

Starting a Greenhouse Business

The greenhouse business is one of the fastest growing industries in Alabama as well as in the United States. People everywhere want their home landscapes to be colorful year-round, businesses want to be attractive to customers, and almost everyone can appreciate the beauty flowers and plants bring to the environment. New greenhouses, garden centers, nurseries, and landscape companies are springing up everywhere.

So, should you become involved in this growing industry? There are many aspects to consider before sowing the first seed or purchasing the materials to build a greenhouse. Careful consideration of the many factors involved in a commercial greenhouse can save many hours and dollars in losses. While you can't plan for everything, a well-thought-out plan can help plot a course as the business grows.

A large percentage of small businesses fail within the first 2 years. Complete as the information in this document may seem, it is designed to provide general guidelines for starting a greenhouse business. Spend time reading as much material as possible to prepare for operating a business. Experience is a good teacher, but preparation can help avoid costly mistakes.

Reasons for Starting a Business: Your Motivation

Many people look at a business and think, "I can do a better job myself!" Many new businesses are established with this spirit. But what are good reasons for wanting to start a greenhouse business?

Sometimes an individual sees a real need for high-quality plants in a town or area. Another individual may see a need in the market for specific kinds of plants, such as rare herbs or herbaceous perennials. These opportunities for profit are solid reasons for motivating an individual to consider establishing a greenhouse business.

Another reason is a love of plants. While it is important to enjoy your work, a love of plants cannot make you a good businessperson. Remember that the real reason to establish a business is to make a profit. If you cannot show a profit in several years, the business may no longer be viable.

Are You Ready for Your Own Business?

After considering your motivation for starting a greenhouse business, consider your personality characteristics. Many people want to start a business because they want to be their own boss. Many entrepreneurs who start businesses will tell you that you are not the boss. The banker becomes a boss if you borrow money. Customers become the bosses because you must satisfy them. While there may not be any one person to report to at work, going into business for yourself means you now have multiple bosses.

What characteristics do you have that will make you a good greenhouse grower and a good businessperson? The answers to the following questions may help determine if you are ready to strike out on your own.

Are you action oriented? Can you make decisions after considering the facts at hand? Business people often don't have all the facts needed to make a black-and-white decision. Decisions frequently must be made under pressure. Can you get the job done? Are you results oriented?

Are you dedicated to success? Can you work long hours, often 7 days a week when necessary? Greenhouse plants must have attention every day. During some seasons, the work can be 70 hours per week or more. You, as the boss, must be prepared to commit the time and attention required. You must be dedicated to getting the job done. You should also learn from your failures and not get discouraged.

Are you a manager? Can you delegate assignments to employees or do you need to do everything yourself? You cannot do everything yourself if you are the boss. You must hire competent people as part of your team and give them responsibility to get jobs done.

Are you a good planner? A manager needs to plan for growth in the business, plan when to plant and harvest crops, and plan for unforeseen challenges such as cold temperatures in the greenhouse or crops that are not ready at harvest.

Do you have the appropriate knowledge and experience? Have you grown the crops you plan to sell? Have you ever operated a business before? It is better to learn (and make mistakes) by working for another greenhouse and get some good experience before starting your own business. While a college degree in business or horticulture may not be required, there are many things you will need to know concerning crop culture, greenhouse operation, people management, sales, and the day-to-day operation of a business.

Do you have enough resources? Do you have enough money to start and operate the business while you get established and until you can pay your own bills? What other resources do you have and are willing to risk on the success of the business? Will you qualify for a loan? Who will give you a business loan?

Do you have people skills? How well do you work with people as the boss and as a salesperson? Can you interview, hire, and fire someone? Can you handle employee and customer complaints? Managing a business involves managing your time, other people's time, your customers' complaints, and your suppliers, as well as your banker, attorney, accountant, and financial planner.

Are you flexible? Can you adapt and grow as your business grows? Are you innovative enough to contribute to the expansion of the company? What will customers want next year? Where will the market be in 5 years?

Analyze yourself carefully to make sure you are prepared for the challenges. Not everyone is made to own a business. Not everyone has all the skills needed to operate a business. Identify the skills and strengths you have and determine if you can hire another person or several individuals to make up for your weaknesses.

Where Is Your Market?

The marketing process includes a range of activities intended to identify and satisfy the desires of consumers while earning a profit for the business. These activities include identifying customer needs, developing products and services to meet those needs, establishing promotional programs and pricing for the products and services, and implementing a system of distribution to the customers. It is essential to identify and understand the market, know who the competition is, and develop a market niche. Remember, grow what sells, not what you are fond of.

Selling plants directly to consumers in a retail business is different from selling plants wholesale to garden centers or other retail businesses. To

determine if a consumer market is large enough, conduct a demographic study—a study of the characteristics of a particular area. This should help you assess whether a greenhouse business is feasible. Characteristics that should be of interest are population, projected population growth, age distribution, income levels, age of community, number and size of residential areas, types of housing and lot sizes, trade areas, gross retail sales, unemployment rate, and major employers. Some important questions to consider are the following:

- Do enough people live or shop in the market area you choose?
- How much competition do you face?
- Are a lot of other businesses already growing and selling the products you would like to produce?
If you will sell plants to a wholesale market:
 - Are there distributors or wholesalers who could purchase your plants?
 - Can you sell directly to retailers in your market area?
 - Are there enough retailers who could purchase your products?
- What advantages, such as higher quality plant material, a broader product mix, or improved services, can you offer retailers to encourage them to purchase plants from you rather than from their current suppliers?

You need to understand the market, how it looks today, and how it will look in 5 years before deciding to go into business. It may be difficult to collect enough information about the market to make a decision. The local chamber of commerce may be able to offer assistance. Ask the local library for additional information. The telephone book is an excellent resource when assessing the competition. Take a little time to look for sources such as census reports, demographic studies, newspapers, and the World Wide Web. Other very good information sources are real estate agencies and the county Extension office. Be creative to find as many facts as possible to help you make decisions about the market.

Characteristics of the markets will have an impact on the type of marketing you choose. Plants can be marketed at wholesale, retail, or, in some cases, mail order. **Wholesale production greenhouses** sell relatively large amounts of products to a small number of accounts. They may sell to florists, independent garden centers, grocery stores, mass merchants, home centers, landscape businesses, or grounds maintenance firms. Many wholesale greenhouses grow a wide range of products throughout the year for daily, seasonal, or contract sales.

A **retail greenhouse** sells a relatively small amount of products to a large number of individual customers. This type of operation generally requires high product quality, active marketing, and superior service to succeed. Many **retail merchandisers** do not grow plants, but purchase all or most of their products from wholesale growers. The greenhouse serves to maintain plant health until sold, not to increase plant size. **Retail growers** produce a variety of plants to sell from their own retail operations. Because it is often disruptive to have customers selecting products in a production facility, the retail facility is often separate from the production facility. The retail facility may be at the same or at a different location.

What Type of Business Will You Establish?

Another consideration in starting a greenhouse business is to decide how the business will be structured legally. Usually, the business is structured in one of three ways: sole proprietorship, partnership, or corporation. Each legal structure has several advantages and disadvantages. Consult an attorney and accountant to decide on the structure that best suits your needs.

Most entrepreneurs start in the **sole proprietorship** legal form of business. The primary advantage of this form of business is that you, the sole proprietor, are responsible for the assets and liabilities of the business. You are the boss. You have complete liability, and you are taxed personally for the profits of the business. However, your personal and business assets can be taken away if the business has financial trouble and you owe creditors money.

A **partnership**, with one or more partners, is another type of business with some different advantages and disadvantages. A partnership may have more resources and partners sharing the responsibility and the liabilities, but you have at least one other individual that you can consult regarding business decisions. Some people find this a great advantage because one person may be good at growing plants and the other may be good at operating a business. This interaction can work to the advantage of both. Like the sole proprietor, all partners are liable for the business's assets and their own personal assets can be jeopardized if the business has financial difficulty.

The **corporation** is the third form of business structure. Today, more greenhouse businesses are corporations because of the advantages a corporation offers. Unlike the sole proprietorship and partnership, the corporation is only liable when

financial difficulties arise. Only the business assets can be taken if creditors demand payment. The primary disadvantage to a corporation is that the business is taxed twice: one time on the profits the corporation earns and a second time when the owners of the corporation receive personal income from that corporation.

Where in Your Market Will You Locate Your Business?

Location of the property in the market area will affect the success of the business, especially if it is a retail business. Study the market to determine the best location. Real estate agents will tell you that the three most important considerations for a retail business are (1) location, (2) location, and (3) location! For a wholesale business, access to the market is more important than the market's (your customers') access to you. When considering where in the market area to locate a business, think about the following.

Size and shape. The exact size and shape of the property will depend on what size business you are planning to start and the layout of that business. However, a minimum of 3 acres is recommended. In general, property with more road frontage is more expensive, but it is also more visible to customers. Plan for expansion. Is there enough room to grow in the next 5 years or so until you can afford to purchase more property for the business?

Zoning regulations. Make sure the property is zoned for business. Check to see if zoning is likely to change in the near future or if it has been disputed in the recent past. Are there any special restrictive clauses that may inhibit your expansion? Are there regulations on the size or height of signs that can be used to promote your business?

Accessibility. The business should be close enough to major roads for delivery and transport trucks to have easy access. Are there any weight limits or restrictions on large trucks? For a retail greenhouse, locate the business so customers can see it from at least 200 feet and can get to the business easily and safely. Plant shopping is often done on impulse. If customers have to cross major barriers or make a special effort to get to your business, chances are they won't.

Labor availability. Operating a greenhouse business is labor intensive and obtaining experienced, dependable labor can be troublesome. Readily available labor and support facilities should be within 20 minutes drive of the greenhouse site. Is there a good source of skilled labor in the area, such as a high school program with horticulture students, a university, college, or technical school? Also, extra unskilled help will be needed during peak business

times. Good sources of extra, part-time help are high school students or older, retired adults. Labor should be available at a price you can afford.

Water quality and availability. Is city water available or will you have to dig a well? If you dig a well, how much water is available and how long will it last? Many greenhouses require about 6 acre-feet of water per year for every acre of greenhouse production area. Regardless of the source, have a water quality test performed. This is an inexpensive, easy procedure that may save a lot of money in the future.

Private labs or your county Extension agent can help take the water sample and have it analyzed. Check the level of soluble salts and bicarbonates. Low soluble salts, a level below 0.75 mmhos/cm, is best because fertilizer is often added to the water during irrigation. When present in excess amounts, some salts are toxic to plants. Water bicarbonate level is important in plant production. A bicarbonate level of less than 100 ppm (parts per million) is recommended for growing most plants.

You will also need a plan for water collection and a plan for water runoff from your greenhouse.

Utilities. How many are available, and what are the connection fees? You will need electricity and, depending on other equipment and needs, you may need gas, water, or sewer services connected. Check with each supplier to determine costs and to anticipate any difficulties they might have in supplying services.

Taxes. What is the tax rate on the property? Are taxes likely to increase substantially in the future forcing you to move the business elsewhere?

Local building codes. What codes will affect which buildings you construct and where on the property you locate them?

Neighboring businesses. What affect will other businesses have on traffic flow of customers into and out of your business?

Natural slope and drainage of the land. Grading land can be very expensive. Greenhouse structures should be located on a slope of 5 percent or less. Avoid locating a greenhouse on a flood plain, in a frost pocket, or on a hilltop where heating costs will be high. Avoid an area where nearby structures or trees will cast shadows on the greenhouses.

Resale value. Someday it may be necessary to sell the property, for good or bad reasons, so have an estimate of its resale value in the future.

Your Business Layout

In a wholesale production greenhouse, the primary factor to consider in arranging buildings and equipment is materials flow and how it impacts labor utilization and future expansion. How will materials come into the facility (delivery and unloading), be stored until needed, and be moved through the production process? How will products move out for packaging and be delivered to customers? Labor is often the single largest expense in a greenhouse business, therefore, materials movement and handling should be arranged to minimize the labor required. One possible arrangement is shown in Figure 1.

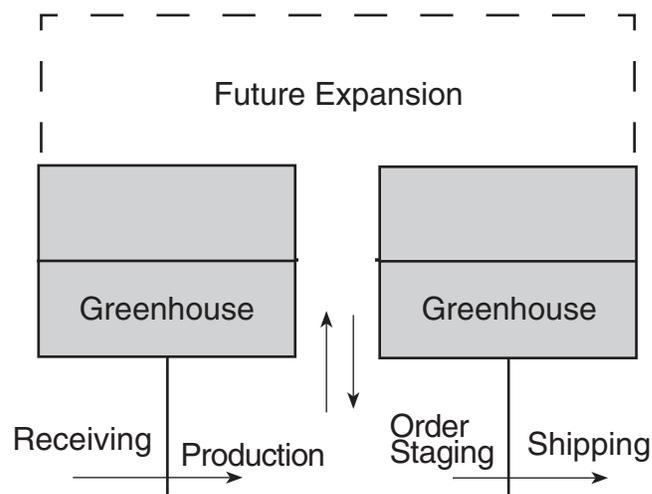


Figure 1. Site plan for the arrangement of a wholesale greenhouse and support facilities

Materials flow is also important in a retail operation, but customer movement and access are also critical. How will products move from delivery trucks to the display area, from the display area to the checkout register, and from checkout to the customer's vehicle?

What type of structures or areas do you need to start the business? A production facility and several other areas might be useful. Some examples of specific structures and areas to keep in mind when considering the construction of a business are the following: greenhouses, shade houses, work area, soil mixing area, storage buildings, pesticide room, roadways (large enough for trucks), parking facilities, sales room, offices, landscaped area (display garden), break room/kitchen, rest rooms, cashier location, loading dock, and shipping area. The sizes of each of these specific areas depend on plans and goals for your individual business.

Greenhouse Styles

Generally, there are two styles of greenhouse layout commonly used for new businesses: detached or freestanding houses or ridge and furrow or gutter connected houses (Figure 2). Detached greenhouses stand independently and may be constructed using different greenhouse types (gable, Quonset, etc.). Access from the work area to the greenhouses is often through a central, covered corridor or uncovered aisle. This layout style is

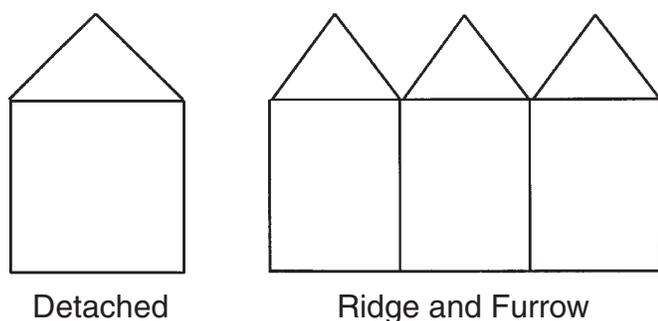


Figure 2. Detached and ridge and furrow greenhouse styles

common for small growers who are starting with 10,000 square feet or less, but who plan to add houses as the business grows. This style has advantages and disadvantages. Each house can be controlled by its own heating/cooling system to accommodate crops requiring widely different environments. Efficient movement of people and materials, however, can be a problem, especially in inclement weather.

Ridge and furrow greenhouses are connected at the eave by a common gutter. Different types of greenhouse construction can be used for a given row of connected houses. Internal walls may separate individual greenhouse sections where crops require different environments or internal walls may be absent where large, single crops are to be grown. Some advantages of the ridge and furrow style are lower construction costs compared to detached houses, especially for future expansion, lower heating costs per unit compared to detached houses, and more efficient movement of people and materials.

Greenhouse Types

The most common greenhouse construction for most new businesses is the Quonset type (Figure 3). These houses are constructed with arched rafters covered with one or two layers of flexible plastic, usually polyethylene. One disadvantage of polyethylene is that it is subject to ultraviolet light degradation and must be replaced every 2 to 3 years. The cost of construction for detached houses

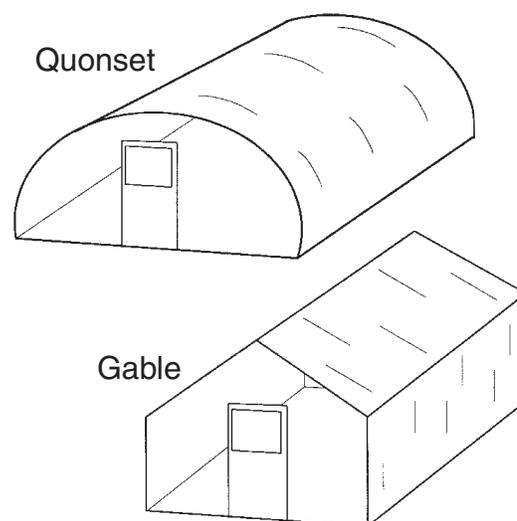


Figure 3. Quonset and gable types of greenhouse construction

is lower than the cost for other greenhouse types, usually \$2.75 to \$3.25 per square foot excluding heating, cooling, and benches. Many new businesses start with one or more houses that are 25 to 40 feet wide and 90 to 100 feet long. However, this type of construction can be applied to either the detached or the ridge and furrow styles.

Many greenhouse construction companies offer packages for constructing Quonset greenhouses. These commonly come with either steel or aluminum bows and the manufacturer specifies the bow spacing depending on the structural strength of the bow material. However, before purchasing, select the frame based on load-bearing requirements. This will be determined by whether or not the structure will support equipment or crops. Hanging the heating system, irrigation equipment, or hanging baskets from the framing will increase the load-bearing requirement. The end walls are often constructed of wood or metal framing covered in polyethylene or rigid plastic with aluminum doors for access. The side walls are often wood or metal with special fasteners for holding the polyethylene in place. The foundation for a Quonset greenhouse is usually a concrete footing poured at intervals dictated by the bow spacing.

Polyethylene manufactured for greenhouse application comes in 20- to 50-foot widths, 1 to 8 millimeters thick. It costs \$0.12 to \$0.18 per square foot. Two layers of polyethylene are frequently applied to greenhouses to reduce heating demand. Double-layer polyethylene houses generally cost 30 to 40 percent less to heat than do single layer houses. The two layers are kept air-inflated using a 100 to 150 ft.³/min. squirrel cage blower mounted to the inside plastic layer. Purchase 4-mil plastic for

the inside layer and 4- or 6-mil plastic for the outside. Use 6-mil polyethylene for single layer applications. Polyethylene can be installed on wood portions of a greenhouse by nailing wood batten strips over the film into the foundation boards and end walls. However, because polyethylene will require replacing frequently, investing in special fasteners will make the job easier. Fastening systems are available for single- or double-layer applications.

A second commonly applied greenhouse type is the even span, gable roof (Figure 3). This type of construction is appropriate where rigid glazing materials will be used such as glass or rigid plastics. The cost of construction for glass-covered, detached- style houses is higher than for Quonset types, usually \$5.50 to \$7.50 per square foot excluding heating, cooling, and benches. However, these structures are more permanent and require less maintenance. Gable construction with rigid glazing is a good choice when plans are long-term and the business is well capitalized. This type of construction can also be applied to either the detached or the ridge and furrow styles.

Gable houses use galvanized steel, aluminum, or a combination of the two materials for constructing the frame. The weight of glazing material, the weight of equipment attached to the frame, snow and wind loads, and the width of the greenhouse will have an impact on the type and size of materials chosen, size and spacing of support posts, and the design and construction of trusses. Glass is very heavy and requires strong support while rigid plastics are lighter requiring less support. Trusses and support posts may be spaced 6, 10, or 12 feet apart depending on load requirements while roof and side bars are spaced according to the width of the glazing material used. In recent years, eave heights have increased to 12 to 15 feet or higher in southern greenhouse construction because taller houses ventilate better and stay cooler. Gable houses, especially those covered with glass, should have a strong, concrete, or concrete block foundation that extends below the frost line according to building codes.

Glass is the traditional greenhouse covering against which all other materials are judged. Originally, glass panes for greenhouses were 18 by 16 inches, but larger sizes are becoming more common. Actually, larger panes are less fragile than are smaller panes. Many greenhouses are covered with double-strength float glass ($\frac{1}{8}$ -inch thick) costing \$0.85 to \$2.00 per square foot. Large, glass panes and tempered glass may cost \$3.00 to \$7.00 per square foot.

Fiberglass reinforced panels (FRP) are rigid plastic panels made from acrylic or polycarbonate that come in large, corrugated or flat sheets. FRP

panels are available in 24- to 57-inch widths and up to 24-foot lengths. These materials are durable, retain heat better than glass, and are lightweight (less structural support needed). Light transmission may be better than glass simply because less structural support is needed, therefore, fewer shadows are created. The cost of FRP panels range from \$1.00 to \$1.25 per square foot depending on the guaranteed life-span of the material.

Double-layer structured panels (DSP) are made from acrylic or polycarbonate and are constructed of two layers of plastic held apart by ribs spaced 1 to 2 inches apart. The double-layer construction increases structural strength and heat retention, but decreases light transmission compared to single-layer materials. Panels may be 4 feet wide and up to 39 feet long. DSP made with polycarbonate costs \$1.75 to \$2.50 per square foot while those made with acrylic costs \$2.00 to \$3.50 per square foot.

Floors and Walks

The type of floor for a greenhouse will depend on the type of production (pots or flats on the floor or on benches), available capital, and soil drainage. Bare ground should be avoided because of potential insect, disease, and weed problems and the presence of a muddy growing surface. Weed mat overlain with 4 inches of $\frac{3}{4}$ -inch crushed stone or pea gravel will help control weeds and provide a porous medium through which water can drain. Areas under benches can be treated the same way. If a solid concrete floor is desired or necessary, install drainage basins and slope the floor toward the drains. Concrete aisles are preferable where carts and wheeled equipment will be used. Walkways can be 2 to 3 feet wide in a small greenhouse. Adjust the width of walks for wheeled equipment. Larger greenhouses often have 2- to 3-foot secondary aisles and 4- to 6-foot or wider main aisles.

Benches

Benches may be constructed from a variety of materials and arranged in many different ways. Careful planning can result in 70 to 80 percent of floor area devoted to crops with fixed benches and up to 90 percent utilization with rolling or movable benches. Rolling benches are designed to open an 18- to 24-inch aisle of work space at any location along a row of benches.

Supports for benches should be strong enough to hold a large number of plants and the largest container size anticipated. Wood, metal pipe, or concrete blocks have been used as bench supports. The bench surface should be strong enough to support plants without sagging, but open to provide water

drainage and air movement. Spruce or redwood lath and 1-inch square, 14-gauge welded-wire fabric or expanded steel mesh make a strong, long lasting, open bench top. Bench height should be 32 to 36 inches and width should be 3 feet if against a wall or up to 6 feet if accessible from both sides. Benches can be purchased from a manufacturer in a variety of sizes and construction types.

Ventilation

The purposes of ventilation are to exchange carbon dioxide and oxygen, to remove hot air, and to lower relative humidity. Forced-air ventilation relies on electric fans controlled by a thermostat and a louvered intake vent. Fans pull cool air into the greenhouse from the outside through an intake vent and warm, inside air is pushed out. Fans should be mounted in a waterproof housing with exterior, air-activated louvers to protect electrical components from inclement weather and to keep cold air out during the winter. It is important to install a screen over the inside of fans to prevent injury. There should be a distance equal to at least 1.5 times the fan diameter between the fans and adjacent structures. The intake vent on the wall opposite the fans can have an air-activated or motorized louver. Fan capacity should be large enough to exchange the air in a greenhouse at least once per minute. Recommendations for warm climates call for a fan capacity to remove 12 to 17 cubic feet of air per minute per square foot of floor area.

Natural ventilation has made a comeback in the South in recent years in the form of retractable-roof greenhouses and Quonset houses with roll-up side walls. Retractable-roof greenhouses come in a variety of types while roll-up side walls on Quonset houses are relatively simple. In both cases, the idea is to move as much of the greenhouse structure out of the way as possible to expose crops to natural conditions during warm weather.

Cooling

One of the best ways to cool a greenhouse in the summer is to reduce light intensity. How much reduction to provide depends on the heat load in the greenhouse and the light requirements of the crops grown. Greenhouse whitewash and shade cloth are popular choices. Greenhouse whitewash is a special kind of latex paint that is diluted in water and sprayed on the covering surface. This material is designed to be applied in the spring and gradually degrade by the action of rain and sun so that little remains by fall. Shade cloth is a black, green, or white woven fabric of polypropylene that is applied over the outside of the covering. Shade cloth can be purchased with various weave densi-

ties that result in 20 to 80 percent light reduction. For many greenhouse applications, 30 to 50 percent light reduction should be sufficient.

Evaporative cooling relies on air passing through a porous pad saturated with water. The evaporating water removes heat from the greenhouse. Fan-and-pad systems consist of a cellulose pad the length of one wall and at least 2 feet tall with water supplied to keep the pad wet during operation. Fans along the opposite wall draw outside air through the pads. Fan-and-pad systems cool more efficiently when the relative humidity is low, a condition that is infrequent in Southeastern summers. However, a 5 to 10 degree reduction over the outside temperature can be achieved with a well-designed system.

Heating

Two popular heating systems for greenhouses are forced-air unit heaters that burn propane or natural gas and hot water or steam central boilers that burn fuel grade oil. Unit heaters cost less in initial investment (\$.30 to \$.50 per square foot) than central boilers (\$1.00 to \$2.50 per square foot), but cost more to operate (\$1.00 per square foot versus \$.60 per square foot). Unit heaters are easier to install and require less maintenance than central boilers require, but even heat distribution can be a problem. Central boilers provide even heat and combustion takes place away from the greenhouse, but installation can be time consuming. Generally, unit heaters are more appropriate for small greenhouse ranges and central boilers for larger ranges.

Unit heaters burn gas in a firebox and heated air rises through the inside of a thin-walled heat exchanger on its way to the exhaust chimney. A fan draws air in from the greenhouse, across the outside of the heat exchanger and into the greenhouse. Thus, most of the heat is removed from the exhaust before it exits the structure. The exhaust chimney must be sufficiently tall to maintain an upward draft and extend above the greenhouse roof. An 8- to 12-foot chimney is usually sufficient. Open flame heaters must be vented to the outside and be provided a fresh air supply for complete combustion. Fresh air must be provided by an unobstructed chimney to avoid carbon dioxide buildup and production of ethylene, both detrimental to plants.

Two warm-air distribution systems are popular for unit heaters: convection tubes and horizontal airflow. A convection tube is a polyethylene tube connected to the air outlet of the unit heater, running the length of the greenhouse and sealed at the other end. Warm air is distributed in the greenhouse through rows of 2- to 3-inch diameter holes

on each side of the tube. Horizontal airflow relies on a number of horizontally mounted fans 2 to 3 feet above the plants that circulate heat throughout the house. This system as well as convection tubes may also be used at times when heating is not required, especially at night, to reduce relative humidity and discourage diseases.

Central boilers burn fuel in a fire box to heat water to 180 degrees F or to steam in a heat exchanger. Exhaust smoke passes through a flue to a chimney that vents exhaust to the outside. The heated water or steam is delivered to the greenhouse to exchange heat with the air through pipe coils, unit heaters, or a combination of both.

Climate Control

Traditionally, the operation of heating, ventilating, and cooling equipment has been controlled by thermostats at plant level located close to the center of the greenhouse. This system is still used effectively in small operations, especially those with detached greenhouses. For accurate control, thermostats should be shaded from direct sunlight, preferably by mounting them in a plastic or wood box ventilated by a small blower. Thermostats have the advantages of being simple, inexpensive, and easy to install, but may be inaccurate and lack coordination with environmental control equipment.

Step controllers and dedicated microprocessors overcome the limitations of thermostats by providing more complex staging of heating and cooling systems and by coordinating the activities of heating, cooling, and ventilating equipment. These units generally cost from \$800 to \$2,500. Greenhouse environmental control computers add additional levels of control over greenhouse equipment along with weather sensing, environmental data logging and plotting, and other functions.

Irrigation Equipment

Hand irrigation using a hose, water breaker, and wand is still one of the most widely used methods of watering crops for small greenhouse operations. However, as the business grows, the cost in labor, the skill required to water effectively, and the logistics of hand watering large crops become prohibitive. Many attempts have been made to utilize impact sprinkles to water greenhouse crops, often with poor results. System design is critical to prevent wet and dry spots, excessive foliar wetting, and large volumes of runoff. Boom irrigation is probably one of the most effective and uniform methods of overhead irrigation. Water is delivered through fan-pattern emitters mounted on a rigid boom that travels back and forth across the

greenhouse. Booms limit runoff when used correctly, but crops must be reasonably uniform in size, age, and water requirement under a single unit to be applicable. The cost of installing booms is probably prohibitive for most new greenhouse businesses.

Drip emitter watering is probably the most common type of automatic watering system. Water is delivered to each pot through a small-diameter, polyethylene microtube held on the medium surface by a lead or plastic weight to keep the tube in the pot. Multiple microtubes on a bench are supplied with water from a black polyethylene (usually $\frac{3}{4}$ " header running down the center of the bench and connected to a water main. Each bench may be turned on or off by a hand valve or electric water solenoid valve installed where the header connects to the water main. Many benches or whole greenhouses can be divided into watering zones, the size of which depends on the capacity of the water supply. Watering can be controlled by devices as simple as on/off switches or as complex as an environmental control computer. Drip emitters deliver water directly to the medium surface at low volume and, therefore, do not wet the foliage. However, their application is usually limited to 4- to 10-inch pots and crops must be reasonably uniform in size, age, and water requirement under a single zone to be applicable.

Subirrigation involves supplying water by flooding into the drainage holes in the bottom of the pots. The water is absorbed by capillary action upward through the potting medium. Capillary mats, gutter benches, flood benches, and flood floors are systems that vary in complexity and cost. All share the advantages of being adaptable to a wide range of container sizes and have the potential for recycling runoff water. However, monitoring nutrients, pH, soluble salts, and contaminants in closed systems requires good management skills.

Fertilizer Injection

A fertilizer injector is a mechanical device that introduces soluble fertilizer dissolved in water (stock solution) into the water pipeline for delivery to the plants. A wide variety of injector devices are available on the market with a range of capacities (gallons per minute) and costs. Inexpensive units such as Hozon or Syfonex connect between a faucet and hose and suction fertilizer concentrate from a bucket into the water line using the Venturi principle. These units have a fixed injection ratio delivering 1 gallon of stock in 16 gallons of water (1:16). These units are only useful for the smallest applications because the injection ratio can vary with changes in water pressure and large volumes of fertilizer concentrate are required. Positive displace-

ment units such as Anderson, Dosmatic, Dosatron, Gewa, and Smith injectors cost more than Venturi types cost, but are much more accurate and reliable and offer a wider range of injection ratios.

When choosing a fertilizer injector, match the correct model with the maximum water flow rate that the unit will be expected to handle. The range of injection ratios available on a particular model will influence maximum daily water output and reasonable stock tank size. Some applications require use of chemicals other than fertilizers, have need for separate injection heads for incompatible chemicals, or present the problem of portable versus fixed installation. Consult the manufacturer to determine the correct model for a particular application.

Crop Selection

What crops should you grow? How many should you grow? What does the customer want? Do your customers want annuals, perennials, flowering plants, herbs, or ornamental grasses? What container sizes do they prefer? How many can they use? You may have some idea about the types of plants you cannot find in the market. You may even have some idea about the types of plants that may be in demand in the next year or two. There is no easy way to determine which crops to grow and how many, but demand in the market should drive production. Only produce what you can grow at a cost low enough and sell at a price high enough to make a profit.

The critical side of profitability is cost of production. The level of competition often sets the selling price. Know your cost of production for each crop and select crops and production methods for profitability. The difference between cost and price—the margin—must be large enough to operate the company, pay yourself a wage, justify the risk of being in business, and provide a return on your investment. Grow the best quality product demanded by the market you are in. Do not sacrifice quality to lower cost. Without quality, you will not survive in the market.

To get an idea of current trends in crops, read industry trade magazines such as *Greenhouse Grower*, *Greenhouse Manager*, and *GrowerTalks*. Read homeowner and homemaker magazines such as *Southern Living*, *Better Homes and Gardens*, *Woman's Day*, *House Beautiful*, and *Family Circle*. See what the industry is talking about in terms of new plants that may have desirable characteristics such as good heat tolerance and disease resistance. See what customers are doing now by reading the publications they read.

First consider producing the most popular varieties and then gradually introduce newer varieties or plants to customers. Add 10 to 30 percent new plant varieties each year. Remember that it is difficult for people to change anything, including the type of plants they are accustomed to buying. The only way they will change is if you educate them. You will be looked to as the expert for information and advice. Gather that information yourself and share it with customers. Plant the varieties you grow in a display garden for you and your customers to evaluate. Visit other gardens to see how well plants perform under similar conditions. Visit trial gardens to learn about new varieties and plan to include them in your production schedule in the future.

Another factor in selecting a crop to grow is deciding how to grow it. Crops can be started from seeds, plugs, or cuttings. The propagation decision depends on the species, cost, scheduling and timing of the crop, available facilities and equipment, and availability of seeds, plugs, or cuttings. Determine the cost of production using several different propagation methods and see which is the most profitable. Your level of experience may also influence the best method to start a crop. For example, if you have never grown bedding plants, starting with plugs will reduce the risk associated with germination, but it will increase the cost. Eventually, you may want to produce plugs for your business to use or perhaps to sell to other businesses.

Complying With Alabama State Laws

Greenhouses need to be licensed by the state of Alabama to conduct business. Plants that are shipped out-of-state must comply with any insect and disease quarantine regulations. For information on complying with state regulations, contact the Plant Industry Section of the Alabama Department of Agriculture and Industries, P.O. Box 3336, Montgomery, AL 36193. Your local Extension agent can also assist in contacting your county's plant industry inspector, who will inspect your crops and provide additional information.

Keeping Good Records

Unfortunately, record keeping is an area of business that many new, small business managers neglect. However, keeping good records is a simple task and in the long run can save time and money. A computer can make the task of record keeping easier. Some records you will want to keep are the following:

Business records. Keep record of cash flow, inventory, income statements, and balance sheets. Any general accounting records can be kept on a computer and will be available to assist in planning for growth of the business.

Employee records. A record of hiring dates, hours worked, rewards, and reprimands needs to be kept. Tracking hours worked by employees can help in planning for seasonal needs and in seeing where the greatest labor needs are.

Crop scheduling. It is useful to record fertilizer applications on crops, planting dates, finishing dates, and other cultural practices for planning future production and as a cultural reference. Legally, you must keep a record of pesticide spray dates, rates, and chemicals used.

Customer records. Keep a record of names, addresses, and telephone numbers to contact past customers directly. Their payment record can also be useful.

Financial Resources: Funding the Dream

One of the most important considerations for your business is how it will be funded. The following list consists of some of the costs encountered when starting a greenhouse business: property cost, taxes, material costs, contractor fees, labor or employee costs, utilities and hookup fees, grading and surveyor fees, permits and licenses, consultant fees, lawyer and accountant fees, loan interest, inventory and supplies cost, your salary, employee benefit fees, insurance fees, and engineer and architect fees. Table 1 lists many of the facilities and costs for a small, wholesale greenhouse operation. Also include a cash reserve fund in the budget. The reserve should contain enough money to operate the business for, at the very least, 6 months, until you show a profit. An emergency fund of 15 percent of the budget should be part of the budget to be used for unexpected expenses.

Now that you have figured out how much money you need, where are you going to get it? The first place to go is your savings. Most banks won't lend money if you don't have some of your own invested. Consider relatives or friends after checking your own bank balance. You may get the capital to start from someone who shares your vision.

Table 1. Capital Greenhouse Facility Costs

Five 24' x 96' greenhouses (Total 11,520 sq.ft.) (Foundation and structure at \$3.25 per sq.ft.)	\$37,440
Double layer, 6 mil plastic (At \$.35 per sq.ft.)	\$6,125
Environmental control systems (Heating, cooling, ventilating, and utilities hook-up at \$3.65 per sq.ft.)	\$42,048
Fuel tank	\$550
Stationary benches over 75% of production area (At \$.45 per sq.ft.)	\$5,184
Land, including site preparation (3 acres at \$5,000 per acre)	\$15,000
Office and work building, 2,000 sq.ft. (At \$16 per sq.ft.)	\$32,000
Office supplies	\$2,700
Lunchroom	\$800
Pesticide storage	\$700
Outside materials storage and work area (30' x 45' at \$2.50 per sq.ft.)	\$3,375
Parking and drive	\$6,000
Step-van truck with racks	\$24,500
Electric back-up generator	\$1,175
Emergency heaters	\$650
Carts	\$1,800
Fertilizer equipment	\$2,500
Pesticide sprayer	\$2,400
Flat and pot handling equipment	\$14,500
Misc. tools and equipment	\$3,500
Total investment	\$202,947

The next place to consider would be the Small Business Administration (SBA). While the application process may be lengthy, the interest rates may be less than banks. Also, it may be easier to qualify for an SBA loan than to qualify for a bank loan. SBA often offers two types of loans:

1. Guaranteed loan—through the bank, guaranteed by the SBA up to \$500,000.
2. Direct loan—directly from the SBA, limited to \$150,000 with fixed interest rate.

Your bank would be another place to seek funds. The best time to get acquainted with your banker is before you need to borrow money. Your banker will request a business plan that includes your ideas and plans for growth of the business.

Writing Your Business Plan

Now that you have considered many factors in starting a greenhouse business, you are ready to put together a business plan. The business plan includes (1) a mission statement, (2) objectives, (3) organizational plan, (4) personnel plan, (5) plant production plan, and (6) financial plan.

The mission statement is simply your reason for being in business. While you may consider yourself in business to produce plants, think of the business

more in terms of your customers. Someone in the custom tailoring business might have a mission statement that reads: "We help you look your best." Some examples of mission statements for a greenhouse business are the following:

"To help you create the garden you have in mind."

"To make my community a more beautiful place to work and play."

"To create an atmosphere of beauty and comfort in my hometown."

The mission statement should be brief, only one sentence and should show your employees and your customers what the overall objective is for your business.

The next step in the business plan is to write objectives and goals. The goals are where you want the business to be at a certain future date. Make goals for the short term (less than 1 year), for the intermediate term (1 to 5 years), and for the long term (6 to 10 years). Goals need to be specific and measurable. If you cannot tell if you have met your goals, it is just a wish. For example, a short-term goal might be to have \$10,000 in sales the first year in operation. The goal is constructed for the short term (first year of operation) and is specific enough to be measured (\$10,000 in sales). Goals should relate to the four planning areas: organization, personnel, plant production, and finances.

The organizational plan is the next component of a business plan. Identify the way in which the business will be organized and how you plan to make additions. It may be as simple as one person: you are the owner, sole proprietor, manager, and no one else works for you yet. It can be as complex as who reports to whom in a business that employs 100 individuals. Outline the chain of command from who will answer the telephone if others in the chain are busy, to who will check the greenhouse during cold nights.

The personnel plan is another facet of the business plan. This includes how many people you plan to hire and what types of skills you will need to make the business operate smoothly. Consider how many people will be needed during busy times and how much you can afford to pay them. Short-term, intermediate-term, and long-term personnel objectives should be put to work in this part of the plan.

The plant production plan may be the easiest component of the business plan to create. Production schedules should appear in this part of the business plan. For example, determine how many crops of bedding plants to grow in the spring, what types of seeds and supplies to order

and when, and when the crops will be scheduled to finish. You may want to track crops by the week and determine how many weeks the crop will be in a specific area.

The financial plan is the most difficult for many people wanting to start a greenhouse business. The financial plan consists of a pro forma income statement (Table 2), a pro forma balance sheet (Table 3), and a cash flow budget. Pro forma means that it is created before any income is made or any assets are purchased. Your accountant can help you make these documents. Make a financial plan for at least the first year of operation, and it would be beneficial to make a plan for the first 5 years of operation. The income statement shows how much money you expect to earn in business, the costs of producing plants, and the costs of operating the business. The balance sheet shows the assets and liabilities of the business and the amount of equity you, as the owner, have invested in the business. The cash flow budget shows how much cash you will need each month to pay your bills. The business plan is a great way for you to see the business on paper before you invest much money. Your banker will require it and many other types of investors may want to see one as well.

Table 2. Income Statement (Pro Forma) January 1, 20xx through December 31, 20xx

Gross Sales	\$75,000
Returns and Losses	(\$2,000)
Net Sales	\$72,500
Cost of Goods Sold (Plants, containers, etc.)	(\$41,250)
Fixed Expenses	
Salary and Wages	\$11,250
Utilities	\$7,500
Advertising and promotion	\$2,250
Other operating expenses	\$7,000
Subtotal fixed expenses	(\$28,000)
Gross Profit Before Taxes	\$3,250
Taxes	(\$1,875)
Net Profit After Taxes	\$1,375

Table 3. Balance Sheet (Pro Forma) Year Ending December 31, 20xx

Current Assets		Current Liabilities	
Cash	\$3,000	Notes Payable	\$10,000
Accounts Receivable	\$5,000	Accounts Payable	\$3,000
Inventory	\$8,000	Taxes Payable	\$2,500
Total Current Assets	\$ 16,000	Total Current Liabilities	\$15,500
Fixed Assets		Long-Term Liabilities	
Equipment	\$20,000	Bank Loan	\$15,000
Vehicles	\$15,000	Total Long Term Liabilities	\$15,000
Office Equipment	\$7,500	Total Liabilities	\$30,500
Total Fixed Assets	\$ 42,500	Owner's Equity	\$28,000
Total Assets	\$58,500		

Resource Materials

While this publication provides a lot of food for thought, you should read other materials. For more specific information, the following publications may be helpful in starting a greenhouse business:

Greenhouse Construction

R.A. Aldrich and J.W. Bartol, Jr. 1994.
Greenhouse engineering.

Northeast regional agricultural engineering service. Ithaca, NY. NRAES-33.

Greenhouse Production and Management

James W. Boodley. 1998. The commercial greenhouse. 2nd ed. Delmar Publishing, Albany, NY. ISBN: 0-8273-7311-2.

John M. Dole and Harold F. Wilkins. 1999. Floriculture: Principles and species. Prentice-Hall, Inc., Englewood Cliffs, NJ. ISBN: 0-13-374703-4.

Paul V. Nelson. 1998. Greenhouse operations and management. 5th ed. Prentice-Hall Inc., Englewood Cliffs, NJ. ISBN: 0-13-374687-9.

Vic Ball. 1998. Ball RedBook. 16th ed. Ball Publishing, Batavia, Illinois 60510. ISBN: 1-883052-15-7.



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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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