,000
<u>Buildings:</u>		
Office	20' x 20'	8,000
Potting & packing shed, storage	35' x 35'	12,250
Concrete slab mixing area	35' x 50' x .33'	642
Propagation green- houses fully equipped (6)	21' x 96'	<u>18,000</u>
SUBTOTAL		38,892
<u>Machinery & Equipment:</u>		
Tractor plus front end loader	52 hp	15,000
Tractor	20 hp	3,700
Trailers (4)	4-wheel	2,400
Sprayer	Backpack, solo	375
Sprayer	Hydraulic piston	2,000
Truck	1/2 ton	5,000
Irrigation system	Pump, controls, PVC pipe, nozzles	20,000
Hand tools	Miscellaneous	<u>750</u>
SUBTOTAL		49,225
TOTAL		<u><u>108,117</u></u>

or if one considers how much could be earned on this investment if such funds were invested elsewhere. Of course, interest should be considered on only one-half the investment in depreciable items since these costs are recovered through depreciation. According to the Schedule F for the nursery being considered, all investment is paid for so a charge must be added for ownership costs.

The unit of production being considered is 32,000 one-gallon container-grown Kurume azaleas produced on one acre. The production system is one where the azaleas were started from cuttings, potted as propagated liners, and then placed in the field for growing. The survival rate in the propagation phase is about 90 percent and after potting into containers about 97.5 percent. Thus, to get 32,000 salable plants, 36,445 cuttings must be stuck to get 32,800 propagated liners which are required to get the salable plants.

Initially, it is assumed that the only financial data available are those data contained on Schedule F. The total costs will determine the amount of income taxes paid when they are subtracted from gross profits. However, a charge must be added for the value of an income for the owner-manager, for interest on the investment, and for interest on operating capital.

Classification of Costs

Before much can be done with the gross figures on the Schedule F, a cost classification scheme must be described. Those costs must be identified which can be associated directly with the acre of azaleas. These are called variable costs and consist of items such as labor used directly on the crop, chemicals, and interest on operating capital. The remaining costs are indirect costs which cannot be allocated directly to a particular crop.

The major items in this group are (1) administrative labor costs; (2) fixed costs associated with the investment such as depreciation, interest, and taxes; and (3) other general overhead costs such as utilities, insurance on personnel, and advertising.

If only one crop were produced, a charge should be added for the owner's salary and for interest on investment capital and operating capital. These costs should then be divided either by the 8 acres to get a per acre cost or by the actual number of salable plants produced to get a per plant cost. However, since the other 7 production acres are likely used for producing a wide range of other container-grown crops, ranging from one to several years to maturity, the indirect costs associated with these acres must be allocated also.

Unfortunately, the costs contained on the Schedule F have been aggregated and must be allocated into the regime described above. Therefore, a scheme may be used such as described by Perkins and Levins [2].

Each item on Schedule F must be dealt with to identify the indirect cost. The direct or variable costs should be estimated from data contained in the Kurume azalea bulletin [1].

Estimation of Costs

The data presented in the first column of Table 2 represent Schedule F costs. The second column represents those costs which cannot be allocated directly to a crop plus the opportunity cost representing a payment to the owner-manager for the value of his management and labor and for an interest charge for operating capital and for interest on the investment.

Table 2. Estimate of fixed or indirect costs for 10 acre nursery for one year

Cost items	Schedule F values	Fixed or indirect costs
	-----dollars-----	
Hired labor:		
Supervisor	12,350	6,175 ^a
Office	10,720	10,720 ^a
Unskilled	89,300	17,860 ^a
Repairs and maintenance	2,450	2,450
Fertilizer, lime, chemicals	12,410	
Supplies purchased	3,780	3,780
Gasoline, fuel, oil	2,335	
Taxes	750	750
Insurance	3,825	3,825
Utilities	4,750	4,750
Advertising	985	985
Containers	35,420	
License, bonds, dues	390	390
Soil mix materials	7,520	
Travel expense	1,240	1,240
Plastic and shade cloth	4,310	
Depreciation	3,950	3,950
Total	196,485	56,875
Opportunity costs:		
Owner-manager salary		16,000 ^a
Interest on above fixed costs		2,844 ^b
Interest on investment:		
Land		2,000 ^b
Buildings		1,944 ^b
Equipment		1,709 ^b
Total fixed costs		81,372

^aBased on 50% for supervisor, 100% of office, 20% of unskilled, and 80% of owner-manager.

^bBased on 100% of value for land and 50% of value for buildings and equipment and costs from Schedule F and owner's salary.

It was assumed that one-half of the supervisor's time and 80 percent of unskilled labor's time could be assigned directly to a crop. Other items may be considered partly as direct costs and partly as indirect costs, but in either case they must be classified as one or the other. Since the Schedule F costs did not include a salary for the owner-manager, it was estimated that the owner-manager could earn \$20,000 elsewhere and that only 20 percent of his time would be devoted directly to a particular crop. An interest rate of 10 percent was used to represent the opportunity cost or the alternative rate of return on the money which could be earned elsewhere if it had not been invested in the business.

Thus, costs of \$81,372 were estimated in the overhead category of indirect or fixed costs. This \$81,372 when spread over 8 acres of growing crops amounts to \$10,172 per acre per year or \$.32 per azalea when 32,000 salable plants per acre were produced.

Next, turn to the azalea bulletin for help in estimating the variable or direct costs. Data contained in Table 3 provides the basis of estimating the variable cost per hour for machinery and equipment. Depreciation, taxes, insurance, and interest for machinery and equipment were included in the fixed costs above.

Data in Table 4 present a detailed explanation of variable costs. These details should be very helpful to a nurseryman in estimating his variable costs when he has not kept detailed records. He needs simply to modify the equipment, materials, performance rates, and costs of inputs to make his own estimate.

Most of the details are self-explanatory but some items require some explanation. Unskilled labor was assumed to cost approximately \$3.50 per hour including Social Security. However, labor was charged at \$4.00 per

Table 3. Data for estimating the variable cost per hour for machinery and equipment for a 10-acre nursery

Item	New cost dollars	Expected life years	Estimated annual use hours	Repairs % of new cost	Variable cost per hour ^a dollars
Tractor, 52 hp w/front end loader	15,000	10	520	60	2.58
Tractor, 20 hp	3,700	10	500	60	1.10
Trailer, 4-wheel	600	10	188	40	.08
Sprayer, hydraulic	2,000	10	48	60	2.50
Mist system	500	10	1,000	40	.04
Irrigation system	10,000	20	240	40	.59
Truck	5,000	10	250	60	3.05

^aIncludes fuel, lubrication cost, and repairs

Source: [1].

Table 4. Estimated variable cost of producing 1 acre of 1-gallon container grown azaleas

Item	Description	Unit	Quantity	Price per unit -----dollars-----	Total cost
<u>Propagation:</u>					
Materials					
Containers	3" plastic pots	ea.	36,445	.04	1,457.80
Soil mixture	Peat, vermiculite and perlite	cu. ft.	405	.60	243.00
Chemicals ^a	Chlorox	gal.	2.5	1.50	3.75
	Spectracide	qt.	7.5	5.70	42.75
	Banrot	2 lb.	7.5	26.50	198.75
	Dexon	3 lb.	10	13.50	540.00
	Disyston	gal.	1.88	19.40	36.47
	Chelated iron	5 lb.	2.5	11.35	28.38
	Fertilizer 12-6-6	50 lb.	3	10.35	31.05
Greenhouse	Plastic greenhouse, cover	sq. ft.	10,000	.02	200.00
	Saran	sq. ft.	7,500	.12	900.00
	Minimum heat during winter				620.00
Machinery and equipment					
	Tractor, 52 hp, plus front end loader	hr.	.62	2.58	1.60
	Tractor, 20 hp	hr.	30.62	1.10	33.68
	Trailer	hr.	.62	.08	.05
	Hydraulic sprayer	hr.	30	2.50	75.00
	Irrigation system	hr.	225	.59	132.75
	Mist	hr.	500	.04	20.00
Labor (hired)	Propagation phase	hr.	397.50	4.00	1,590.00
	Related activities ^b	hr.	80	4.00	320.00
SUBTOTAL					6,475.03
Interest on operating capital, 6 mos. @ 10%					323.75
SUBTOTAL FOR PROPAGATION					6,798.78

Table 4. (Continued)

Item	Description	Unit	Quantity	Price per unit ----dollars----	Total cost
<u>Field Production:</u>					
Materials					
Containers	1-gal. plastic pot	ea.	32,800	.13	4,264.00
Soil mixture	Pine bark mix with fertilizer	cu. yd.	125	6.25	781.25
Chemicals ^a	Osmocote (18-6-12)	lb.	360	.40	144.00
	Ammonium nitrate	lb.	2,250	.07	157.50
	Roundup	gal.	.25	60.00	15.00
	Spectracide	qt.	7.50	5.70	42.75
	Chelated iron	5 lb.	2.50	11.35	28.38
	Nursery special 12-6-6	50 lb.	42.50	10.35	439.88
	Lime	50 lb.	20	2.25	45.00
	Superphosphate	50 lb.	7.50	4.75	35.62
Black plastic	6 mil.	sq. ft.	26,250	.02	525.00
Machinery and equipment					
	Tractor, 52 hp plus front end loader	hr.	42.50	2.58	109.65
	Tractor, 20 hp	hr.	212	1.10	233.20
	Trailer	hr.	223	.08	17.84
	Hydraulic sprayer	hr.	15	2.50	37.50
	Irrigation system	hr.	562.50	.59	331.88
	Hand tools	hr.		3.00	3.00
Labor (hired)	Field production	hr.	1,741.25	4.00	6,965.00
	Related activities ^b	hr.	348.25	4.00	<u>1,393.00</u>
SUBTOTAL					15,405.45
Interest, propagation compounded at 10%, and on operating capital, field, 6 mos. @ 10%					<u>1,450.10</u>
SUBTOTAL FOR FIELD PRODUCTION					<u>16,855.55</u>
TOTAL VARIABLE COST					<u>23,654.33</u>

^aTrade names which appear in the table are intended only as an example--not an endorsement.

^bRelated production activities refer to activities not specifically listed such as time for doing repair work, purchasing supplies, complete banking requirements, loss of time due to weather, particularly rain, time associated with selling, and time losses between production activities.

hour because the manager and supervisor at higher costs provide part of the labor. An interest charge of 10 percent was made on the operating capital for 6 months in each phase of production. The reason for the 6 month, or one-half the first year's operating capital charge, is to select an average sum of money invested in the crop.

Next, the two components of costs are combined in Table 5. Based on the procedure and input costs used, the average cost per salable azalea was estimated to be \$1.06. Approximately 30 percent of the production costs are in the fixed category.

If only the costs found on the Schedule F are included in the calculations, the cost estimate would have been approximately \$.16 less per plant. The value of the owner-manager's income, \$20,000, added \$.08 to the cost of a plant. Interest on investment, overhead funds, and operating capital added another \$.08 when estimated at 10 percent. This means if a nurseryman at the present time were borrowing all of the capital required for the nursery operation, he would need to add \$.08 per plant to his selling price to cover these costs.

If instead of losing 2.5 percent of plants from potting into gallons to loading on the customer's truck, an additional 10 percent was not salable, costs per plant would increase by almost \$.12. Supposing an acre block of azaleas or similar plants did not sell for an additional year, the additional maintenance cost per plant would be approximately \$.60 plus the profit which may have been made if a crop had been produced which sold on schedule. A retailer who purchases plants which do not sell would have somewhat the same type costs except probably considerably higher.

Table 5. Estimated costs of producing Kurume azaleas in one-gallon containers

Item	Fixed costs		One acre	
	Entire nursery	One acre	Variable cost	Total cost
-----dollars-----				
Total	81,372	10,172	23,654	33,286
Per plant ^a		.32	.74	1.06

^aBased on 32,000 salable plants per acre.

Source: Tables 2 and 4.

SUMMARY

Knowing the costs of producing salable plants is necessary to correctly price the plants and to know which ones are the most profitable. Rapidly rising input prices make being aware of costs more important today than in the past when prices were more stable.

To do a good job of cost estimating, detailed records are necessary to provide accuracy. The best approach is to develop a simple form to be completed each day which shows the allocation of labor, equipment, and materials to each field. The labor not allocated falls in the fixed costs or overhead category. Just being aware of how inputs were used may well be worth the effort to improve efficiency.

The first attempt to allocate costs between fixed and variable may require some work, but once a scheme is devised very little time is required to use it. However, the system should be subject to review and revision. It is just a matter of time before many nurseries will be computerized. The same records and procedures are required regardless of which method of summary is used. Detailed records are needed for a year before a summary can begin. Having a system already in use before acquiring a computer will make the transition easier.

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- [1] Badenhop, M. B. August, 1979. Factors Affecting Southern Regional Production Advantages for Kurume Azaleas. Southern Cooperative Series Bulletin 241. Agricultural Experiment Station, University of Tennessee, Knoxville.
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