MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

Fact Sheet

Fact Sheet 593

Starting in the Greenhouse Business

Horticultural plant production is the fastest growing sector of the agricultural industry in Maryland. Greenhouse production, as part of this horticultural industry, is one of the most highly specialized and intensive forms of agriculture. Capital expenditures for greenhouse structures and plant material can be considerable. Unlike field or row crop agriculture, where production area is based on acres, greenhouse costs are calculated on a per square foot of growing area or per plant basis. Greenhouse growers/managers deal with smaller but higher value production units with little room for error. A person considering entering into greenhouse production must have a basic knowledge of propagation, plant nutrition, soil management, greenhouse structures, pest management, environmental control systems, business management, marketing, and employee relations. Greenhouse operations often start as a single unit operated by an individual family. With modest sized operations, experienced people can be the grower, manager, marketing expert, and repair person while larger operations usually require a staff of full-time and part-time people.

LABOR FORCE

The greenhouse business is labor intensive. Obtaining experienced labor can at times prove troublesome. Innovative Maryland greenhouse growers use various approaches to attract skilled employees, such as allowing workers to create their own shedules, and hiring retired or disabled people.

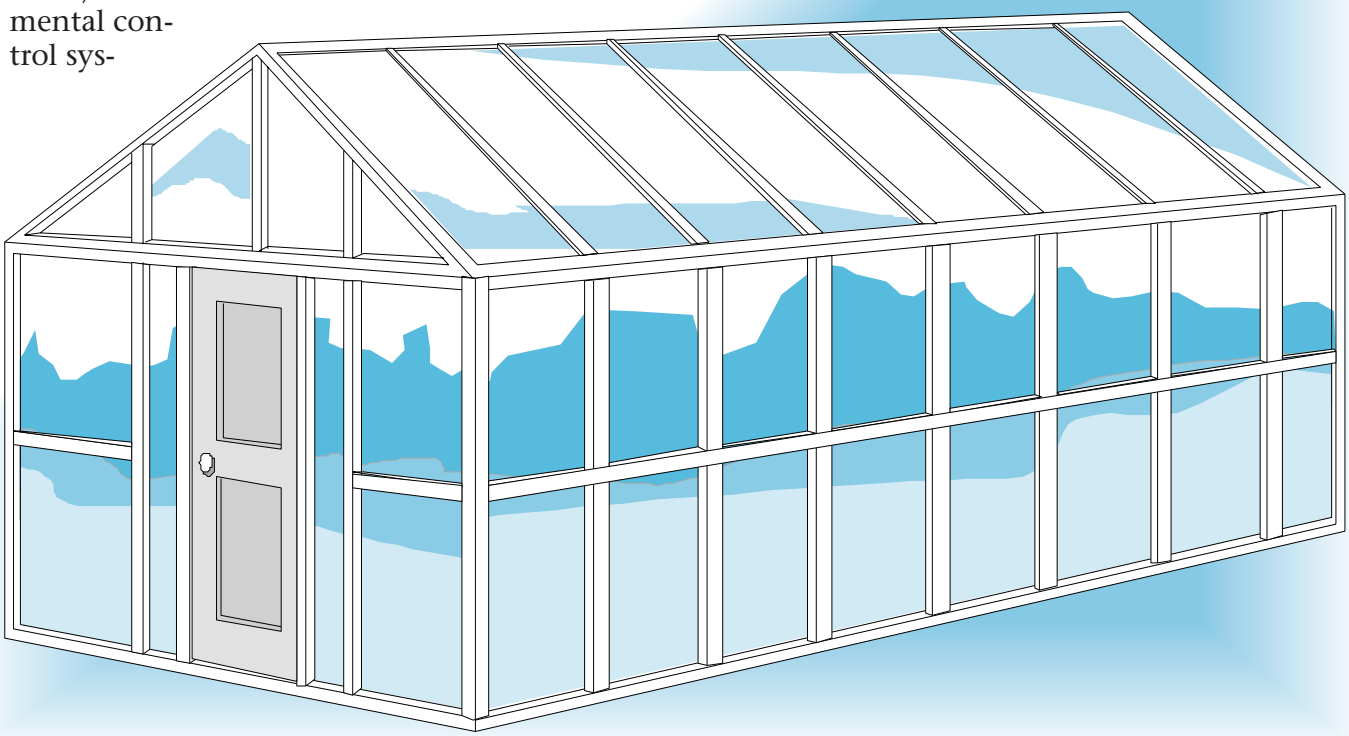

Table 1. Availability of typical greenhouse crops

Month	Crops produced
January	spring bulbs, azalea, primula, cineraria, calceolaria, cyclamen
February	roses, spring bulbs, oxalis, cineraria, calceolaria, primula, cyclamen, azalea, lilies
March	hydrangea, kalanchoe, cineraria, calceolaria, primula, cyclamen, azalea, lilies, bedding plants
April	spring bulbs, azalea, lilies, gloxinia, heimalis begonia, bedding plants, flowering baskets
May	hydrangea, azalea, kalanchoe, lilies, gloxinia, potted roses, late flowering bulbs, geranium, new ~guinea impatiens, bedding plants, flowering baskets
June	gloxinia, heimalis begonia, foliage, hibiscus, gerbera, potted bedding plants
July	gerbera, gloxinia, streptocarpus, heimalis begonia
August	hibiscus, azalea, heimalis begonia, foliage plants, field chrysanthemum
September	foliage plants, gloxinia, azalea, hibiscus, ornamental pepper, field chrysanthemum
October	hibiscus, foliage, flowering cabbage, flowering kale, cyclamen
November	poinsettia, cyclamen, Christmas cactus
December	poinsettia, Christmas cactus, cyclamen, heimalis begonia

Table 2.Seasonal plant material produced for specific holidays

Occasion/season	Preferred type*	Plant material
Valentine's Day	anything red,	cut roses, potted tulips, azalea, cyclamen
Easter	potted	spring bulbs, Easter lily, hydrangea, chrysanthemum, azalea
Secretary's Day	both	cineraria, spring bulbs, potted chrysanthemum, cineraria, ~primula
Mother's Day	both	roses, hydrangea, spring bulbs, azalea, potted chrysanthemum, gloxinia, African-violet, early bedding plants, fuchsia
Memorial Day	potted	geranium
September	potted	foliage plants
Thanksgiving	cut	chrysanthemum
Christmas	potted	poinsettia, cyclamen, Christmas cactus

The holidays are denoted as either `cut' or `potted' based on whether cut flowers or potted plants are the primary products sold.

Labor reducing equipment such as automated irrigation equipment, computer controlled heating/cooling systems, automatic seeders, and potting machines can reduce labor requirements. While requiring considerable initial capital outlay, these devices enable growers to increase productivity with fewer but better, well-trained permanent employees.

WHAT TO GROW

Determine the market potential for a crop before you grow it! The decision of which crops you grow is principally a function of where you are selling the product. If you are selling wholesale, you might consider producing cell-pack bedding plants and/or seasonal pot plants. If you are selling retail in urban markets there may be a stronger market for larger bedding plants and a wide selection of flowering plants. Fall sales of large, mum plants in 3-gallon sized containers may appeal to individuals who want 'instant landscapes'. Visit florists and garden centers in your area and in other states to learn which crops have high market potential. Local landscapers and professional gardeners can provide insight into the newest crops. Greenhouse specialists with Maryland Cooperative Extension can indicate plant materials that provide high gross returns.

The majority of Maryland greenhouse operators produce potted and bedding plants. Although cut flower consumption in Maryland is very high, only a few growers produce cut flowers. Although the products and types of operations discussed in this fact sheet focus on potted and bedding plant production, the information presented holds true for cut flowers as well.

The production of greenhouse crops is best discussed in terms of the marketing channels which various growers use to sell their crops. The market channels are wholesale, retail, and specialty growing.

Wholesale Grower. (Wholesale operations produce plants for resale by florists or garden centers. These growers normally produce a diverse group of plant material that fulfills the needs of their clients.) A wholesale grower will produce plants either for daily sales or seasonal holiday sales, or some combination of both.

a. Wholesale-Daily Sales. For successful daily sales, growers produce at least five different crops at the same time. This group of five crops will include different species and colors (cultivars) to provide up to fifteen different items for sale. In addition to the blooming material, the grower may have foliage plants that were likely purchased from Florida for resale.

Some of the more popular items produced by growers are found in Table 1. Many of the plants produced by seasonal growers are also grown by year-round producers, who will grow a very limited number of plants for sale at any one time.

b. Wholesale-Seasonal Sales. A seasonal grower will normally produce one or more of the crops listed in Table 2. Growers will usually sell directly to one or more major accounts. To increase the number of offerings at different prices, growers will produce a selection of different varieties at different sizes. For example, a grower will grow white, pink and red poinsettias in sizes ranging from one bloom per 4-inch pot up to 25 blooms in an 8-inch pot. Growers can produce poinsettias to be ready for sale over wide marketing times, starting as early as November 15.

Although a variety of cut flowers and potted plants are sold at most holidays, many holidays have a traditional type of plant material associated with the holiday. The type of holiday is denoted 'cut' if the plant material grown is primarily cut flowers and 'potted' if the holiday is primarily a potted plant holiday.

Retail Grower. Retail growers will produce crops that they will sell through their retail operation. The retail grower may also produce a limited number of the crops that a wholesale-daily sales operation produces. The exact product mix depends on the retail outlet. A retail grower with a garden center will produce crops for sale from mid-March through October. In contrast, retail florists have crops for sale year-round with the majority of the production between January and June.

To increase the number of crops that can be grown in a single year and decrease the amount of time the crop is in the greenhouse, retail growers often purchase "pre-fin-

ished" crops that they can grow on to flower. For example, "pre-finished" poinsettias are received in the first week of October then grown on for 10 weeks to flower. A traditional wholesale grower would have the same crop in their greenhouse for 17 plus weeks. Another strategy is to produce crops that are not available from wholesalers during peak market periods. During the spring, garden center operators may have trouble purchasing high quality flowering baskets, geraniums, impatiens, and begonias. Some retail growers produce those crops that are in short supply, purchasing the remainder of the products they need from local suppliers.

Specialty/Custom Grower. Specialty growers produce crops under exclusive contract for one or more customers. For example, bedding plants that are grown for landscapers may consist of specific cultivars based on the landscaper's needs. Landscapers require larger sized plants that quickly fill a planting area with flowers in full color. Landscapers may replant a given area three or more times a year with seasonal plants. Constant replacement of damaged plants by landscapers requires the contract grower to have replacement plants on hand at all times.

To provide for replacement plants, contract growers must plant continuously between April through October. The initial planting will be in 3-inch pots with the size of the plant increasing throughout the season until late summer when only 6-inch pots are in production. Contract growing is a volatile market. Prompt servicing of the landscapers needs is the cornerstone of the successful business relationship. It is not uncommon for a grower to discard large portions of a crop during the season because markets did not materialize.

Vegetable transplant producers are another type of contract grower. The producers grow one crop and then shut down the greenhouse for the rest of the season. The grower will produce specific varieties based on the requirements of the farmers who have placed orders. The seed is sown based on an anticipated date of planting into the field. Many transplant growers produce one additional crop of bedding plants to better utilize their greenhouse.

SPECIALIZE OR GENERALIZE IN PRODUCTION

The type of operation that a grower undertakes is dependent on two main factors. The first is the growers interest in retailing. Many growers are not interested in dealing with consumers on a daily basis. The second factor that dictates whether the operation involves retailing is zoning restrictions. Many growers are prohibited from conducting full service retail operations on their property because of zoning restrictions. Check with the appropriate county zoning officers before you begin retail sales. If there is a strong landscape industry nearby, then contract growing holds some possibilities. If there are a number of local florists and garden centers that need products, then a wholesale growing operation should be investigated. By specializing, growers improve their capability to efficiently produce top quality crops. When growers are able to reduce costs and improve quality through specialization, they are more competitive with plant material imported from outside the region. A common error new growers make is trying to diversify when they are still too small to service any one market. When a small grower devotes a major portion of their production area to one crop, they are able to improve their production program and gain name recognition in the market place. The best advice is to first determine your options and then decide which options will become profitable the most rapidly.

SITE SELECTION FOR A GREENHOUSE OPERATION

Site location of a greenhouse operation is critical to future profitability. Before deciding where to locate your greenhouse and how to lay out and orient the greenhouses, several questions must be answered. You must define how and where you will market your crop; the type of operation, and the nature of the sales area in order to determine what type of location is most suitable.

A retail operation should be located on well-traveled roads, near major highways, or within a driving distance of 20 minutes or less of consumers. The advantage of proximity to your customers is increased customer traffic. A major problem is that land cost and

zoning in and near most cities in Maryland often precludes establishment of wholesale operations.

A wholesale greenhouse should be located where zoning restrictions will not limit future expansion of the operation. In many Maryland counties, wholesale production of greenhouse crops is considered an agricultural operation. You need to check with local county governments to determine restrictions that apply to your operation.

Growers should determine the specific licensing or permitting required to run a greenhouse building. To apply restricted use pesticides al pesticide applicators must be certified users. Retail operators are required to have sales tax collection permits. Your local extension educator should be able to direct you to the appropriate departments that deal with these permits and licenses.

After you have considered market potential, customer base and the county you wish to locate in, you are ready to look at site characteristics or requirements. There are seven major factors to consider before deciding on a location for the greenhouse operation:

1) Water Supply and Quality. You will need up to 6 acre-feet of water per acre of greenhouse per year from such sources as wells, ponds or city utilities. Some greenhouse growers have used low yielding wells by pumping water into holding tanks or ponds, and then pumping from these large reservoirs at high demand times. Not all potable water is suitable for irrigation purposes. Prior to using any water, have the water tested by a commercial water testing lab that has experience with greenhouse water requirements. State and local health department water tests will not alert you to excessive sodium, iron or pH problems, which should be adjusted prior to using for irrigating plants. Pond water should be chlorinated at the time of use to kill root rot organisms.

2) Labor Force. Readily available labor force and support services need to be nearby (within 20 minutes). When determining labor supply investigate the competition for both skilled and unskilled seasonal help. Most greenhouses have peak labor requirements from February to June.

3) Greenhouse Orientation. An area that is free from shadows cast from buildings or trees is a must in determining where to site the greenhouse. Note winter shadows and summer locations of deciduous trees. Also consider location of future expansion of greenhouses and support areas. Whenever possible, freestanding houses should be constructed with the length running east and west. Greenhouses that are connected together should be constructed north to south to provide even light coverage within the houses throughout the day.

4) Percent Slope. Slopes should be less than 5 percent for areas where greenhouse structures will be located. This will facilitate moving carts of plants around the complex.

5) Roadways. Adequate roadways and bridges are essential to permit access to trucks that deliver supplies and pick up finished plants from your greenhouse. Retail operations should separate customer and service entrances and provide adequate parking.

6) Physical Conditions. Avoid locating greenhouse operations in a flood plain, on a hilltop where heating bills will be high, or in a frost-pocket area. Locating the greenhouse near parking areas with night lighting will limit the types of crops you can grow.

7) Prevailing Winds. You may wish to plant a windbreak of trees to cut down northern and western winds, but locate the windbreak far enough away to prevent shading.

COST OF BUILDING A GREENHOUSE

Greenhouse designs vary, with the principal decision facing growers being the choice of greenhouse covering. Traditionally, greenhouses were glass covered. The majority of greenhouses in Maryland are now covered with two layers of polyethylene. An increasing number of growers are currently turning to structured sheets of acrylic or polycarbonate plastic that are more rigid and durable than polyethylene. These two-layered structural sheets provide excellent light transmission with good heat retention.

Maryland growers normally do not install fiberglass glazing. The use of fiberglass coverings is confined primarily to the southwest United States, because of the need to diffuse

that region's high light intensity and protect against hail. In Maryland, the two principal types of greenhouse coverings are the air-inflated, double-layer polyethylene covered, quonset-styled greenhouse (polyhouse) and the traditional glass greenhouse (glasshouse). There are advantages and disadvantages to both types.

The principal advantage to the polyhouse is that it is initially significantly less expensive to install. For this reason it is often the choice of those entering the greenhouse industry for the first time. Another advantage of the polyhouse is that with two layers of polyethylene it is less expensive to heat than a glasshouse.

The principal advantages of the glasshouse are the high level of light transmitted through the glass and its long life with little or no need for reglazing. The permanency or rigidity of a glasshouse provides excellent crop protection in adverse weather. For instance, with extremely wet snow a polyhouse may collapse if not adequately designed for the snow load, destroying the entire crop. Under similar conditions, a properly designed glasshouse could lose some panes but would not collapse. A key concern for all greenhouse operators is correct engineering for the location. A greenhouse designed for warmer climates may not stand up to Maryland weather, while a northern engineered house may be overbuilt for our climate.

Table 3 shows the estimated cost of constructing a 28 foot by 95 foot double-layered polyhouse (2,660 sq. ft.). The design provides 1,700 square feet of bench space with utilization of 64 percent of the covered area. Completely installed in 1990, the cost of this greenhouse with benches would be $20,120 or $7.56 per square feet of total ground space.

Although many growers start with one greenhouse, to be economically viable a grower needs to have more than 10,000 square feet of greenhouse space.

A grower can modify the costs of constructing the polyhouse presented in Table 3 by personally erecting the greenhouse, substituting polyethylene for clear plastic in the end gables; connecting to an existing water supply; and eliminating benches, cooling pads, and power vents for summer production. This stripped-down greenhouse would cost $3.24 per square foot, a reduction of 57 percent. The prices in this example are only estimates and an individual grower may find suitable used material or price reductions from dealers to further reduce the cost of construction.

Frame: The principal consideration in selecting the frame is to determine the load-bearing requirement of the frame. Each manufacturer will specify the appropriate bow spacing depending on the strength of the tubing. With a given tube strength, the closer the bow spacing, the greater the strength of the structure, and the expense.

Top Covering: The polyethylene used in this example has a three-year service life. To provide maximum energy savings, the two layers must be kept separated through the use of an air blower. Polythylene covering materials are rated with 1-, 2- or 3-year service life. Special additives can be incorporated into the plastic to reduce heat loss. Growers will normally use a combination of 4- and 6-mil plastic to cover the roof.

End Walls: This example utilizes polycarbonate structural sheets and aluminum doors for the end gables. These materials provide more protection against wind and air infiltration and provide better insulation of the house. However, single polyethylene can be substituted for the polycarbonate, and plywood doors can be constructed for approximately $250. This design change could reduce the total cost per square foo. of the house by $0.67.

Cooling, Ventilation, and Heating Systems: Exhaust fans are needed to exchange inside and outside air and to equalize temperatures within the house. If the house is not used for summer production, the power vent and cooling pad could be eliminated. A motorized inlet vent would then be needed, costing approximately $195. This design change would reduce the total cost per square foot of the house by $0.77.

Floor: In this example, heavy plastic was spread on the floor to provide a weed barrier. Gravel was laid on the plastic in the aisles. Depending on intensity of use and availabili-

Table 3. Approximate cost of constructing a 28-foot by 95-foot double-layered polyethylene, quonset-styled greenhouse (2,660 ft²) in 1990

	Cost	Cost per square foot ($/ft²*)
Frame		
Frame bows with 5-foot spacing †	2.320	0.87
Glazing		
Two layers of 6 mil polyethylene (3-year life)	515	0.19
Inflation equipment	65	0.02
Attachment apparatus	360	0.14
End Walls		
Polycarbonate sheet and frame (10-year life)	1,665	0.63
One welded aluminum front door (4 ft by 8 ft)	190	0.07
One welded aluminum back door (3 ft by 7 ft)	175	0.07
Assembly and installation @ $1.35/ft2	3,590	1.35
Heating system		
Gas unit heater (225,000 btu)	665	0.25
Assorted heat equipment	130	0.05
Control panel (1-stage heating/3-stage cooling)	410	0.15
Floor		
Grading=mminimal slope	300	0.11
Perimeter base=mTreated 2-inch by 6-inch lumber	120	0.05
Plastic for ground cover (3 oz/ft²)	180	0.07
Gravel, 3/4-inch, 13 tons, delivery extra	145	0.05
Power and utility sources		
Well (15 gal/min)	2,500	0.94
Basic irrigation hookups	200	0.08
Electrical service	450	0.17
Liquid propane gas tank, 500 gal, hookup	200	0.08
Benches (labor excluded)		
Coated wire=m14 gauge, 1-inch grid	1,090	0.41
Treated lumber frame, 2-inch by 4-inch	575	0.22
Cinder block legs	185	0.07
Cooling and ventilation system		
Two-speed, 3/4 hp, 42-inch fan	670	0.25
One speed, 3/4 hp, 42-inch fan	665	0.25
Four horizontal air flow fans	375	0.14
Assorted fan and vent equipment	145	0.05
Power vent (5 ft by 15 ft)	935	0.35
Cooling pad (5 ft by 15 ft)	1,300	0.49
Total:	20,120	7.56

* Cost per square foot is stated in terms of ground space, not bench space.
† This is only an example. Each installation will vary depending on location and components.

ty of capital, growers utilize a range of floor choices between bare ground and concrete.

Power and Utility Sources, Installation: Well-drilling costs will depend on the flow rate desired and the depth of the well. A local well driller has experience on expected flow rates and well depths in your area. Table 3 estimates the cost of a pressure tank and pressure switch for irrigation. Many gas companies provide the above-ground liquid propane storage tank at no charge; however, the customer must pay for the hookup. With previous construction experience, some growers could be able to build the polyhouse themselves.

Benches: Plants can be grown on the ground, although accurate temperature control is difficult to achieve. There are a variety of bench styles available. This example uses a wooden frame and wire mesh base bench as a relatively low cost alternative. In this example there are four rows of benches running the length of the house stopping four feet short of the end gable. Two 4-foot wide benches are placed close to the side. In the middle, there are two 6-foot wide benches. The middle aisle is 4 feet wide and the two side aisles are 2 feet wide. The benches sit freely on two 16-inch cinder blocks and a 16-inch length of wood (2 x 4 in.). The bottom cinder block lies flat on the floor, the second block sits upright on the bottom block, and the wood lies flat across the top block upon which the bench rests. These legs are placed 4 feet on center along each edge of a bench.

Summary

This fact sheet describes the resources needed to successfully start a greenhouse business. Growers must first assess the market for their products, and decide which crops are best suited for the market selected. Once the type of operation is selected, then the appropriate location can be selected. Finally the type of greenhouse structure can be determined depending on the grower's requirements and available capital.

Reference Information

For additional information, consult the following publications:

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STARTING IN THE GREENHOUSE BUSINESS

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