

ANNUAL FIXED COSTS OF OVERWINTERING PLANTS  
IN NURSERIES DIFFERENTIATED BY SYSTEM FOR OHIO - 1984

BY

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ANNUAL FIXED COSTS OF OVERWINTERING PLANT MATERIAL  
IN NURSERIES DIFFERENTIATED BY TYPE OF STRUCTURE FOR OHIO - 1984

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ABSTRACT

The objective of this study was to estimate annual fixed costs of systems used by Ohio nurseries for overwintering nursery products. Most systems use one of the four structures analyzed in this report. The four structures were: a simple polyhut, a polyhouse constructed to support a single polyethylene film, a polyhouse equipped with an inflation kit so it can support a double polyethylene film with air being blown between the films, and a polyhouse equipped with both an inflation kit plus heating capability. Annual fixed costs for the four structures were \$109.61 or \$0.19 per sq. ft. for a 6' by 96' polyhut, \$487.28 or \$0.36 per sq. ft. for a 14' x 96' polyhouse without inflation or heating capability, \$506.15 or \$0.38 per sq. ft. for a 14' x 96' polyhouse with inflation but not heating capability and \$691.08 or \$0.51 per sq. ft. for a 14' x 96' polyhouse with both inflation and heating capability. For a 14' x 96' area in a system that did not require a structure, annual fixed costs would be \$180.07 or \$0.13 per sq. ft. Annual fixed costs per sq. ft. of the overwintering structures varied directly with the amount of protection offered. The systems without structures would offer the least protection while the polyhouse with double polyethylene film and heat offers the most.

INTRODUCTION

Practically all plants grown in containers as well as field grown plants harvested in the autumn for spring sales will suffer damage or death if not protected. Costs of overwintering plant material contribute significantly to the expense of producing nursery products in Northern U.S.D.A. climatic zones. A recent study (1) showed polyhouse structures for overwintering account for about 20% of the total capital requirement for establishing an 8 acre (growing space) container nursery. The study was based on a 20' by 200' structure without inflation or heat. Adding inflation would have increased costs slightly while adding inflation and heat would have increased the cost to about 33% of total capital requirements.

The specific objective of this study was to estimate annual fixed costs of alternative overwintering systems.

## MATERIALS AND METHODS

In the study, four overwintering structures were synthesized using the conceptual framework of economic engineering wherein the 'best proven practice' was included in each model. They were synthesized based on the Columbus, Ohio, area, but would be representative of U.S.D.A. climatic zones five and six. Each structure synthesized measured 14' x 96' in the case of polyhouses and 6' x 96' in the case of the polyhut.

Data for this study were obtained from wholesale nurseries and nursery suppliers in Ohio during 1984. Prices reflect quantities of materials based on a nursery containing 17 total acres, 350,000 sq. ft. of growing space and 210,000 sq. ft. of overwintering space. The overwintering space would be made up of either 156 polyhouses, 156 spaces where structures were not used, 365 polyhuts, or some combination of the three. Details on capital requirements for constructing the structures are contained in a companion article in this publication entitled "Capital Requirements of Overwintering Structures for Nurseries in Ohio - 1984".

Costs were established for all factors of overwintering contributing to fixed costs including management and invested capital. In economic terms, costs associated with factors of production provided by owner operators are often referred to as 'opportunity costs' or the income these factors could have received if they were employed elsewhere. For example, owners could usually be employed as managers at other nurseries, and money invested in overwintering structures could have earned interest if it had been placed in financial institutions. Most fixed costs are derived from costs of constructing structures. These costs were grouped into a total of nine categories for polyhouses: galvanized steel pipe, wood, hardware, heating system, inflation, miscellaneous, labor, general overhead and interest on general overhead, insurance and taxes. Not all categories were included for every structure. For polyhuts, costs were grouped into five categories: polyhut framework, concrete blocks for weighting plastic, labor, and interest on general overhead insurance and taxes. Annual fixed costs, with the exception of general overhead and interest on general overhead, insurance and taxes were composed of depreciation, interest, insurance, and taxes. Depreciation was calculated by dividing initial cost by years of useful life. Interest costs were estimated by multiplying the initial value of materials and labor by 15% per annum. Taxes and insurance costs were based on rates prevailing in the rural areas adjacent to Columbus, Ohio. They were assessed at the rate of \$20 per \$1000 of market value. General overhead was assessed by taking the figure \$95,025 developed in an earlier study (1) using 1982 figures for the appropriate sized nursery and inflating it by 10% to \$104,527.

This figure was divided by 156 for polyhouses and spaces not requiring structures or 365 polyhuts to yield values for this study. One fourth of the general overhead costs were assigned to overwintering. Interest charges for general overhead, insurance, and taxes were computed for a 6 month average use period at a rate of 15% per annum.

## RESULTS AND DISCUSSION

Annual fixed costs for a 14' x 96' house constructed to support one layer of polyethylene film were \$487.28 (Table 1). By category, they were \$146.72 for galvanized steel pipe, \$31.19 for wood, \$11.50 for hardware, \$27.00 for miscellaneous, \$89.10 for labor, \$167.51 for general overhead, and \$14.26 for interest on general overhead, insurance and taxes. Of the total costs for materials and labor, \$113.15 was for depreciation, \$169.73 for interest, and \$22.63 for insurance and taxes. Total interest was \$183.99 and exceeded depreciation.

Providing a kit to the above house to blow air between a double polyethylene film cover would have increased annual fixed costs by \$18.87 to \$506.15 (Table 2). Further addition of a heating system increases these costs to \$691.08 (Table 3).

Annual fixed costs for a 6' x 96' polyhut were \$109.61 (Table 4). By category, they were \$11.34 for the polyhut framework, \$3.30 for concrete blocks for weighting plastic, \$17.82 for labor, \$71.60 for general overhead, and \$5.55 for interest on general overhead, insurance and taxes. Of the total costs for materials and labor, \$12.02 was for depreciation, \$18.04 for interest, and \$2.04 for insurance and taxes. Total interest was \$23.59 and as in the case of the polyhouses exceeded depreciation. The largest expense was for general overhead accounting for 65 percent of the total. General overhead is assessed based on square footage of the structure. While costs of constructing a polyhut are considerably less than for the various polyhouses, they nevertheless carry the same general overhead cost on a per square foot basis.

Annual fixed costs for overwintering where structures were not used were made up of general overhead and interest on general overhead. For a 14' x 96' area they totaled \$180.07. By category, they were \$167.51 for general overhead and \$12.56 for interest on general overhead.

#### SUMMARY

Annual fixed costs for overwintering structures were \$0.19 cents per sq. ft. for a polyhut, \$0.36 per sq. ft. for a polyhouse without inflation or heat capability, \$0.38 per sq. ft. for a polyhouse with inflation capability but not heat and \$0.51 per sq. ft. for a polyhouse with both inflation and heat capability. Where structures were not used they were \$0.13. Annual fixed costs for the various overwintering structures are positively correlated with the amount of protection offered plants being overwintered. The polyhut would provide the least amount of protection, while a heated house covered with a double polyethylene film would provide the most.

#### LITERATURE CITED

1. Taylor, Reed D., Harold H. Kneen, David E. Hahn and Elton M. Smith. 1983. Costs of Establishing and Operating Container Nurseries Differentiated by Size of Firm and Species of Plant in U.S.D.A. Climatic Zone Six. Southern Coop. Ser. Bull. 301.

TABLE 1.--Annual Fixed Costs (Dollars)\* for a Container Nursery Overwintering System, 14' x 96' Polyhouse, U.S.D.A. Climatic Zones Five and Six, 1984

Item	Description	Depreciation**	Interest***	Insurance and Taxes****	Total
Galvanized Steel Pipe					
Arches - 26	3/4" x 21'	31.12	46.68	6.22	84.02
Ground inserts - 52	3/4" x 4.2'	12.45	18.67	2.49	33.61
Threaded ridge line - 5 including couplings	3/4" x 21'	5.98	8.98	1.20	16.16
End braces - 4	3/4" x 21'	4.79	7.18	.96	12.93
Subtotal		<u>54.34</u>	<u>81.51</u>	<u>10.87</u>	<u>146.72</u>
Wood - treated white pine					
Base boards	2" x 4" x 220'	5.94	8.91	1.19	16.04
Door frame - Uprights - 4	4" x 4" x 8'	1.73	2.59	.35	4.67
Door frame brace - 4	1" x 4" x 6'	.65	.97	.13	1.75
Door sill plate - 4	2" x 4" x 3'	.32	.49	.06	.87
Doors (3' x 6') - 2	4' x 8' plywood	2.91	4.37	.58	7.86
Subtotal		<u>11.55</u>	<u>17.33</u>	<u>2.31</u>	<u>31.19</u>
Hardware					
Pins for connecting arches and ground inserts - 52	1/2" x 6"	3.38	5.07	.68	9.13
Hinges	3" rustproof	.48	.72	.09	1.29
Door latch	Hasp	.40	.60	.08	1.08
Subtotal		<u>4.26</u>	<u>6.39</u>	<u>.85</u>	<u>11.50</u>
Miscellaneous	welding rod, nails, connectors, etc.	10.00	15.00	2.00	27.00
Labor Requirements	construction	33.00	49.50	6.60	89.10
General Overhead****					167.51
Interest on General Overhead Insurance, and Taxes	Compounded at 15% per annum for 6 months				14.26
TOTAL		<u>113.15</u>	<u>169.73</u>	<u>22.63</u>	<u>487.28</u>

\*Based on a nursery containing 17 total acres, 350,000 sq ft of growing space, 210,000 sq ft of polyhouse space, 156 (14' x 96') polyhouses.

\*\*Depreciation was estimated by dividing initial cost by the years of useful life.

\*\*\*Interest costs were estimated by multiplying the initial value of construction costs by the interest rate, 15% per annum.

\*\*\*\*Insurance and taxes were estimated by multiplying the initial value of construction by 2%.

\*\*\*\*\*General overhead was estimated by taking the figure \$95,025 developed in an earlier study using 1982 figures for the appropriate sized nursery and inflating it by 10% to \$104,527. This figure was divided by 156 polyhouses to yield a value of \$670.04 per polyhouse. One fourth of the general overhead costs were assigned to overwintering.

TABLE 2.--Annual Fixed Costs (Dollars)\* for a Container Nursery Overwintering System, 14' x 96' Polyhouse with Inflation, U.S.D.A. Climatic Zones Five and Six, 1984

Item	Description	Depreciation**	Interest***	Insurance and Taxes****	Total
<b>Galvanized Steel Pipe</b>					
Arches - 26	3/4" x 21'	31.12	46.68	6.22	84.02
Ground inserts - 52	3/4" x 4.2'	12.45	18.67	2.49	33.61
Threaded ridge line - 5 including couplings	3/4" x 21'	5.98	8.98	1.20	16.16
End braces - 4	3/4" x 21'	4.79	7.18	.96	12.93
Subtotal		<u>54.34</u>	<u>81.51</u>	<u>10.87</u>	<u>146.72</u>
<b>Wood - treated white pine</b>					
Base boards	2" x 4" x 220'	5.94	8.31	1.19	16.04
Door frame - Uprights - 4	4" x 4" x 8'	1.73	2.59	.35	4.67
Door frame brace - 4	1" x 4" x 6'	.65	.97	.13	1.75
Door sill plate - 4	2" x 4" x 3'	.32	.49	.06	.87
Doors (3' x 6') - 2	4' x 8' plywood	2.91	4.37	.58	7.86
Subtotal		<u>11.55</u>	<u>17.33</u>	<u>2.31</u>	<u>31.19</u>
<b>Hardware</b>					
Pins for connecting arches and ground inserts - 52	1/2" x 6"	3.38	5.07	.68	9.13
Hinges	3" rustproof	.48	.72	.09	1.29
Door latch	Hasp	.40	.60	.08	1.08
Subtotal		<u>4.26</u>	<u>6.39</u>	<u>.85</u>	<u>11.50</u>
<b>Inflation</b>					
Shaded pole blower kit	complete	6.95	10.43	1.39	18.77
<b>Miscellaneous</b>					
	welding rod, nails, connectors, etc.	10.00	15.00	2.00	27.00
<b>Labor Requirements</b>					
	construction	33.00	49.50	6.60	89.10
<b>General Overhead*****</b>					167.51
<b>Interest on General Overhead Insurance, and Taxes</b>					14.36
<b>TOTAL</b>		<u>120.10</u>	<u>180.16</u>	<u>24.02</u>	<u>506.15</u>

\*Based on a nursery containing 17 total acres, 350,000 sq ft of growing space, 210,000 sq ft of polyhouse space, 156 (14' x 96') polyhouses.

\*\*Depreciation was estimated by dividing initial cost by the years of useful life.

\*\*\*Interest costs were estimated by multiplying the initial value of construction costs by the interest rate, 15% per annum.

\*\*\*\*Insurance and taxes were estimated by multiplying the initial value of construction by 2%.

\*\*\*\*\*General overhead was estimated by taking the figure \$95,025 developed in an earlier study using 1982 figures for the appropriate sized nursery and inflating it by 10% to \$104,527. This figure was divided by 156 polyhouses to yield a value of \$670.04 annual cost per polyhouse. One fourth of the general overhead costs were assigned to overwintering.

TABLE 3.--Annual Fixed Costs (Dollars)\* for a Container Nursery Overwintering System 14' x 96' Polyhouse with inflation and heat, U.S.D.A. Climatic Zones Five and Six, 1984

Item	Description	Depreciation**	Interest***	Insurance and Taxes****	Total
<b>Galvanized Steel Pipe</b>					
Arches - 26	3/4" x 21'	31.12	46.68	6.22	84.02
Ground inserts - 52	3/4" x 4.2'	12.45	18.67	2.49	33.61
Threaded ridge line - 5 including couplings	3/4" x 21'	5.98	8.98	1.20	16.16
End braces - 4	3/4" x 21'	4.79	7.18	.96	12.93
Subtotal		<u>54.34</u>	<u>81.51</u>	<u>10.87</u>	<u>146.72</u>
<b>Wood - treated white pine</b>					
Base boards	2" x 4" x 192'	5.29	7.94	1.06	14.29
Door frame - Uprights - 4	4" x 4" x 8'	1.73	2.59	.35	4.67
Door sill plate - 4	2" x 4" x 3'	.32	.49	.06	.87
Ends - including doors	4" x 8' plywood	8.74	13.11	1.75	23.60
Ends - wall studs - 4	2" x 4" x 12"	1.30	1.94	.26	3.50
Ends - vertical stud base - 2	2" x 4" x 12"	.65	.97	.13	1.75
Subtotal		<u>18.03</u>	<u>27.04</u>	<u>3.61</u>	<u>48.68</u>
<b>Hardware</b>					
Pins for connecting arches and ground inserts - 52	1/2" x 6"	3.38	5.07	.68	9.13
Bolts, washers, and nuts	1/4" x 2" (oval hd)	.14	.22	.02	.38
Hinges	3" rustproof	.48	.72	.09	1.29
Door latch	Hasp	.40	.60	.08	1.08
Subtotal		<u>4.40</u>	<u>6.61</u>	<u>.87</u>	<u>11.88</u>
<b>Heating System</b>					
Gas fired unit heater - Dayton	125,000 BTU	40.89	61.34	8.18	110.41
Thermostat		4.00	6.00	.80	10.80
Set-up for propane	vent., reg., etc.	10.00	15.00	2.00	27.00
Subtotal		<u>54.89</u>	<u>82.34</u>	<u>10.98</u>	<u>148.21</u>
<b>Inflation</b>					
Shaded pole blower kit	complete	6.95	10.43	1.39	18.77
<b>Miscellaneous</b>					
	welding rod, nails, connectors, etc.	10.00	15.00	2.00	27.00
<b>Labor Requirements</b>					
		39.60	59.40	7.92	106.92
<b>General Overhead****</b>					
					167.51
<b>Interest on General Overhead Insurance, and Taxes</b>					
	Compounded at 15% per annum for 6 months				15.39
<b>TOTAL</b>		<u>188.21</u>	<u>282.33</u>	<u>37.64</u>	<u>691.08</u>

\*Based on a nursery containing 17 total acres, 350,000 sq ft of growing space, 210,000 sq ft of polyhouse space, 156 (14' x 96') polyhouses.

\*\*Depreciation was estimated by dividing initial cost by the years of useful life.

\*\*\*Interest costs were estimated by multiplying the initial value of construction by the interest rate, 15% per annum.

\*\*\*\*Insurance and taxes were estimated by multiplying the initial value of construction by 2%.

\*\*\*\*\*General overhead was estimated by taking the figure \$95,025 developed in an earlier study using 1982 figures for the appropriate sized nursery and inflating it by 10% to \$104,527. This figure was divided by 156 polyhouses to yield a value of \$670.04 annual cost per polyhouse. One fourth of the general overhead costs were assigned to overwintering.



TABLE 4.--Annual Fixed Costs (Dollars)\* for a Container Nursery Overwintering System, 6' x 96' Polyhut, U.S.D.A. Climatic Zones Five and Six, 1984

Item	Description	Depreciation**	Interest***	Insurance and Taxes****	Total
Polyhut Framework - 6' x 96' concrete reinforcement mesh 6" x 6" - 10 gauge wire**	5' x 10' sections	4.20	6.30	.84	11.34
Concrete Blocks for Weighting Plastic	2" x 4" x 8" - 6 lb weight	1.22	1.84	.24	3.30
Labor Requirements		6.60	9.90	1.32	17.82
General Overhead*****					71.60
Interest on General Overhead Insurance and Taxes	Compounded at 15% per annum for 6 months				5.55
TOTAL		12.02	18.04	2.40	109.61

\*Based on a nursery containing 17 total acres, 350,000 sq ft of growing space, 210,000 sq ft of polyhut space, 365 (6' x 96') polyhuts.

\*\*Depreciation was estimated by dividing initial cost by the years of useful life.

\*\*\*Interest costs were estimated by multiplying the initial value of construction costs by the interest rate, 15% per annum

\*\*\*\*Insurance and taxes were estimated by multiplying the initial value of construction by 2%.

\*\*\*\*\*General overhead was estimated by taking the figure \$95,025 developed in an earlier study using 1982 figures for the appropriate sized nursery and inflating it by 10% to \$104,527. This figure was divided by 365 polyhuts to yield a value of \$286.38 per polyhut. One fourth of the general overhead costs were assigned to overwintering.

