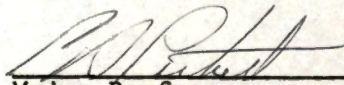


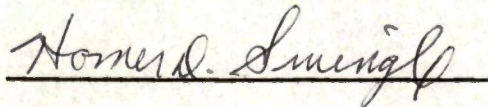
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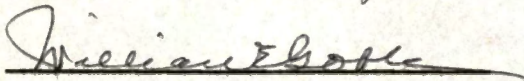
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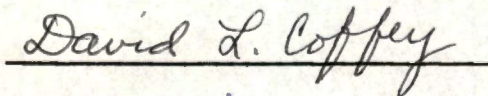
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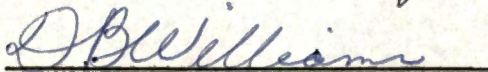

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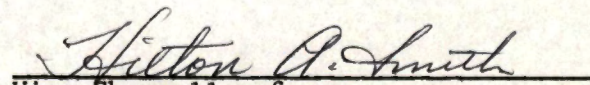








Accepted for the Council:


Vice Chancellor for
Graduate Studies and Research

THE FLOWER PRODUCTION INDUSTRY OF TENNESSEE

A Dissertation
Presented to
the Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

by
James L. Pointer

June 1974

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ABSTRACT

The object of this research was to evaluate the greenhouse flower production industry in Tennessee by studying various aspects such as the physical structure of each operation, managers' qualifications, managers' preference, production, sanitation, and marketing practices, operating efficiency, and how problems outside the greenhouse business affected management decisions.

A survey form of over 100 questions was completed by 70 greenhouse operators showing data on the growth and vitality of the greenhouse flower production industry in Tennessee after the turn of the century. The flower industry depends upon the economy for growth and vitality. The largest number (170) of producers was reported in 1940; after that a decline began that was to continue until 1954 at which time there were only 104 operators. A gradual but steady increase has continued since 1954. In 1970 it reached an all-time high of 176 operators and a total of 2.6 million square feet of greenhouse area with a business of over \$4 million.

Most greenhouse operations fall under the family enterprise classification and 60.0 percent of the greenhouses are operated as proprietorships, 20.0 percent as partnerships, and 18.6 percent as corporations.

Wholesale and retail sale of flowers increased during the 1960-1970 period. The average wholesale sales volume in 1960 was \$48,679 and in 1970 had increased to \$69,218.

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CHAPTER I

INTRODUCTION

It is difficult to make an absolute statement about the greenhouse production industry in the United States without clarifying each statement, due to the diversified uses of greenhouses in the beginning. The crops ranged from the production of fruits (17) to vegetables (18) to conservatories (9) before the glasshouse finally became a place for the commercial production of flowers and vegetables (23).

After the Civil War, flower production increased rapidly, reflecting the post Civil War prosperity, and continued throughout the last part of the nineteenth century (6). The major production area was in Philadelphia. The inclusion of horticultural specialty crops* in the early data prevents us from knowing exactly how fast the change was made from vegetable production to flower production in the post World War I period (5). Available data indicate that floricultural production has been steadily increasing since 1930 and commercial floriculture retail sales in 1967 were over \$2 billion, including goods and services (7). Tennessee's greenhouse industry had a parallel beginning to that of the United States, but on a much smaller scale. It was after 1900 (1, 2)

* Horticulture specialty crops referred to in this report include "(1) crops grown under glass (flowers, plants, and vegetables) and mushroom rooms; (2) nursery products (trees, shrubs, vines, ornamentals, etc.); and (3) flower and vegetable seeds, bulbs, and flowers and plants grown in the open" (20).

that greenhouse producers began to devote more of their space to growing cut flowers.

The number of Tennessee greenhouse operators declined sharply from 170 in 1940 to a low of 104 in 1954 (21). As the economy changed after 1954 so did the number of greenhouse operators, and in the five years between 1954 and 1959 there was an increase of 45 operators; in the next five years another 28 operators entered the greenhouse production business (21).

There were 155 Tennessee greenhouse operators in 1969 reporting income of more than \$2,500 with a total of 2,122,753 square feet of greenhouse area (22). Another 68 reported income less than \$2,500 and represented 22,021 square feet (22), which includes the hobby growers.

The floriculture industry is over a \$4 million business in Tennessee. The industry is continually facing problems of adjusting to changing technology of production and marketing. The continued growth of the floricultural segment of the ornamental horticulture industry in Tennessee, and other states, depends on the ability of firms to adjust to changing conditions and to adopt new technology that is economically feasible. Changes in the industry are usually limited by lack of information at the firm level on production and marketing operations. Data are needed on the existing floricultural operations in Tennessee for the evaluation of alternative processes and consideration of feasible technological improvements, or expansions in existing operations. These data include physical structure of operations, management, managers' preferences, production practices, sanitation practices, marketing

practices, overall operating efficiency, and management problems outside of business.



CHAPTER II

PURPOSE OF THE STUDY

Although census data are helpful in evaluating the floricultural industry in Tennessee, additional information is needed to evaluate more efficiently the changes that have occurred in this industry. In most cases, little information is available on management in this industry. Therefore, the purpose of this study is to make an up-to-date survey of the floricultural industry (greenhouse operators) in Tennessee. The specific objectives are to provide information on:

1. Physical structure of each operation.
2. Managers' qualification to manage the greenhouse.
3. Managers' preference for several factors such as type of heat, fuel, construction, covering, employment of men and women.
4. Management production practices.
5. Management sanitation practices.
6. Managers' marketing practices.
7. Overall operating efficiency.
8. Management problems outside of business.

These data are needed to provide guidelines for the initiation of educational programs and communication media that will meet the needs and comprehension level of all producers.

CHAPTER III

SURVEY METHODS

To make a complete study of the floricultural industry in Tennessee required several different methods of investigation. First an accurate listing of certified greenhouse operators as prepared by the Tennessee State Department of Agriculture, Division of Plant Industries, was obtained. Then, on visits to these operators, inquiries about other people operating in their county were made. Several additional operations in the state not listed by the Tennessee State Department of Agriculture were found.

After visiting the majority of greenhouse operators in the state one or more times, a survey form was designed in consultation with faculty members of the Agricultural Economics, Agricultural Biology, and Horticulture Departments. An effort was made to cover all major aspects of the flower production industry. The questions grouped under general headings are in Appendix A.

After the questions had been compiled, they were strategically located within the questionnaire to separate closely related questions so that one answer might not influence the accuracy of a similar question.

It was the intention to interview each grower and fill out each survey personally. In about 10 percent of the interviews, the grower, for reason of lack of time or for need of consulting his records, kept the survey and filled it out himself.

After surveying a number of operations, having 80.0 percent of the total greenhouse square footage in Tennessee, a follow-up survey was sent by mail to those who failed to return the one previously left. Although the response was not 100.0 percent, there was only one person who refused to divulge any information.

In studying how the collected data could be most meaningful, it was concluded that a summary for each question would be the first step. Then a comparison of key questions would be made against other questions in the survey, Appendix B.

CHAPTER IV

REVIEW OF THE LITERATURE

The modern greenhouse is an evolution from a simple beginning; it appears to have started as a window garden in the human residence. The evolution of the greenhouse from this direction consisted of the gradual enlargement of the glass area by the addition of more windows and finally by the installation of bay windows. When a glass roof was added, the result could then fairly be called a "greenhouse" (17).

Another line of descent may be traced to the European practice of growing fruit trees and vines against brick or stone walls, partially as a protection against inclement weather and partially because such walls absorb the sun's heat and thus help to hasten or insure the maturity of high-quality fruit. Heating flues were then built behind the wall to supply additional warmth and early in the eighteenth century, panes of glass framed in wood were sometimes leaned against the vines (17). "The Practical Fruit Gardener" (17) reported in 1731 a method of building a glass front, or wall, several feet away from the stone structure. From this arrangement it was only a short step to the open-end lean-to that, in turn, became the transition to other greenhouse forms.

Another line of descent is by way of the propagating pit, or storage cellar, covered with glass to protect plants during cold weather (5). Heat in the form of fermenting substances and later heat by a stove was added (18).

Greenhouse Development

It is impossible to know which was first, or if all came into use during the same era and the good points of each combined to build what we see today as a glass structure, known and called a "greenhouse," or glasshouse.

The first greenhouse to be built in the United States, however, was erected for Andrew Fanevil in Boston (11, 18). James Beekman, though, gets credit for owning the first greenhouse in New York in 1764 (18). A few greenhouses existed at the turn of the nineteenth century, for in 1801, a Dr. Hosack had greenhouses in his botanical gardens (18). The Princes of Flushing, New York, also had a greenhouse 200 feet x 25 feet in 1825 (14). These early greenhouses were heated by flues and fermenting substances (18).

George Washington had a conservatory on his Mt. Vernon estate in 1787 (9). There is no indication that it was used for commercial production. It was reported that Washington placed in his greenhouse many of the plants that he purchased from the eminent botanist, John Bartram of Philadelphia. The conservatory was razed in 1835 and not rebuilt until many years later (9).

It is quite clear why the greenhouse business was late in arriving on the industrial scene in the United States. The predominant crop grown in greenhouses was flowers, which represented a luxury trade. Only after people satisfy their wants for the basic needs of life--food, clothing, and shelter--do they satisfy their cultural and aesthetic wants. The average family was too busy trying to feed themselves and build homes to devote much time to growing decorative plants.

It was only after an affluent society developed that the florist production business began to increase to meet this demand for the luxury of flowers.

In 1820, steam in closed circuits was introduced; this was followed by hot-water heating (18). The first greenhouse had high glass side walls to let in the sunlight and some had removable tops of sash.

History of the Greenhouse Industry

The history of the floricultural industry during the early nineteenth century is obscure because other branches of horticulture were merged with it (24). Growers produced bedding plants,* flowers, shrubs, hardy border plants, vegetables, and fruits. In many cases, plants other than flowers produced the greater income. The industry began in Philadelphia because of its ready market (18), for at that time Philadelphia was the city with the largest population. It was also considered to be the social center of the United States (10, 19). Because it was located between New York and Philadelphia (two of the best markets at that time), New Jersey produced more flowers and plants than any other state (6).

Bedding plants were the principal crop grown in greenhouses prior to 1820 (14). The emphasis was on cut-flower production from 1830 to 1840 (14). As a result of this interest in flowers, new greenhouses began to develop. There were four put into production in the United States between 1800 and 1820; 35 began operation between 1820 and 1840 (6). Only 141 greenhouses began operation between 1840 and 1860, but during

* Bedding plants include vegetable plants, annual flowers, and some perennials.

the next 20 years, until 1880, 1,311 new greenhouses were put into operation (6) which reflects the prosperity that existed after the Civil War. Two thousand more greenhouses were built between 1880 and 1890 (6). This rapid expansion continued throughout the last half of the nineteenth century, mostly in the eastern part of the United States. Chicago, Illinois, had only one small greenhouse in 1854 (14).

In 1890, the largest greenhouse in the United States was less than four acres, while in 1900 there were a number of larger houses near each of the most populated cities. There was a greenhouse in Chicago which contained 600,000 square feet, or approximately 14 acres. The structure was of iron and glass. The glass used was imported from France and Belgium; this was changed by the early 1900's when the United States began manufacturing all its glass needs (19).

The limitation of available data on greenhouse production before 1890 in the United States necessitates our acceptance of this date as a beginning of comparative data for this type of industry. In 1890 (1), there were less than 5,000 greenhouse establishments in this country. The increase from 1890 to 1910 was gradual. In 1900, there were slightly over 6,000 greenhouse operations; in 1910, there were 7,444; and in 1920, a big jump was made to 13,000. By 1930, the number of greenhouses had increased to 14,000 (5), or in the 20 years from 1910 to 1930 there was an increase of almost 200 percent. The impact upon floriculture of these increases was greater than is apparent. It was during and after World War I that many greenhouse vegetable growers converted to growing flower crops, or at least included them in rotation (5). There were about 110,000 people employed and receiving \$62,500,000 for their services in

the production of floricultural crops in 1939 (13). There were over 32,000 farms reporting the production of horticultural specialty crops in 1939 (13, 21). In 1940, the number of greenhouses had reached over 16,000, and during the next ten years increased to 18,941 (21).

In 1949, 165 million square feet of glass was used in 15,779 greenhouses. Out of this 165 million square feet, 15 million was used for the production of horticultural specialties and 150 million devoted entirely to floricultural plants (5, 21).

By 1964 (21), the number of greenhouses had increased to 16,922 with 218,879,232 square feet; the average size of each house was 12,935 square feet. This was an increase of 1,143 operators since 1949, and an increase of 54,092,884 square feet, or an average increase of 3,197 square feet for each operator in this 15-year period.

The value of horticultural specialty crops in 1890 was \$26 million in the United States and has increased steadily since that time. In 1950, the total value had increased sharply to \$392 million (5) and commercial floriculture in 1967 had become a \$2-billion-a-year business (7) at the retail level, including goods and services. Cash farm receipts from salable products for this market exceeded \$700 million annually in 1967 (7).

The number of farms reporting horticultural specialty crops in the United States decreased 1.1 percent between 1959 and 1964, while the total area used for production increased 2.2 percent (21). The value of horticultural specialty crops increased 14.6 percent between 1959 and 1964 with an average value of \$705 million. The increase per acre reached an all-time high in 1964, with an average of \$2,562 (21) per acre

and cut flowers, potted plants, florist greens, and bedding plants had an 8.6 percent increase from 1959 to 1964 (21). There were 5,025 acres (or about 218,879,000 square feet) under glass or other protection (21). During this same period, outside-grown plants declined 23.0 percent.

Marketing

Retail florists occupy a unique position in the business world and relate directly to the total production of horticultural specialty crops in the United States. The products and services they sell fulfill a social, rather than a physical, need. Floral products can be used to convey not only sympathy, respect, and gratitude, but many other human feelings that are difficult for people to express any other way (8).

Unlike food consumption, for which the potential market is limited by the capacity of the human stomach, consumption of a social product such as flowers might be increased considerably. The majority of floral-product sales is dictated by social custom. Although these customs are deeply ingrained, the floral industry's full potential remains to be achieved. However, the market is gradually expanding, and sales of floral products can be further maximized through increased promotional and merchandizing efforts and improved management practices (8).

Current economic conditions tend to favor expansion (8) of the market for floral products. The future of the retail florist industry, and to some degree the future of growers of floral products, may depend on whether or not this challenge is met. Failure on the part of florists to take full advantage of their opportunities may have a lasting effect on the pattern of growth of the floral industry.

In the United States the retail florist represents a billion-dollar industry (8); through sales and extensive services, florists have made important contributions to the American economy and the United States' agriculture. In 1964, this industry provided full-time employment for nearly 100,000 persons, and represented the major outlet for over 20,000 growers of floral products (8).

Farm Value of Floriculture Crops

Table 1 illustrates the importance of floral crops as an agricultural commodity, relative to other well-known and important agricultural crops. Using the 1964 crop year as the base, floral crops in dollar value far exceed a number of other agricultural crops that are produced in the United States (including Alaska and Hawaii). The 1964 figures show that the dollar value at wholesale prices of the floral crops produced annually is \$358 million (21). This is about 30.0 percent above the 1959 floral crop value.

This increase in value was due primarily to an increase in the quantities produced since the prices to growers and the acreage devoted to production changed very little during that period (8). This substantial production growth, achieved on fewer acres, was made possible by the use of improved cultural practices. Some of the major factors commonly associated with improved efficiency in production were: (1) regional specialization in production, taking advantage of suitable climate, soil conditions, and availability of labor; (2) mechanization; (3) improved fungicides and herbicides; and (4) improved plant varieties (8).

Table 1. Farm Value of Floriculture Crops Compared with Other Selected Crops in the United States, 1964 (8)

Crop	Value ^a	Crop	Value
Cotton	\$2,521	Peanuts	\$239
Corn	1,993	Grapes	219
Soybeans	1,830	Lettuce	180
Wheat	1,610	Peaches	160
Tobacco	1,413	Dry Beans	136
Potatoes	604	Strawberries	130
Oranges	426	Green Beans	89
Floriculture	358	Grapefruit	87
Rice	349	Onions	74
Tomatoes	345	Sweetpotatoes	64
Apples	248	Lemons	56
Nursery Products	241		

^aRounded to nearest million.

During the first half of this century, horticultural specialty crops became increasingly important in the agriculture of every state and region of the United States (20). By 1950, these crops made up nearly 2.0 percent of the value of the nation's sales of farm products. From 1890 to 1950, greenhouse crops were the major kind of horticultural specialty production; from 1930 to 1950, there was an increase in outdoor flower production. The agricultural census reported 30,000 horticultural specialty farms in 1930 and 45,000 in 1950 (5).

In 1890, the average size of greenhouses was 8,000 square feet; by 1910, the average had increased to 15,000 square feet. In 1920, the average was 12,610 square feet, a decline in ten years of 2,390 square feet. It is assumed that this decline was due to the effect World War II had on the greenhouse industry. The average size remained near 12,000 square feet for the next 30 years (5). The average size in 1960 was 11,267; in 1964 it was 11,395 (21).

It is interesting to note that in 1889 the greenhouse area equalled 0.5 square foot per person and in 1950 had increased to 1.5 square feet per person (5). From 1890 to 1910, on the average, one greenhouse served every 12,500 people; from 1910 to 1950 one greenhouse served every 8,000 people (5). The sales per capita in 1890 equalled 23 cents and in 1950 had increased to \$1.50 per capita. Greenhouse products equalled 6.0 percent of all farm production in 1890 and 1.0 percent in 1950. The sales volume increased from 37 cents per square foot in 1890 to \$1.00 per square foot in 1950.

History of Tennessee's Greenhouse Industry

Tennessee's greenhouse industry dates back before 1900 (1, 2), but most of the products grown were vegetables and a limited number of cut flowers. The agricultural census did not record greenhouse sales data separately in Tennessee until 1930.

The greenhouse industry in Tennessee was more or less patterned after and an offshoot of vegetable gardening, or truck cropping, near the large metropolitan centers of Knoxville, Nashville, Memphis, and Chattanooga. Baum's and Babelay's in Knoxville and Joy's in Nashville grew from vegetable operations (1, 3, 12). Other early operators were Geney's in Nashville and Buffa in Memphis.

Tennessee followed the national trend in growth of floricultural production under glass. In 1930, the square footage was not taken in the census (21), but a figure of \$434,312 is shown as its sales volume. In 1940, there were 170 firms producing floral crops under 1,486,353 square feet of glass (21).

From 1946 to 1950, Tennessee had a 26.0 percent decrease--from 170 to 127 operators (20), but during this time there was an increase of 175,092 square feet of greenhouse area. The decline in the number of greenhouse operators continued through 1954 to a low of 104, then increased to 149 in 1959 and to 177 in 1964 (21). The square footage of greenhouse buildings declined 25.0 percent from 1950 to 1954, but showed a 43.0 percent increase from 1954 to 1959 for a total of 2,168,302 square feet and 2,351,494 square feet from 1959 to 1964 (21), or an increase of 8.0 percent.

The dollar value of floriculture sales had a similar response with a slight increase during the 1930-1940 era--from \$434,312 to \$512,437, or an increase of almost 15.0 percent. In the 1940-1950 era, the growth in volume sales was very rapid--from \$512,437 to \$2,545,900, or an increase of 497.0 percent. The sales volume decreased 5.0 percent to \$2,418,605 from 1950 to 1954 but recovered--from 1954 to 1959 the increase was 28.0 percent, or \$3,365,391; in 1959-1964 the increase was only 10.0 percent, to \$3,383,742; and in 1964-1970 there was a 3.0 percent increase for a total sales volume of \$3,488,259 (22).

Available data for individual crops in Tennessee show that standard chrysanthemum production was 1,938,000 blooms in 1966, 2,256,000 in 1967 (an increase of 14.0 percent), and then dropped back to 1,998,000 in 1968 for a 3.0 percent decline (15). During the same time, production of pompon chrysanthemums in 1966 was 19,000 bunches, dropping to 14,000 bunches in 1967, then increasing to 20,000 bunches in 1968. Potted chrysanthemums during this same three-year period had a steady increase

from 246,000 pots in 1966 to 299,000 pots in 1967 and 311,000 pots in 1968 (15).

The value of sales at wholesale for these three types of chrysanthemums for 1966, 1967, and 1968, respectively, was \$753,000, \$937,000, and \$957,000 (15).

Carnation production increased during this period, but the wholesale value decreased. The trend in rose production for the 1966-1968 period was similar with production increasing from 3,172,000 to 3,591,000 blooms. The wholesale value declined from \$599,000 to \$373,000 (15).

In 1970 (15), there were 20 greenhouses (32.0 percent) producing flowers and bedding plants located in Shelby County (Memphis) out of a total of 63 in West Tennessee. Davidson County had 13 (37.0 percent) out of 35 greenhouses in Middle Tennessee; and Knox, Hamilton, and Sullivan Counties had 35 (46.0 percent) out of 76 greenhouses in East Tennessee. Shelby County had 11.0 percent; Davidson County 7.0 percent; and Knox, Hamilton, and Sullivan 20.0 percent of all greenhouses in the state. These five counties, therefore, have 38.0 percent of all greenhouses in the state (16).

CHAPTER V

SURVEY SUMMARY

Physical Structure of Each Operation

The first question of the survey dealt with the business structure for the greenhouse operator. The results show that 60.0 percent of the greenhouse operations fall in the proprietorship category, 20.0 percent partnership, 18.6 percent corporations, and 1.4 percent are publicly owned.

In the greenhouse operation, 74.3 percent of all managers were full time and 25.7 percent part time.

Ten percent of the managers had only 1 year of tenure, 10.0 percent had managed the same businesses for 10 years, while 1.4 percent of the managers had 45 years of tenure. The median is 16.5 years and represents 69.4 percent of the managers below the median. The ten managers with the most tenure had served an average of 30.9 years.

The greenhouses had been in operation from less than 1 year to 95 years; the median being 23.5 years representing 65.0 percent of all greenhouse operators, and the average was 21 years of operation for 70 greenhouses. The ten oldest operations had been in business an average of 63.7 years.

Of those surveyed, 65.7 percent operated their businesses full time and 15.7 percent operated for six months of the year.

Family members operated 84.3 percent of all greenhouses surveyed and 15.7 percent operated as corporations or partnerships where no family

members were employed. Only 12 managers reported that no member of the family was employed, while 33.3 percent reported two family members worked in the business, and 2.8 percent reported seven family members worked full time in the business.

Seventy individuals or firms operated 607 greenhouses totaling 2,583,521 square feet for the production of flowers and bedding plants. Of these operators, 43 had one or more houses covered with glass equaling 1,440,010 square feet, 41 operations had 320,809 square feet of fiberglass, and 30 operations had 822,702 square feet of polyethylene houses. There were 1,320,104 square feet of greenhouses with metal frames, 270,739 square feet of quonset houses, and 992,678 square feet framed with wood.

The study shows the industry has grown within the past five years. Forty-four operators have increased their operation by 357,171 square feet; the increase had 120,159 square feet of metal frame, 123,207 square feet of wood frame, and 43,805 square feet quonset-type structures. The covering for these houses was 68,909 square feet of glass, 107,135 square feet of fiberglass, and 181,127 square feet of polyethylene.

For heating, 22.9 percent of the houses used steam, 37.1 percent hot water, 22.9 percent hot air, 12.9 percent gas heaters, and 4.2 percent use other types of heat such as electricity, coal stoves, salamander heaters, etc.; 37.1 percent of the heating systems operated on coal, 41.5 percent gas, 17.1 percent oil, 2.9 percent electricity, and 1.4 percent wood.

At the present time, 46.4 percent are using manual ventilation, 27.5 percent have some of their houses ventilated automatically, 13.0

percent are using evaporative-pad cooling, 11.6 percent are using fans only, and 1.5 percent are using side vents only for cooling.

The water source can be a very important part of the production practices for greenhouse operators since it is necessary to keep a constant check on soluble salts build-up. City water was used by 42.6 percent of the operators, 16.4 percent used spring water, 41.0 percent used wells, and one small operator used rainwater. Water acidity was checked by only four operators.

The majority of greenhouse operations fall under the family-enterprise classification; 58.7 percent hire four or less full-time employees, whereas the overall average in the state is 6.3 persons. The survey indicates that 85.3 percent hire four or less part-time help, the industry average is 3.2 part-time employees. The largest employer has 40 full-time greenhouse workers and the largest employer of part-time help uses 19 people.

The distribution of labor requirements varies from one operator to another, depending on crops being produced. The average for the industry runs fairly uniform throughout the season (Table 2) with an average number of 6.2 employees for January; 62.8 percent hire 4 or less during this same period. There is a slight increase in February to an average of 6.5 with 60.5 percent of the growers using 4 or less employees. March showed a slight increase with 6.8 employees, with 56.3 percent using 4 or less employees. April had an average of 7.0 employees per operator which is a slight increase over March. This is an expected occurrence since bedding plant production requires an increased number of workers from February to June and then begins to decrease until fall.

In April, 56.3 percent of the greenhouse operations used 4 or less employees. In May, there was a slight and expected decline to 6.8 workers and 58.6 percent of the operators used 4 or less workers. There were 6.7 workers in June with 58.6 percent of the operators using 4 or less workers.

Table 2. Average Labor Distribution Per Month and Percent of Operators Using Less Than Four Workers Each Month

Month	Average Number Actual Workers	Percent Using Four or Less Workers
January	6.2	62.8
February	6.5	60.5
March	6.8	56.3
April	7.0	56.3
May	6.8	58.6
June	6.7	58.6
July	6.6	54.7
August	6.6	54.9
September	6.9	54.9
October	6.9	54.9
November	6.8	56.0
December	6.8	56.7

In making visits to greenhouse producers, the problem mentioned most was "lack of labor." When the question, "Do you have all the help you want?" was asked on the survey, 61.1 percent answered, "Yes." To the question, "Do you have help when you want it?" again 59.7 percent answered in the affirmative.

The question on what labor costs per hour on a full- or part-time basis brought out some interesting answers. The median pay was \$1.70 per hour. One greenhouse operator paid \$3.00 per hour. The average pay scale was \$1.75.

For part-time employees the median wage was \$1.55, the average \$1.54, and the highest \$2.00.

In job performance, 48.0 percent classified all their employees as skilled and needing little or no instruction to do their jobs; 55.0 percent stated that it was difficult to secure qualified help.

The ages of the labor force were divided into five classes ranging from 18 to over 66 years:

1. The first age class was from 18 to 25. This group includes the high school graduate during the years immediately following graduation and advanced study when they do not have a permanent job. This age group comprises 20.0 percent of the total greenhouse labor force.
2. The second class, age 26 to 35, is 20.7 percent of the total greenhouse labor force.
3. The third class, age 36 to 50, is 28.6 percent of the total greenhouse labor force.
4. The fourth age class, 51 to 65, is only 22.1 percent of the greenhouse labor force.
5. The fifth class of workers, 66 years and over, comprises 8.6 percent of greenhouse workers. One operator had a 94-year-old man who worked from three to six hours each day. He was doing a commendable job.

Managers' Qualification to Manage

The survey indicated that 7.1 percent of the managers were between 20 and 29 years old, 21.4 percent from 30 to 39 years, 20.1 percent 40

to 49 years, 30.0 percent 50 to 59 years, and 21.4 percent were over 60 years old. It is interesting to note that 51.4 percent of all managers are 50 years of age, or older.

The education of the managers ranged from the second grade to one with a Doctor of Philosophy degree; the median was 10.5 years of schooling. The average of those below the median was 7.5 years and represented 32.5 percent of the managers. The ten managers with the highest education averaged 16.4 years.

When the question was asked concerning previous training which qualified them for the job of manager of a greenhouse, 66.6 percent stated they had no experience or training of any kind before they assumed their responsibilities; 33.3 percent of the managers had work experience ranging from 1 to 23 years, with the median of 5 years. The managers had a greenhouse work experience of 15.5 years, with an average of 7.7 years and represented 60.9 percent of all managers with less than the median work experience. The ten managers with the most years of work experience had an average of 41.5 years.

In response to a question about whether the managers were enjoying a higher, lower, or about-the-same income from the greenhouse business as they could receive in any other occupation for which they were qualified, 28 thought they were making less income in the greenhouse production business than they could in other endeavors, 14 thought they were making more money, and 28 thought their incomes were about the same in this field as they could make working in other types of business.

In the process of dispersing information through the media of newsletters, technical journals, by salesmen, and through professional organizations, the greenhouse managers have a wide interest.

The managers belong to 13 different trade-oriented associations (Table 3).

Technical information received by the managers from sources other than state and government agencies was from six major sources (Table 4). The survey showed that state universities were used over twice as much as the next highest source (Table 5). Two managers reported they received no technical information.

Managers' Preference

In expressing their opinions of the methods of heating they would use if they were rebuilding their greenhouses, 20.9 percent of the managers chose steam, 34.3 percent liked hot water best, 38.8 percent gas-unit heaters, 1.5 percent electricity, and 4.5 percent would use hot air. The operators' choices of fuel were as follows: 14.9 percent coal; 56.8 percent gas; 26.8 percent oil; and 1.5 percent electric heat.

If they were rebuilding, 36.2 percent of those surveyed would use glass, 42.0 percent fiberglass, and 21.8 percent polyethylene.

In considering preference for male or female workers, 63.6 percent preferred female and 34.0 percent male; 2.4 percent had no preference. In addition to asking their preference of sex, they were asked to give reasons for their choice and some of those reasons are listed in Table 6.

A question was asked to get the manager's opinion as to what his attitude was concerning expanding the greenhouse operation. The question

Table 3. Membership in Trade-Related Organizations

Number of Members	Trade-Related Organizations
40	Tennessee Flower Growers Association
13	Tri-State Flower Growers Association
7	Ohio State Flower Growers Association
1	Illinois State Flower Growers Association
1	Cornell Flower Growers Association
3	North Carolina Flower Growers Association
2	Society of American Florists
1	American Orchid Society
1	Orchids, Inc.
2	Bedding Plants, Inc.
1	Allied Florist, Inc.
1	Tennessee State Florist Association
2	Southern Florists' Association

Table 4. Sources of Technical Information Other Than
State and Government Agencies

Number	Source
47	<u>Grower Talks</u>
41	<u>The Ball Red Book</u>
40	Salesmen
36	<u>Florist Review</u>
16	<u>Geiger News</u>
41	Other trade magazines

Table 5. Sources of Information from Universities and Federal Agencies

Number	Source
42	University of Tennessee
14	Ohio State University
5	Mississippi State University
5	Cornell University
4	Virginia Polytechnic Institute and State University
3	North Carolina State University
3	University of Kentucky
2	Pennsylvania State University
2	Rutgers University
2	University of Maryland
2	University of Hawaii
1	Auburn University
1	University of Illinois
1	Harvard University
1	Colorado State University
1	University of Florida
1	Michigan State University
1	University of Missouri
1	United States Department of Agriculture

Table 6. Preference of Male Versus Female Employees

Reason for Choice	Number	Percent
Women are preferred because		81.0
They do tedious work better	3	
They do better work	10	
They are more cooperative	11	
They cause less trouble	2	
They are more interested in their work	1	
They are more agile	1	
They are more reliable	1	
Men are preferred because		19.0
They can do rough or heavy work	4	
They are easier to work with	1	
They are available	1	
Women are too hard to get along with	1	

was, "Would you increase the size of your operation if you had more labor, more money, or both?" If they had the money and labor, 57.4 percent stated they would expand their business; 14.8 percent said they would not expand, 8.5 percent would expand if they could get labor, and 19.1 percent needed money to expand. This indicates the confidence operators have in the demand for their product in the future, and of the greenhouse industry's vitality.

The University of Tennessee Extension Service is always searching for new and better ways to dispense information to all agricultural producers. The circular letter is one of the media used to disperse timely information. To the question, "Would a newsletter specializing in greenhouse information be of use to you?" 97.0 percent of the managers answered "yes" and 3.0 percent said "no." Another question concerning special mailings whenever something important occurred was responded to

by 45 persons who thought it should be mailed as quickly as possible and 15 thought it could be included in the next monthly newsletter.

The majority of the managers agreed that training for greenhouse owners and workers in the form of short courses would be beneficial. While 44 managers said they would attend, only 17 said they would send their employees. Negative responses indicated that 13 managers would not attend such courses and 28 would not send their employees for this type of educational development.

In trying to find a subject that greenhouse management thought should be covered in such a short course, only two subjects were suggested: one about greenhouse management itself and another on greenhouse production.

Management Production Practices

If there is a standard potting mixture in the Tennessee greenhouse industry, it was not discovered in this survey. There was only one manager who stated that he used 100 percent soil; 27 percent used one-third soil; 47.0 percent used artificial media with varying ratios between Michigan peat, Perlite, and Vermiculite; 50.0 percent of the managers stated that they use a mixture of one part peat, one part soil, and one part sand. More people use this 1-1-1 ratio than any other, but it is by no means a standard mix. The production practices vary between individuals and crops, their watering systems, and their ultimate market demands.

It is surprising that after all the efforts of the educational institutions and greenhouse industries to emphasize the importance of

soil pasteurization that there is still 33.8 percent of the operators that do not pasteurize their potting media.

Of those checked, 22.8 percent soil test ground beds in every house each year, 38.6 percent seldom soil test, and 38.6 percent never soil test. Of those that do soil test, 30.3 percent test in the winter, 48.5 percent in the spring, 12.2 percent in the summer, and 9.0 percent in the fall. Only 54.5 percent of the growers testing use the results as a guide to balance their fertilizer program. While few test for minor elements, the growers are so sold on their use that 71.0 percent add minor elements to their soils.

Before 1970, Tennessee offered little specialized assistance in crop production to the greenhouse operators, but in most cases rendered good service in soil testing. Of those using soil testing, 45.3 percent used the services in Tennessee, 3.0 percent used Michigan State, 3.2 percent Mississippi State, 19.5 percent did their own soil analysis, 12.9 percent used Ohio State, 9.7 percent used Peters Fertilizer Company, 3.2 percent Edwards Laboratories, and 3.2 percent used Rainbow Fertilizer Company.

In the greenhouse production industry, the use of fertilizers is more intense and exacting than in other types of farm production. Based on the percentage of fertilizers used, regular formulations commonly used on the farm only account for 17.8 percent of the fertilizer used in greenhouse production. Slow-release fertilizer mixed in the growing media or placed on the top of potted plant media make up 16.4 percent. Automation of the watering system lends itself to the application of water-soluble fertilizers and accounts for 65.8 percent of all fertilizers used in greenhouse plant production in Tennessee. This is reflected in the method

of application for fertilizer--only 8.6 percent is broadcast, 18.6 percent premixed, 72.8 percent applied by water injection.

Another production practice that has not been readily adopted by the Tennessee growers is the use of CO₂ burners. Only 19.0 percent of the growers have used them and none use them consistently. (This may be due to more ventilation of houses during the winter months.) For those that have used these burners, 55.5 percent used them on chrysanthemums, 22.2 percent tried them on carnations, 11.2 percent on roses, and 11.1 percent in the production of geraniums.

The methods of watering plants in a greenhouse were many, and some operators had several different types; 73.9 percent used a mist system; 33.3 percent a perimeter bench system; 40.0 percent soaker hoses; 52.0 percent hand watering; and 19.0 percent the Chapin (spaghetti tube) system.

Bedding plants were the number-one crop for 48.6 percent, with chrysanthemums being the most important crop for 27.2 percent, orchids the main crop for 11.4 percent, geraniums 7.1 percent, carnations 4.3 percent, and roses were listed as the number-one crop for 1.4 percent of the producers.

Management Sanitation Practices

Sanitation is one of the more important aspects of management. It is usually directly related to the amount of disease and insect problems experienced throughout the year.

Operators were requested to rate their sanitation practices from 1 (poor) to 5 (excellent) both inside and outside the greenhouse. Good

sanitation must be practiced both inside and outside the greenhouse if proper controls are to be maintained.

Operator responses (Table 7) showed that 1.4 percent rated themselves as having poor sanitation practices outside the greenhouse, but no one thought his sanitation practices inside the greenhouse were poor; 10.1 percent thought their outside operations ranked below average; and 7.2 percent listed their inside sanitation practices below average. The No. 3 category would be average, and 36.2 percent listed themselves as average for outside and 39.1 percent as average for inside. The No. 4 on the scale would be those that do above-average jobs, and 39.1 percent thought their outside practices and 42.0 percent thought their inside practices were within this classification. It was explained that for excellent, or No. 5 rating, that little or no problems should be encountered that could be traced to a lack of sanitation; 13.2 percent of the managers thought their outside and 11.7 percent thought their inside practices qualified as excellent. Outside sanitation was rated below average by 10.1 percent of the growers; only 7.2 percent considered inside sanitation at this level.

In conjunction with the sanitation rating, the question was asked if they experienced disease and insect problems and to rate their answers in three categories: never, some, often; 4.4 percent said they never had a problem with insects, 82.8 percent answered that some problems were encountered, and 12.8 percent stated they had insect problems often. Problems with diseases were listed as 18.6 percent never, 77.1 percent some, and 4.3 percent often.

Table 7. Operators' Self-Evaluation for Greenhouse Sanitation

Scale*	Inside	Outside
	-----percent-----	
5	11.7	13.2
4	42.0	39.1
3	39.1	36.2
2	7.2	10.1
1	-	1.4

* 1 = poor, 2 = below average, 3 = average, 4 = above average, 5 = excellent.

Managers listed four diseases as being a problem in the production of flowers. Many growers failed to indicate any particular disease problem. Rot on both stem and roots was the most troublesome to 16 producers; mildew and virus were listed by 2 and gray mold by 1.

The operators named 13 insects that cause them the most trouble in the greenhouse; these are listed in Table 8.

The managers listed chrysanthemums and bedding plants as being most often attacked by insects.

The managers followed a regular spray program for disease control 59.7 percent of the time, but they practice a regular insect spray program 76.4 percent of the time.

Thirty-five percent of the operators used a vapor-type fungicide and 60.0 percent used a fogging machine for insecticides; 77.3 percent of the operators tried to identify the insect or disease before spraying, therefore they tried to use flexibility in their disease and insect spray programs for the unexpected and 99.0 percent followed up after spraying to evaluate the control.

Table 8. Insects That Cause the Greenhouse Manager the Most Trouble

Insect	Number of Operators Voting*
Spider mite	29
Aphid	23
White fly	13
Mealybug	7
Scale	4
Leaf miner	2
Snail and slug	2
Ant	2
Leaf roller	1
Fungus gnat	1
Sowbug	1
Fleabettle	1

* Each operator had two votes.

In the production of greenhouse plants, the practice of pasteurization of soil is the most important phase of disease prevention; 90.0 percent of the producers pasteurize their soil in beds while 10.0 percent never pasteurize. Steam was the pasteurizing method used by 70.0 percent of the growers, but only 47.0 percent knew the recommended time and temperature to use (Table 9). Two growers used MC_2 gas but they did not know the rate to use on a given amount of soil.

Nematode infestation is another problem encountered in a greenhouse, and 80.0 percent of the managers knew what they were and how the root-knot nematodes affected plants. The 20.0 percent who did not know what nematodes were grew crops such as orchids and were not concerned with their control. Of those interviewed, 80.0 percent had experienced problems with nematodes in their greenhouses or had seen them in other greenhouses.

Table 9. Time and Temperature Used in the Steam
Pasteurization System

Number of Participants	Time (Hours)	Soil Temperature (° Fahrenheit)
16	0.50	180
4	1.00	180
3	2.00	180
4	2.50	180
2	3.00	180
1	4.00	180
1	2.00	190
1	2.00	230
1	3.00	240
1	3.00	250

In the proper selection and use of insecticides, 90.0 percent of the growers inspect and identify the insect before selecting and applying a control. A follow-up inspection by 99.0 percent of the growers is made within 12 to 24 hours after application of the insecticide to evaluate the control of the insects.

In questioning the managers on subjects of safe use of chemicals, 98.5 percent stated they always read the labels on their containers; 92.8 percent said they always follow the manufacturer's directions for safe use of the chemicals, and 89.8 percent always mix the chemicals accurately.

Only 50.0 percent post signs and 41.2 percent lock the doors of their greenhouses after applying chemicals. These figures are not as bad as they may seem, since many operations are small and require less than four employees, therefore everyone is told verbally when and where chemicals have been applied.

It was found that greenhouse operators were rapidly adopting the use of protective clothing:

1. 31.4 percent used a spray cap
2. 34.4 percent used a protective jacket
3. 32.9 percent used protective trousers
4. 25.7 percent used boots
5. 41.4 percent used gloves
6. 20.0 percent used eye goggles
7. 27.2 percent used respirators
8. 48.6 percent used a mask

The operators were cautious in the disposal of used pesticide containers--60.0 percent buried the containers, 38.5 percent used garbage disposal service, and 1.5 percent returned the containers to the manufacturer for reuse.

Storage facilities for pesticides was one of the safety areas that needs attention of the greenhouse operators; 36.0 percent had locked storerooms for chemicals; 28.0 percent had temperature controls in their chemical storage rooms; 10.0 percent had their chemical storage rooms marked for fire hazards; and 23.0 percent had their chemical storage rooms marked with poison signs.

Managers' Marketing Practices

Many of the greenhouse operators refused to reveal their sales volume figures, but in 1960 the wholesale sales volume for 18 greenhouse operations was \$876,224, averaging \$48,679 per operator. In 1965, 22 operators reported a wholesale sales volume of \$934,583, an average of

\$42,481 per operator, and 37 operators reported \$2,561,049 in wholesale sales in 1970, an average of \$69,218 per operator. Retail sales for 1960 amounted to \$460,401 as reported by 12 operators. Eighteen operators reported a retail sales volume of \$247,733 for 1965 and 18 greenhouse operators reported \$423,406 in retail sales in 1970.

Wholesale and retail sales figures for 1970 were reported by 45 operators. Their report indicated that 1,669,164 square feet of area had a total sales volume of \$2,932,509, averaging \$1.76 per square foot. The highest return per square foot of area was \$8.95, the next highest \$5.59, then \$4.39. The size of operation had no correlation with the dollar return per square foot of area. The three producers showing the highest dollar return per square foot had a growing area from 8,000 to 45,000 square feet. The lowest return was \$0.36 on over 2,000 square feet. Other data on the average sales volume per square foot of growing area are shown in Table 10.

Table 10. Average Sales Volume per Square Foot of Growing Area

Average Return/ Square Foot	Growers		Square Feet		Total Sales Volume	
	Number	Percent	Number	Percent	Value	Percent
\$0.36-\$0.75	8	18.0	77,082	5.0	\$ 38,781	1.0
0.76- 1.00	5	11.0	623,795	37.0	545,250	19.0
1.01- 2.00	13	29.0	531,373	32.0	808,700	28.0
2.01- 3.00	13	29.0	220,981	13.0	562,645	19.0
3.01- up	6	13.0	215,933	13.0	977,133	33.0
Total	45		1,669,164		\$2,932,509	

If we could assume that the average sales volume of \$1.76 per square foot is representative for the Tennessee greenhouse industry as a whole, then by extrapolation we can get the combined sales volume for all greenhouse producers. In 1971, there were 176 greenhouse operations with an area of 3,128,443 square feet x \$1.76 average sales volume, equaling a sales volume of \$5.5 million.

The competition among greenhouse producers is sharp during periods of overproduction. The question was asked about unfair practices of competitors to gain a larger share of the market. It was the belief of 28.0 percent of the growers that their competition engaged in unfair practices, such as changing their delivery day so as to reach the florist the day before their regular run; 2.0 percent reported that their competition gave a kickback or volume rebate.

A change in the market or consumer preference was reported by 40.0 percent of the producers. The consumer was buying and asking for better quality. Petunia sales were down and they contributed this to disease problems encountered in recent years. Bedding plants, house and foliage plants were increasing in sales faster than most growers could meet the buyers' demand.

The demand for bedding plants has increased so fast that the producers have not tried to sell to landscape contractors for use in community or highway beautification projects.

Some producers thought it was essential to extend credit to their wholesale customers; 41.0 percent extended credit often, 24.0 percent sometimes, 9.0 percent seldom, and 26.0 percent said they never extended

credit. The ones stating they never extended credit were strictly in the retail business; 28.5 percent of those extending credit stated they had trouble collecting their accounts.

The greenhouse producers were asked on what basis they established their prices; 33.0 percent followed prices set by competition, 36.0 percent based their prices on quality and grade of their product, 29.0 percent on cost of production, and 2.0 percent on supply of a product and transportation cost.

There were only 24 greenhouse producers shipping across state lines. These 24 producers did a total of 18.0 percent of their business in 11 different states. Business in Tennessee was usually concentrated in the immediate area of production. In west Tennessee, the average distance covered was 55 miles and 50.0 percent of the business was done in Memphis. The middle Tennessee producers made deliveries less than 50 miles from their place of business and 70.0 percent of their production was sold in small towns, 17.0 percent in Murfreesboro, and only 13.0 percent in Nashville.

Due to the large number of greenhouses located in east Tennessee, sales were numerous in all towns. Knoxville and Kingsport each received 20.0 percent of sales of flowers produced, Chattanooga 11.0 percent, Morristown 12.0 percent, and 37.0 percent of sales were made in 27 other cities in the state. Delivery distance for east Tennessee producers averaged 55 miles.

Overall Operating Efficiency

In trying to find problem areas in the operating efficiency in greenhouse production, the managers listed "lack of labor" as their Number 1 problem; lack of operating capital was the second biggest problem, pricing their products and wage scale for unskilled labor the third largest. Other problems are listed in Table 11.

Table 11. Problems Affecting Greenhouse Operational Efficiency

Problem	Percent Reporting		
	Never	Seldom	Often
Disease	17.0	70.0	13.0
Insects	14.0	62.0	24.0
Nematodes	79.0	17.0	4.0
Labor	40.0	29.0	31.0
Sanitation	56.0	35.0	9.0
Soil pasteurization	66.0	23.0	11.0
Potting media	64.0	27.0	9.0
Media testing and nutrition	64.0	30.0	6.0
Marketing	35.0	43.0	22.0
Pricing	40.0	32.0	28.0
Equipment, heating, cooling, watering	35.0	45.0	20.0
Greenhouse construction	19.0	67.0	14.0
Greenhouse maintenance	20.0	58.0	22.0
Application of technology	31.0	60.0	9.0
Competition--local and out-of-state growers	41.0	36.0	23.0
Regulatory compliance	59.0	35.0	6.0
Source of suppliers	52.0	31.0	17.0
Freight	53.0	20.0	27.0
Suitable soil	42.0	44.0	14.0
Weed control	39.0	41.0	20.0
Wage rate for unskilled labor	55.0	18.0	27.0
Lack of operating capital	41.0	26.0	33.0

Management Problems Outside of Business

It is critical that plants and greenhouse supplies arrive promptly. Some perishable items cannot be received more than a day or two before

using. A delay of one or two days past their scheduled date of arrival could cost the producer his profit for the entire crop. The growers responded to the question, "Do you have problems with transportation agencies?" with 63.0 percent having no problem and 37.0 percent experiencing problems.

Only two growers reported that they had experienced credit difficulties with suppliers. This was not a refusal to sell them on credit, but a refusal to sell until they supplied references to establish credit.

Trade information in the form of pricing is limited to a small number of greenhouse crops; 46.0 percent of the growers thought this was adequate. Availability of marketing information was listed by 54.0 percent as being inadequate but no one had any suggestions on how the situation could be corrected.

CHAPTER VI

SUMMARY OF SURVEY DATA

Type of Organization--Proprietorship, Partnership, Corporation, and Other, Compared with:

1. Education of manager. A comparison made between the type of organization and the education of the manager showed that 60.0 percent operate as a proprietorship, 20.0 percent as a partnership, and 18.6 percent as a corporation. The other 1.4 percent in this survey represent a public greenhouse that would not fall under the first three organizational types.

The educational level as related to the different organizational types is shown in Table 12.

2. Is greenhouse operation a family enterprise? In making a comparison between the type of organizational structure of the greenhouse production industry and whether or not it was operated as a family enterprise, the study showed that 84.3 percent were family enterprises. Proprietorship was the predominant type of organization and represented 54.3 percent of all greenhouse operations. The family partnership made up 17.1 percent and the family corporation represented 12.9 percent.

3. How many family members work full time in the greenhouse operation? In comparing the number of family members working full time

Table 12. Educational Level and Type of Business
Organizational Structure

Grade	Proprietorship	Partnership	Corporation	Other
2	1	-	-	-
4	1	1	1	-
5	1	-	-	-
6	4	-	-	-
7	1	-	-	-
8	3	-	-	-
9	1	1	-	-
10	6	2	-	-
11	1	-	-	-
12	10	4	4	-
13	3	-	2	-
14	3	1	2	-
15	2	1	1	-
16	3	4	2	1
17	2	-	-	-
18	-	-	1	-

within each business organization, proprietorship management used 58.6 percent of family members, partnerships used 20.0 percent, and corporations used 18.6 percent.

4. What is the total greenhouse square footage? The proprietorships operate 22.3 percent, or 571,108 square feet of greenhouse area; partnerships operate 16.4 percent, or 415,722 square feet; and corporations operate 61.3 percent, or 1,560,889 square feet. Those surveyed represent 81.0 percent of the total greenhouse area in the state.

5. What is the frame and cover on the greenhouse? In comparing the type of organization with the type of greenhouse covering (Table 13), it was found that proprietorship organizations owned 214,020 square feet of glass which represents 15.0 percent of all glass. They owned 151,928

Table 13. Type of Organization as Related to Physical Structure of Greenhouse

Physical Structure	Type of Organization						
	Proprietorship		Partnership		Corporation		Total
	Sq. Ft.	Percent	Sq. Ft.	Percent	Sq. Ft.	Percent	
<u>Greenhouse Covering</u>							
Glass	214,020	15.0	305,057	21.0	919,683	64.0	1,438,760 100.0
Fiberglass	151,928	46.0	28,185	9.0	149,076	45.0	329,189 100.0
Polyethylene	236,840	51.0	18,880	4.0	212,830	45.0	468,550 100.0
<u>Greenhouse Frame</u>							
Metal	191,874	15.0	306,427	23.0	823,353	62.0	1,321,654 100.0
Wood	322,538	33.3	41,815	4.4	599,686	62.3	964,039 100.0
Quonset	93,689	37.0	3,880	1.0	158,550	62.0	256,119 100.0

square feet of fiberglass-covered greenhouses, or 46.0 percent of the fiberglass houses in the state. Proprietorship organizations owned 51.0 percent, or 236,840 square feet of all polyethylene-covered greenhouses. Proprietorship owned 15.0 percent of the metal-framed greenhouses, or 191,874 square feet; 33.0 percent of the wood, or 322,538 square feet; and 37.0 percent of the quonset-type greenhouses consisting of 93,689 square feet.

Partnership operations were made up with 21.0 percent, or 305,057 square feet, of glass-covered greenhouses; 9.0 percent, or 28,185 square feet, of the fiberglass; and 4.0 percent, or 18,880 square feet, of polyethylene-covered greenhouses.

Partnership operations made up 23.0 percent, or 306,427 square feet, of metal-framed greenhouses. They operated 41,815 square feet, or 4.0 percent, of wood-framed houses; and only 1 percent, 3,880 square feet, of quonset-type houses.

Corporation-type organizations made up 64.0 percent, or 919,683 square feet, of the greenhouse area covered with glass; 45.0 percent, or 149,076 square feet, covered with fiberglass; and 45.0 percent, or 212,830 square feet, covered with polyethylene. Corporations owned 62.0 percent, or 823,353 square feet, of metal-framed greenhouses; 62.3 percent, or 599,686 square feet, of wood-framed greenhouses; and 62.0 percent, or 158,550 square feet, of quonset houses.

6. Managers' preference of heating system. The type of heating in a greenhouse is one of the important considerations that managers must decide on when building. It was thought that a choice of the type of

heat used in greenhouses if they were rebuilding should give a good preference rating for each type of heat (Table 14). The managers who were operating under a proprietorship thought that suspended gas heaters were first choice by 45.0 percent; 35.0 percent thought hot water would be their choice, steam is the choice of 10.0 percent, 8.0 percent liked hot-air furnaces, and 2.0 percent chose electricity. Those who chose electricity for a heat source were operators with small areas of less than 500 square feet.

Table 14. Choice of Heat by Various Organizational Type Managers

Type	Steam	Hot Water	Suspended Gas Heaters	Electricity	Hot Air
	-----Percent-----				
Proprietorship	10.0	35.0	45.0	2.0	8.0
Partnership	29.0	50.0	21.0	-	-
Corporation	38.0	24.0	38.0	-	-
Average	25.7	36.3	34.7	0.6	2.7

Partnership managers chose hot-water heat by 50.0 percent, 29.0 percent chose steam, and 21.0 percent suspended gas heaters; 38.0 percent of corporate managers chose steam, 24.0 percent hot water, and 38.0 percent suspended gas heaters.

7. How much have you increased your greenhouse area? In trying to determine which type of management organization was building and expanding their operations, it was found that proprietorships had expanded their operations in the past five years by 18 percent, or 111,945 square

feet; partnerships by 15 percent, 61,285 square feet; and corporations by 19 percent, or 199,299 square feet.

8. Managers' preference of greenhouse frame. In choosing the type framing material to be used, 49.0 percent of the proprietorship managers chose quonset structures with pipe, 41.0 percent aluminum framing material, and 10.0 percent chose wood. The partnership managers chose aluminum by 57.0 percent, wood by 14.0 percent, and quonset by 29.0 percent. Corporate managers chose aluminum by 42.0 percent, wood by 25.0 percent, and quonset by 33.0 percent.

9. Managers' preference of greenhouse cover. In expressing their preference of greenhouse covering, 54.0 percent of the managers of proprietorships chose fiberglass, 71.0 percent of managers of partnerships and 38.0 percent of corporate managers chose glass, as indicated in Table 15.

Table 15. Choice of Greenhouse Covering as Related to Business Structure

Business Structure	Glass	Fiberglass	Polyethylene
	-----Percent-----		
Proprietorship	24.0	54.0	22.0
Partnership	71.0	21.0	8.0
Corporation	38.0	31.0	31.0
Average	44.3	35.3	20.3

Months of Year Greenhouse is Operated, Compared with:

1. Education of manager. The greenhouses surveyed operate different months of the year. Some are bedding-plant producers and only operate for a period of three to six months, while other operations continue the year round (Table 16). A comparison of the months of year the greenhouse is operated with the education of the manager indicates that the reason for part-time operations was probably lack of production skills required for full-time production.

There were 30.0 percent of greenhouses surveyed that operated on a part-time basis. The education of the managers of these part-time greenhouse operations was five with a grammar-school-or-below level, twelve with between 9 and 12 years of schooling, and two with one year of college; one was a college graduate and one had earned credit one year beyond a bachelor's degree.

Table 16. Comparison of Months of the Year Greenhouse is Operated with Education of Manager

Months of Year	Years in School																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
3	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
5	-	1	-	-	-	-	-	-	-	-	-	2	1	-	-	-	1	-
6	-	-	-	-	-	-	-	1	1	2	-	4	1	-	-	1	-	-
7	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-
8	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	3	-	2	1	2	1	4	1	11	3	6	4	9	1	1

Of the 70.0 percent of managers operating greenhouses full time, eight were grammar school graduates or below, 17 had completed high

school or had some high school training, and 24 had from one to six years beyond high school.

In comparing months of the year the greenhouse is operated with the major crop, the survey showed that 96.0 percent of the part-time operators listed bedding plants as their major crop and 4.0 percent tomatoes as their major crop. For the full-time operations, 41.0 percent listed chrysanthemums as their major crop, 28.0 percent bedding plants, 15.0 percent orchids, 7.0 percent geraniums, 7.0 percent carnations, and 2.0 percent roses.

2. Wholesale sales volume. Data were not available to make a valid comparison of the sales volume of the part-time operator to the full-time operator. The part-time operator was more reluctant to divulge sales figures and in many cases did not have detailed records. In 1960 (Table 17), three part-time operators who operated five months reported \$7,800 in combined wholesale sales, while 15 full-time operators had combined wholesale sales of \$867,224.

In 1965, four part-time operators had combined sales of \$18,200 at wholesale value and the 17 full-time operators sold \$909,883 at wholesale value.

In 1970, 12 part-time operators reported wholesale sales of \$102,316 and 25 full-time operators reported \$2,433,133 in wholesale sales.

3. Retail sales volume. In 1960, Table 18, four part-time operators sold \$44,050 at retail and eight full-time operators had combined retail sales of \$176,000.

Table 17. Wholesale Sales Volume of Part- and Full-Time Greenhouse Operations for 1960, 1965, and 1970

Year	Part-Time			Full-Time			Total
	Number of Operators	Volume	Percent of Volume	Number of Operators	Volume	Percent of Volume	
1960	3	\$ 7,800	1.0	15	\$ 867,224	99.0	\$ 875,024
1965	4	18,200	2.0	17	909,883	98.0	928,083
1970	12	102,316	4.0	25	2,433,133	96.0	2,535,449

Table 18. Retail Sales Volume of Part- and Full-Time Greenhouse Operations for 1960, 1965, and 1970

Year	Part-Time			Full-Time			Total
	Number of Operators	Volume	Percent of Volume	Number of Operators	Volume	Percent of Volume	
1960	4	\$44,050	20.0	8	\$176,000	80.0	\$220,050
1965	8	19,033	8.0	10	229,200	92.0	248,233
1970	12	41,343	10.0	16	372,090	90.0	413,433

In 1965, eight part-time operators sold \$19,033 at retail and ten full-time operators sold \$229,200.

There were \$41,343 in retail sales in 1970 reported by twelve part-time operators and \$372,090 in sales by sixteen full-time operations.

Age of Manager Compared with:

1. Structure of greenhouses operated. The age of managers was listed in five classes and compared with several different management practices to see if age could be recognized as influential in management decisions.

In Table 19 it is evident that the older managers are operating in

Table 19. Managers' Age Versus Type of Greenhouse Structure

Age	Cover (Square Feet)			Frame (Square Feet)		
	Glass	Fiber-glass	Poly-ethylene	Aluminum	Wood	Quonset
20-29	53,130	47,290	11,965	59,670	51,250	1,500
30-39	196,970	64,862	44,036	194,262	85,706	35,500
40-49	600,710	122,580	143,439	546,214	184,220	136,295
50-59	412,360	22,304	142,610	89,498	374,111	113,665
60-up	476,840	68,084	127,332	433,260	222,744	16,252
Total	1,740,010	325,120	469,382	1,322,904	918,031	303,212
Percent	68.0	13.0	19.0	52.0	36.0	12.0

glass houses, in most cases built before fiberglass and polyethylene were available. Polyethylene was used more than fiberglass in all except the two age groups below 39. Polyethylene makes up 19.0 percent of the greenhouse covers, and while quonset-type houses are more easily covered with

polyethylene they represent only 12.0 percent of greenhouse framing. This is evidence of the acceptance of polyethylene on other than quonset frames.

2. Managers' preference for greenhouse frame and covers. The managers' preferences were solicited for their preference of frame and covering if they were rebuilding their greenhouses (Table 20).

Table 20. Frame and Cover Preference by Managers' Age Groups Rebuilding Their Greenhouses

Age Group	Frame			Cover		
	Aluminum	Wood	Quonset	Glass	Fiberglass	Polyethylene
20-29	3	-	2	2	2	1
30-39	8	-	7	6	5	4
40-49	6	3	4	7	6	-
50-59	5	3	12	6	6	9
60-up	7	4	4	4	9	1
Total	29	10	29	25	28	15
Percent	43.0	14.0	43.0	37.0	41.0	22.0

3. Where are soil analyses determined? Only 27 out of 70 managers interviewed practice soil testing. The source of sample analysis by management age groups is shown in Table 21.

4. What is your major crop? We earlier compared preference for growing a specific crop as it related to education. The major crop according to age group of management is shown in Table 22.

Table 21. Where Producers Have Soil Analyzed Related to Managers' Age

Age Group	University of Tennessee	Michigan State University	Mississippi State University	Yourself	Ohio State University	Peters Fertilizer Company	Edwards Laboratory	Rainbow Fertilizer Company
20-29	-	-	-	-	-	1	-	-
30-39	5	-	-	1	1	1	-	-
40-49	2	-	-	2	1	-	-	-
50-59	7	-	-	3	2	-	-	1
60-up	-	1	1	-	-	1	1	-
Total	14	1	1	6	4	3	1	1
Percent	45.0	3.0	3.0	20.0	13.0	10.0	3.0	3.0

Table 22. Major Crops Related to Managers' Age

Age Group	Crop						
	Bedding Plants	Mums	Roses	Geraniums	Orchids	Carnations	Tomatoes
20-29	3	2	-	-	-	-	-
30-39	5	6	-	1	2	1	-
40-49	6	3	-	1	3	1	-
50-59	15	3	-	1	1	1	-
60-up	4	5	1	2	2	-	1
Total	33	19	1	5	8	3	1
Percent	48.0	28.0	1.0	7.0	11.0	4.0	1.0

Education of Manager Compared with:

1. Is manager full- or part-time operator? The education of the greenhouse manager when compared with other management practices should present some data as to their operational skills. In 52 cases the managers were employed full time and there were 18 employed part time (Table 23).

2. Is the greenhouse operation a family enterprise? Family enterprises made up 84.3 percent of the operations. The breakdown by education, family enterprise status, part-time versus full-time management in each educational class is shown in Table 23.

3. What are the frame and cover on the greenhouse? In comparing the education of the managers with type of greenhouse frame and covering, no indication was found of a trend for any educational level. The survey did show that the largest square footage of greenhouse space was operated by high school graduates (Table 24).

Table 23. Education of Greenhouse Manager Compared to Management Practices

Education of Manager	Manager		Family Enterprise		Square Feet Involved in Greenhouse Space
	Full-Time	Part-Time	Yes	No	
2	-	1	1	-	2,220
4	3	-	3	-	265,275
5	-	1	1	-	1,560
6	3	1	4	-	52,900
7	1	-	1	-	13,923
8	2	1	3	-	8,700
9	2	-	2	-	40,535
10	6	2	6	2	39,115
11	1	-	1	-	9,200
12	15	3	16	2	1,031,162
13	4	1	5	-	158,224
14	4	2	4	2	607,745
15	3	1	4	-	120,900
16	7	3	5	5	231,377
17	1	1	2	-	3,200
18	-	1	1	-	2,912
Total	52	18	59	11	2,588,948
Percent	74.0	26.0	84.0	16.0	

Table 24. Greenhouse Frame and Covering Related
to Managers' Education

Education of Manager	Cover (Square Feet)			Frame (Square Feet)		
	Glass	Fiberglass	Polyethylene	Aluminum	Wood	Quonset
2	-	1,210	-	-	1,210	-
4	68,530	64,250	132,495	20,900	111,880	132,495
5	520	-	1,040	520	1,040	-
6	21,600	19,260	12,040	29,600	17,360	5,940
7	13,235	688	-	-	13,923	-
8	7,970	900	-	4,270	4,600	-
9	7,424	17,114	16,000	20,058	20,480	-
10	21,350	14,105	3,652	13,550	23,055	2,500
11	9,200	-	-	-	9,200	-
12	423,528	53,916	180,818	135,601	490,281	62,380
13	111,960	36,104	10,160	95,280	59,240	3,704
14	543,800	10,700	53,280	546,050	23,730	38,000
15	33,750	87,150	-	33,750	87,150	-
16	150,743	20,712	59,932	123,333	96,784	11,270
17	2,000	1,200	-	-	3,200	-
18	-	2,912	-	-	2,912	-
Total	1,445,610	330,219	469,417	1,022,912	966,045	256,289
Percent	64.0	15.0	21.0	46.0	43.0	11.0

4. What type of heating system is used? Greenhouse heating systems are being simplified and economized. The older type greenhouse used steam and hot water, while newer houses are being heated predominantly by hot air and suspended gas heating units. The breakdown as to type of heat being used by each educational group is indicated in Table 25.

Table 25. Type of Heat Used in Relation to Managers' Education

Education of Manager	Steam	Hot Water	Hot Air	Suspended Gas Heaters	Other
2	-	-	1	-	-
4	-	3	-	-	-
5	-	-	1	-	-
6	-	2	1	-	1
7	-	1	-	-	-
8	-	3	-	-	-
9	1	1	-	-	-
10	1	2	4	1	-
11	-	1	-	-	-
12	4	5	6	3	-
13	1	2	2	-	-
14	5	1	-	-	-
15	1	1	1	1	-
16	3	3	-	3	1
17	-	1	-	-	1
18	-	-	-	1	-
Total	16	26	16	9	3
Percent	23.0	37.0	23.0	13.0	4.0

5. What type of fuel do you use? The type of fuel used is often not the choice of the manager but is determined by cost, availability, and in some cases the Environmental Policy Act. The type of fuel being used is shown in Table 26 in relation to each manager's educational level.

Table 26. Type of Fuel Used in Relation to the Managers' Education

Educational Level	Coal	Gas	Oil	Electricity	Wood
2	-	-	1	-	-
4	2	-	1	-	-
5	1	-	-	-	-
6	2	1	-	1	-
7	1	-	-	-	-
8	2	1	-	-	-
9	1	-	1	-	-
10	3	3	2	-	-
11	1	-	-	-	-
12	7	9	2	-	-
13	3	2	-	-	-
14	1	4	1	-	-
15	1	1	2	-	-
16	1	6	2	1	-
17	-	1	-	-	1
18	-	1	-	-	-
Total	26	29	12	2	1
Percent	37.0	42.0	17.0	3.0	1.0

6. Managers' preference of heat. The type of heat greenhouse managers would use if they were rebuilding is shown in Table 27 and is compared to their educational level.

7. Managers' preference of fuel. In a discussion on enlarging greenhouse operations, gas (Table 28) was the type of fuel preferred by most managers.

8. Increase in greenhouse area, framing material, and cover in relation to the education of the manager. Table 29 shows that managers with second-, fifth-, and seventh-grade education did not increase their existing facilities during the past five years, while there was an

Table 27. Managers' Preference of Heat in
Relation to Their Education

Education of Manager	Steam	Hot Water	Gas Unit Heaters	Electricity	Hot Air Furnace
2	-	-	-	-	1
4	-	3	-	-	-
5	-	-	1	-	-
6	1	2	1	-	-
7	-	1	-	-	-
8	-	2	1	-	-
9	1	1	-	-	-
10	-	3	5	-	-
11	-	1	-	-	-
12	5	4	6	-	1
13	-	1	3	-	1
14	3	1	2	-	-
15	1	1	1	-	-
16	3	2	5	-	-
17	-	1	-	1	-
18	-	-	1	-	-
Total	14	23	26	1	3
Percent	21.0	35.0	39.0	1.0	4.0

Table 28. Managers' Preference of Fuel in Relation
to Their Education

Education of Manager	Coal	Gas	Oil	Electricity
2	-	-	1	-
4	1	1	1	-
5	-	1	-	-
6	1	2	1	-
7	1	-	-	-
8	1	2	-	-
9	1	-	1	-
10	-	5	3	-
11	-	-	1	-
12	4	8	4	-
13	1	4	-	-
14	-	5	1	-
15	-	1	2	-
16	-	7	3	-
17	-	1	-	1
18	-	1	-	-
Total	10	38	18	1
Percent	15.0	57.0	27.0	1.0

Table 29. Increase in Greenhouse Area in the Past Five Years, Type of Frame and Cover with Relation to the Managers' Education

Education of Manager	Total Square Feet	Frame (Square Feet)			Cover (Square Feet)		
		Aluminum	Wood	Quonset	Glass	Fiberglass	Polyethylene
2	-	-	-	-	-	-	-
4	85,625	-	-	85,625	-	-	85,625
5	-	-	-	-	-	-	-
6	8,000	-	6,000	2,000	-	6,000	2,000
7	-	-	-	-	-	-	-
8	500	-	500	-	-	500	-
9	29,000	22,000	7,000	-	7,000	15,000	7,000
10	13,086	-	7,786	5,300	5,450	5,036	2,600
11	3,200	-	3,200	-	3,200	-	-
12	89,399	60,479	8,040	20,880	33,979	4,440	50,980
13	18,680	14,880	3,800	-	2,880	12,000	3,800
14	32,600	11,800	17,800	3,000	5,400	15,800	11,400
15	37,575	-	37,575	-	-	22,075	15,500
16	46,606	11,000	31,006	4,600	11,000	784	34,822
17	1,000	-	1,000	-	-	1,000	-
18	3,000	-	3,000	-	-	3,000	-
Total	368,271	120,159	126,707	121,405	68,909	85,635	213,727
Percent		33.0	34.0	33.0	19.0	23.0	58.0

increase in all other grade levels. The high school graduates had the largest increase--89,399 square feet; the fourth-grade managers were second with 85,625 square feet.

The frames used by the managers were about equally divided between aluminum--33 percent, wood--34 percent, and quonset--33 percent. Three educational groups used more aluminum framing, nine used more wood, and one used more of the quonset framing.

When we compare covering materials, polyethylene was used to cover 58 percent of the total square footage, fiberglass 23 percent, and glass 19 percent. Glass was not used by any manager with less than a ninth-grade education.

What Is Your Major Crop Compared with:

1. Value of sales of greenhouse products. The major crops produced were based on the sales volume at wholesale and retail (Table 30). In 1960, 11.4 percent of the greenhouse producers stated that bedding plants were their major crop and accounted for \$79,800 in wholesale sales. In 1965, bedding plants were the major crop reported by 14.3 percent of the greenhouse producers with \$131,700 in wholesale sales. In 1970, bedding plants were the major crop for 28.6 percent of the producers and accounted for \$385,216 in wholesale sales. This shows that the popularity of bedding plants increased about four times in the 1960 to 1970 period.

In 1960, 11.4 percent of the producers reported that bedding plants were their major crop sold at retail and accounted for \$95,750. This retail sales volume was greater than for wholesale during the same year.

Table 30. Wholesale and Retail Sales for Major Crops

Year	Bedding Plants		Chrysanthemums		Orchids		Sale of All Crops		Total
	Wholesale	Retail	Wholesale	Retail	Wholesale	Retail	Wholesale	Retail	
1960	\$ 79,800	\$ 95,750	\$ 364,100	\$114,000	\$157,324		\$ 876,224	\$460,401	\$1,336,625
1965	131,700	97,233	559,000	25,440	231,883		934,583	247,733	1,182,316
1970	385,216	146,151	1,893,200	295,500	257,633		2,561,049	423,406	2,984,455

In 1965, the retail sales for bedding plants increased in popularity but sales volume showed a smaller increase than wholesale sales; 17.2 percent of the growers sold bedding plants with a retail value of \$97,233. In 1970, 25.7 percent of the producers reported that bedding plants were their major crop and constituted a retail value of \$146,151. Bedding plants were designated by the producers as their major crop for the 1960-1970 period. Chrysanthemums ranked second by the growers, yet, they accounted for several thousand dollars more in wholesale and retail sales value.

Bedding plants as the selected major crop showed an increase in both retail and wholesale sales in 1960, 1965, and in 1970. In the case of chrysanthemums there was a decline in their 1965 retail sales, but it recovered and increased in 1970. The trend in retail sales has been a steady increase.

Even though orchid producers have been encountering heavy competition from imported orchid blooms, they have continued to increase their sales volume during the 1960, 1965, and 1970 period. There was a slight increase in the number of producers reporting orchids as their major crop from 2.9 percent in 1960 to 5.7 percent in 1965. There was no change from 1965 to 1970, which indicates that new producers did not enter the specialized field of orchid production during this period.

CHAPTER VII

SUMMARY

This survey was compiled from interviews with 70 greenhouse operators in Tennessee out of a total of more than 176. The production of floral crops under controlled environmental structures consists of 607 greenhouses having an area of 2,583,521 square feet; there was a total of 1,440,010 square feet of glass (56 percent), 822,702 square feet of polyethylene (32 percent), and 320,809 square feet of fiberglass (12 percent). The greenhouse area has been increased during the 1965-70 period by 357,171 square feet; 60.0 percent of the greenhouses are operated as a proprietorship, 20.0 percent partnership, 18.6 percent as corporations, and 1.4 percent publicly owned; out of these 84.3 percent are operated as family enterprises.

Hot water is the most popular heat for greenhouses and represents 37.1 percent of the total area. Butane, or natural gas, was the most popular fuel and represented 41.4 percent of the greenhouse area heated. Manually operated ventilation systems were used in 46.4 percent of the greenhouse area.

Greenhouse managers 50 years of age and older made up 51.4 percent of the total and 74.3 percent are employed full time. Their educational level ranged from a second-grade class to grade 18 (Ph.D.), and 66.6 percent had no previous experience or training in greenhouse operation before assuming their management positions.

In considering their labor force, 63.6 percent of all the managers preferred to hire female workers and gave various reasons for their choice--the two most favored were that women are more cooperative than men and do better work.

It was thought by 97.0 percent of the managers that a newsletter specializing in greenhouse information would be of help to the industry. When asked about a short course for managers and employees, 44 managers said they would attend such classes but 28 said they would not send their employees.

Only 33.8 percent of the managers pasteurized their potting soil, 22.8 percent soil test on a regular basis. Of those who soil test, 54.5 percent use the information as a guide to balance the elements in their fertilizer program. Those having soil analyzed, 89.6 percent, do not request tests for minor elements, yet 71.0 percent of this group use minor elements in their plant fertilizer program. Water-soluble fertilizers are preferred by 65.7 percent of greenhouse operators.

Operators are cognizant of the danger of using chemicals in greenhouses and are taking precautionary measures to safeguard their employees. Over 20.0 percent use eye goggles when spraying and 48.6 percent of the operators use a mask when spraying or fogging.

Wholesale sales have increased in the last three five-year periods of 1960, 1965, and 1970 with \$876,224, \$934,583, and \$2,561,049, respectively. Retail sales increased in the 1965 and 1970 periods by \$247,733 and \$423,406, respectively. There were 24 greenhouse producers shipping 18.0 percent of their volume across state lines into 11 other states.



LITERATURE CITED

LITERATURE CITED

1. Babelay, John P. Personal Interview. Knoxville, Tennessee, August, 1972.
2. Baum, Karl P. A Pictorial History of Baum's Home of Flowers, Inc., Knoxville, Tennessee, 1889-1969. 1969, p. 1.
3. _____. Personal Interview. Knoxville, Tennessee, August, 1972.
4. ¹Collins Encyclopedia with Bibliography and Index. The Crowell-Collier Pub. Co., Vol. II, 1964, p. 435.
5. Fossum, M. Truman. Trade in Horticulture Specialties. A Statistical Compendium. U.S. Dept. Agr., Bur. Agr. Econ., Mkt. Res. Rept. 33, Washington, D.C., April, 1953, p. 4, 7, 8, 9.
6. Hale, J. H. Horticulture. The United States at the Eleventh Census, 1890. Report on the Statistics of Agr., Vol. V, U.S. Dept. Int., Census Ofc., Washington, Gov. Print. Ofc., 1895, p. 569.
7. Hall, Richard, and Stephen M. Raleigh, Jr. Commercial Floriculture and Related Products: An Analysis of Purchases and Buyers of Goods and Services. U.S. Dept. Agr., Econ. Res. Serv., Mkt. Res. Rept. 855, October, 1969, p. 1.
8. Havas, Nick. A Graphic View of the Retail Florist Industry Marketing and Management Practices. U.S. Dept. Agr., Econ. Res. Serv., Mkt. Res. Rept. 788, 1970, p. 1, 2, 3.
9. Haworth, Paul Leland. George Washington: Country Gentlemen. The Bobbs-Merrill Co., Indianapolis, Ind., 1915, pp. 159-160.
10. Laurie, Alex, D. C. Kiplinger, and Kennard S. Nelson. Commercial Flower Forcing. 7th Ed., McGraw-Hill Book Co., New York, N.Y., 1969, p. 1.
11. McCabe, Norbert Gerhard. Floricultural Production in the American Economy. Thesis, M.Sc., Univ. Ill., 1949, 71 pages.
12. Moore, Mrs. Ben P. Joy. Personal Interview, Joy's Greenhouses, Inc., Nashville, Tenn., August, 1972.
13. Post, Kenneth. Florist Crop Production and Marketing. Orange Judd Pub. Co., Inc., New York, 1952, p. 1.

14. Sanders, Edgar. The Cut Flower and Plant Trade, Scope, and Extent with System of Marketing. The Florist Exchange, VII, March 30, 1895, p. 406.
15. Statistical Reporting Service. Flower and Foliage Plant Production and Sales in Selected States, 1959-1968. U.S. Dept. Agr., Stat. Bull. 442, Crop Reporting Board, June, 1969, p. 3, 9, 13, 19, 23, 27, 31, 33.
16. Tennessee Certified Greenhouse List for 1970-1971. State of Tenn. Dept. Agr., Div. Plant Industries, 1970, 17 pages.
17. The Encyclopedia Americana International Edition. Int. Hdq. 575 Lexington Av., New York, N.Y. 10022, No. 13, 1968, pp. 432-434.
18. Thomas, Leroy. Commercial Floriculture. The Making of America. Ed. by Robert Marion Lafollette. The Making of America Co., Chicago, Vol. V, 1905, p. 251.
19. U.S. Bureau of the Census. Twelfth Census of the United States: 1902 Agric., Vol. VI, Part II (Washington, Gov. Print. Ofc.), 1902, p. 774.
20. U.S. Bureau of the Census. U.S. Census of Agriculture: 1950. Vol. I, Counties and State Economic Areas, Part 20, U.S. Gov. Print. Ofc., Washington, D.C., 1952, p. 18.
21. U.S. Bureau of the Census. Census of Agriculture, 1964. Vol. II, General Report, Statistics by Subject. U.S. Gov. Print. Ofc., Washington, D.C., 1968, p. 350, 482.
22. U.S. Dept. Commerce. 1969 Census of Agriculture, Part 31, Tennessee. Social and Econ. Stat. Admin., Vol. I, Sect. 2, Table 25, June, 1972, p. 8.
23. U.S. Bureau of the Census. Census of Agriculture: 1969. Vol. I, Area Reports, Part 31, Tennessee Section 1. Summary Data. U.S. Gov. Print. Ofc., Washington, D.C., 1972, p. 318.
24. White, E. A. Floriculture. The Standard Cyclopedia of Horticulture. Ed. by L. H. Bailey, Vol. II, 1928, p. 2.



APPENDIXES

APPENDIX A

SURVEY QUESTIONNAIRE

Physical Structure of Each Operation

1. Type of organization
 - a. Proprietorship
 - b. Partnership
 - c. Corporation
2. Is owner (manager) full- or part-time operator?
3. How many years under present manager?
4. Years greenhouse has been in operation?
5. Months of the year operated?
6. Is the greenhouse operated as a family enterprise?
7. How many family members, including the manager, work full time?
8. What is the total greenhouse square footage?
9. How many houses do you have?
10. What structural material was used for cover and frame? Express in square feet.
11. How much have you increased your greenhouse space in the 1965-70 period?
12. The increase was of aluminum, steel frame, pipeframe, wood, quonset?
13. The increase was covered with glass, fiberglass, ultraviolet resistant polyethylene?
14. What type of heat do you use?

15. What type of fuel do you use?
16. What was your heating cost for 1969-70?
17. What type of ventilation do you use?
18. What is your source of water?
19. Number of employees?
20. Distribution of labor per month?
21. Do you have all the help you want?
22. Do you have help when you want it?
23. What is the cost of labor? Full time? Part time?
24. What percent of your help is skilled?
25. Do you have difficulty securing qualified help?
26. What are the ages of your help?

Managers' Qualifications to Manage

1. Age?
2. Education?
3. Years of special training before assuming manager's position?
4. Years manager has worked in greenhouse?
5. Are you enjoying a higher, same, lower income in the greenhouse business than you could receive in any other occupation for which you are qualified?
6. To what trade organizations do you belong?
7. Where is technical information obtained?
8. From what universities do you obtain technical information?

Managers' Preference

1. If you were rebuilding, what type of heat would you use?

2. What type of fuel?
3. If you were building again, what construction would you use?
4. What type of covering would you use?
5. Do you prefer to employ women? Men? Why?
6. Would you increase the size of your operation if you had more labor?
More money? Both?
7. Would a newsletter on a regular basis be helpful to you?
8. Would you prefer to receive information only when we at the University of Tennessee think it important to a majority of producers (not necessarily on a regular basis)?
9. Would you be interested in attending a training meeting for greenhouse managers?
10. Would you be interested in sending your employees to a training meeting?
11. What subjects would you like to cover in a training meeting?

Management Production Practices

1. Do you use all soil? Soil% Peat% Sand% Artificial mixes% Bark%
Other%
2. Do you pasteurize all soil used?
3. Do you soil test? Every house each year, 1/2 of house each year,
1/4 of house each year, seldom, never? Total number of tests each
year?
4. Do you soil test more in winter, spring, summer, fall?
5. Do you use soil-test information as a guide to balance the elements
in your fertilizer program?

6. Do you test for minor elements?
7. Do you add minor elements?
8. Where are soil analyses determined?
9. What type of fertilizers do you use?
10. Are fertilizers added by premix, broadcast, or in water?
11. Do you use CO₂ burners?
12. How do you apply water? Mist, skinner system, soaker hose, by hand, subsurface irrigation, Chapin or similar system?
13. What is your major crop?

Management Sanitation Practices

1. Sanitation outside greenhouse: 1 (poor) - 2 - 3 - 4 - 5 (excellent)
2. Sanitation inside greenhouse: 1 (poor) - 2 - 3 - 4 - 5 (excellent)
3. Do you have insect troubles?
4. Do you have disease troubles?
5. What are the most common diseases which cause you trouble in the production of plants or flowers?
6. Do you follow a regular spray program with fungicides to protect your plants from diseases?
7. Do you follow a regular spray program with insecticides to protect your plants from insects?
8. Have you used any vapor-type fungicides?
9. Do you use insecticides in a fogging machine?
10. If steam is used, give temperature and time.
11. If chemical is used, give name and rate.
12. Do you know what nematodes are?

13. Have you ever had problems with nematodes on your plants?
14. Do you identify the insect or disease before applying control measures?
15. Do you make a regular check after applying a chemical to see how effective your control has been?
16. Do you read pesticide labels?
17. Do you follow all directions?
18. What precaution is used with chemicals?
19. Do you mix chemicals accurately?
20. Do you post poison signs?
21. Do you lock doors until greenhouse is ventilated?
22. Do you wear protective clothing?
23. Disposal of pesticide and pesticide containers: buried, returned to manufacturer, garbage pick-up.
24. Storage facilities for pesticides: locked storeroom, temperature control, marked for fire hazard, marked with poison sign.

Managers' Marketing Practices

1. Value of sales of plants and flowers: wholesale--1960, 1965, 1970; retail--1960, 1965, 1970?
2. Do your competitors change delivery date or schedule, or practice unfair methods to gain a larger portion of the market?
3. Have you noted any recent (within the past five years) change in preferences of various customers (retail, wholesale, mass marketing outlets) for different kinds of plants?

4. Have you sold to landscape contractors for use in community or highway beautification projects?
5. Do you sell on credit terms?
6. Have you had trouble collecting?
7. How do you establish your price?
8. Do you sell in other states?

Overall Operating Efficiency

1. What factors affect your operational efficiency?

Management Problems Outside of Business

1. Do you have problems with transportation facilities or agencies?
2. Have you had problems obtaining credit from your suppliers?
3. Is adequate information readily available concerning the market for your products?

APPENDIX B

SURVEY DATA QUESTIONNAIRE

B. Type of organization: Proprietorship, partnership, corporation, and other. Compare with:

8. Education of manager: Grade 1/ ☐ 2/ ☐ 3/ ☐ 4/ ☐ 5/ ☐ 6/ ☐ 7/ ☐
8/ ☐ 9/ ☐ 10/ ☐ 11/ ☐ 12/ ☐ 13/ ☐ 14/ ☐ 15/ ☐ 16/ ☐ 17/ ☐ 18/ ☐
19/ ☐ 20/ ☐

12. Is the greenhouse operation a family enterprise? Yes/ ☐ No/ ☐

13. How many family members, including the manager, work full time?

14. What is your total greenhouse square footage?

16. Cover: Glass, Fiberglass, Polyethylene

Frame: Aluminum, Wood, Quonset

24. If you were rebuilding, what type of heat would you use?

26. How much have you increased your greenhouse space in the past five years? _____ sq. ft.

29. If you were building again, what construction would you use?

All aluminum/ ☐ Wood frame/ ☐ Quonset/ ☐

30. What type of covering would you use?

Glass/ ☐ Fiberglass/ ☐ Polyethylene/ ☐

C. Months of year operated? Compare with:

8. Education of manager: Grade 1/ ☐ 2/ ☐ 3/ ☐ 4/ ☐ 5/ ☐ 6/ ☐ 7/ ☐
8/ ☐ 9/ ☐ 10/ ☐ 11/ ☐ 12/ ☐ 13/ ☐ 14/ ☐ 15/ ☐ 16/ ☐ 17/ ☐ 18/ ☐
19/ ☐ 20/ ☐

93. Value of sales of plants and flowers:

Wholesale: 1960 \$ _____	Retail: 1960 \$ _____
1965 \$ _____	1965 \$ _____
1970 \$ _____	1970 \$ _____

E. Age of manager: 20-29, 30-39, 40-49, 50-59, 60-up. Compare with:

16. Cover: Glass, Fiberglass, Polyethylene

Frame: Aluminum, Wood, Quonset

29. If you were building again, what construction would you use?

All aluminum ☐ Wood ☐ Quonset ☐

What type of covering would you use?

Glass ☐ Fiberglass ☐ Polyethylene ☐

30. Do you use all soil? _____ Soil _____ % Peat _____ % Sand _____ %

Artificial mixes _____ %

31. Where are soil analyses determined? 1--University of Tennessee,

2--Michigan State, 3--Mississippi State, 4--Yourself, 5--Ohio

State, 6--Peters, 7--Edwards Laboratories, 8--Rainbow Fertilizer

32. What is your major crop? 1--Bedding plants, 2--Chrysanthemums,

3--Roses, 4--Geraniums, 5--Orchids, 6--Carnations, 7--Tomatoes

F. Education of manager: 1-18. Compare with:

9. Is owner (manager) full-time ☐ part-time ☐ operator?12. Is the greenhouse operation a family enterprise? Yes ☐ No ☐

14. What is your total greenhouse square footage?

16. Cover: Glass, Fiberglass, Polyethylene

Frame: Aluminum, Wood, Quonset

20. What type of heat do you use? Steam ☐ Hot water ☐ Hot air ☐Gas heaters ☐ Other ☐

21. What type of fuel do you use?
24. If you were rebuilding, what type of heat would you use?
25. What type of fuel?
26. How much have you increased your greenhouse space in the past five years? _____ sq. ft.

The increase was of Aluminum ☐ Wood ☐ Quonset ☐

The increase was covered with Glass ☐ Fiberglass ☐

Polyethylene ☐

H. What is your major crop? Compare with:

1. Bedding plants
2. Chrysanthemums
3. Roses
4. Geraniums
5. Orchids
6. Carnations
7. Tomatoes

Value of sales of greenhouse products

VITA

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He entered the University of Tennessee on January 2, 1946, and graduated with a Bachelor of Science degree in agriculture (major in horticulture) March 7, 1949; did graduate work at Virginia Polytechnic Institute and State University, receiving a Master of Science degree in horticulture June 9, 1950.

He was employed by the Horticulture Department, University of Tennessee, from July 1, 1950, to June 30, 1953, as farm manager and instructor in horticulture. He entered private business July 1, 1953, as Secretary-Treasurer and General Manager of DeLozier and Harris Tractor Company, Inc., and returned to the employ of the University of Tennessee Agricultural Extension Service on July 1, 1963, as Assistant County Agent in Knox County, Tennessee.

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