

Layout and Design Considerations for a Wholesale Container Nursery ¹

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Many commercial nurseries begin as small backyard operations, with little thought given to initial or future layout design. Nursery managers are often anxious to realize a rapid return on their investment, and overlook the need for thorough nursery layout planning. Nursery managers may be apprehensive about nursery expansion or may not have a clear perspective of nursery crop production systems. Consequently, an inefficient, haphazard layout design may result which requires a costly change later.

This publication provides the framework for planning and implementing efficient nursery layouts. Visits to nurseries with similar production systems will be valuable, and discussions with other managers about how they would change their production systems will usually give insight to an effective layout. A slight modification in the proposed design may increase the flexibility for future expansion and increase time and motion efficiency.

A nursery operation encompasses many different phases and components of production. Proper timing of operations is essential, and efficient use of land and resources is important. Layout design must be

efficient if the nursery is to be productive and compete in today's market. Facilities or activity areas will vary with the type of nursery and specific production scheme employed. For example, a nursery may produce small plants or liners that only require greenhouse space. Other nurseries may purchase liners so propagation areas are not needed. The first requirement in planning is to determine the activities that are proposed in the nursery, and the space needed for each immediately, and as the nursery expands. Make a scaled drawing (Figure 1) to ensure that required areas or facilities are well planned and integrated so that nursery activities or operations progress efficiently (Figure 2). Appropriate judgement of distance and arrangement of areas can be achieved when every element is seen on the same scale. Scales of 1 inch equals 50 to 200 ft are common, but the dimension of the property and the available drawing supplies and equipment may dictate other scales.

An efficient arrangement of the 8 areas that should be considered for a container nursery is seen in Figure 1 . These activity areas must be arranged efficiently, considering constraints such as land form,

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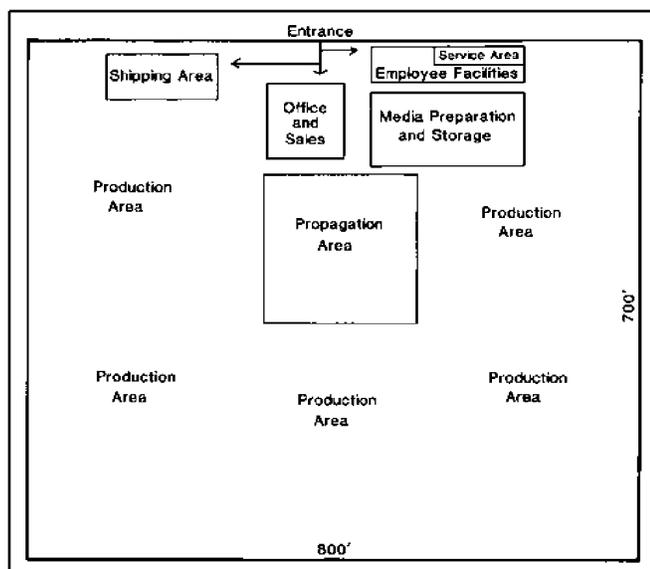


Figure 1.

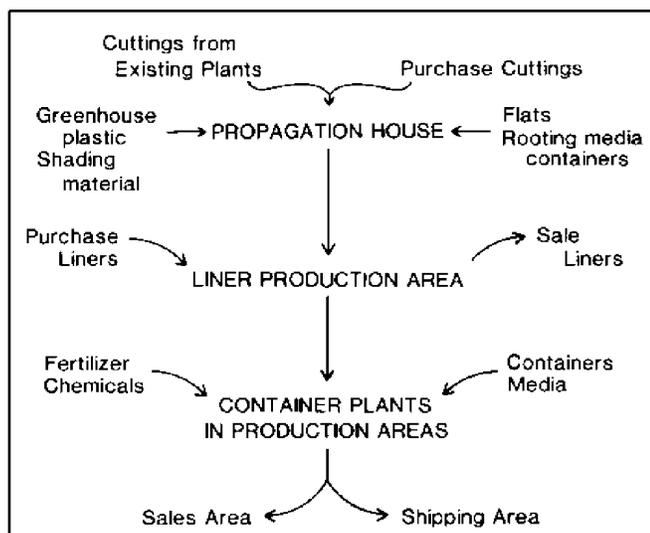


Figure 2.

slope, and natural barriers. The container nursery layout in Figure 1 is adaptable to most land shapes, the exception being very narrow tracts. The layout for narrow land tracts (Figure 3)

requires more time to transport employees to work sites, and plants must be transported greater distances, either to and from potting areas or to shipping areas. Labor costs are 25% to 35% of total production costs for the average nursery, and 60% of labor is moving materials. Efficiency can also be improved by planning travel routes. One way to evaluate equipment and personnel movement is to plot the routes on a scaled drawing of the nursery

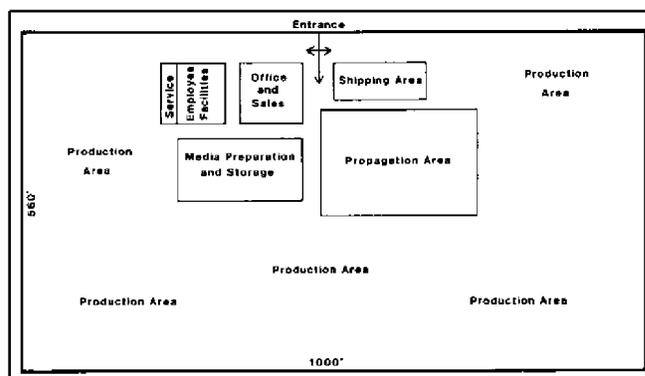


Figure 3.

layout so comparisons of alternative routes can be made. Cost of travel time is of more concern for nursery operations located on non-adjoining land. In this case, some reduction in travel time can be achieved by strategically locating shipping and potting areas near production areas.

Nursery Entrance

The organization and appearance of a nursery gives visitors and customers an impression of the operation that directly influences sales. The nursery entrance provides the first and most important opportunity to present a good image. The entrance should be accessible to the nursery office and shipping areas, and be landscaped with an attractive, uncluttered arrangement of plants including those sold by the nursery. The entrance planting should contain any special plant materials offered by the nursery, or plant materials that need to be introduced or emphasized.

Nursery Office and Sales Area

The nursery office should be clearly identified and located close to the nursery entrance (Figure 1). Customer parking for cars must be provided, and receiving trucks should be directed to the loading areas by signs so drivers can proceed without delays. A sales area, located close to the office and containing a representative display of salable plant materials, enables customers to view salable plant material without traveling through the nursery. This saves time for customers and sales personnel.

Propagation Area

The propagation area is the heart of the nursery operation and must be located in an area accessible to the production and potting areas. A propagation area located close to the office helps in communication between the office staff and the propagation managers who must make long-range decisions regarding the number of specific plants to be produced. Propagation area size and design are determined by production type, number of plants and species produced, and markets.

The propagation area may contain greenhouse structure designs from A-frame steel and fiberglass to quonset PVC or galvanized pipe and polyethylene. Steel frame, gutter-connected, or ridge-and furrow type greenhouses usually cover more than 1000 sq ft. Conduit or PVC greenhouses usually cover less than 1000 sq ft and cost considerably less than steel frame or ridge-and furrow-type houses. Plant species that require different rooting environments may be segregated using smaller greenhouses. However, several small greenhouses will require more land than 1 or 2 larger houses of equivalent square footage, and this should be considered if less than ample land is available for the propagation area and facilities.

Certain plant species, such as junipers, may be propagated outdoors in small containers or raised ground beds and will not require special propagation structures (Figure 4). Because of repeated mist cycles or frequent watering, this area must be located on well-drained soil. Seeds may also be germinated in outdoor beds, although structures built to accommodate tiers or racks of seed germinating flats will use space more efficiently (Figure 5). Outdoor propagation has the disadvantage of lacking water control. Heavy rains may occur and pack the rooting media, destroying aeration and contributing to soil-borne diseases.

The amount of land available for propagation may determine if plant stock blocks are maintained to supply cuttings. Stock blocks are generally 20% to 25% the size of container production areas and should be located close to the propagation area. Limited land availability requires taking cuttings from salable nursery plants and eliminating stock blocks. Cutting

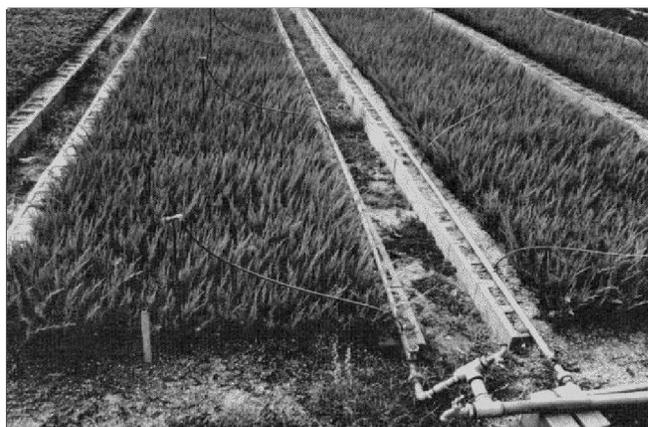


Figure 4.



Figure 5.

preparation areas may be included in the propagation area of the layout. A protective structure allows for cutting preparation during inclement weather (Figure 6) and will be an advantage for the nursery producing large numbers of junipers propagated during the winter. A nursery producing primarily broadleaf evergreens, propagated during the summer, may choose to exclude a cutting preparation area from the layout and require that cuttings be prepared for sticking when cut from the plant.

Media Preparation and Storage

Media mixing and potting may be accomplished at one central location where potting media or media components are stored in bulk quantities. Potting media or components are stored either in loose piles or in open bins often constructed of concrete. Media components are usually mixed by commercially available soil mixers, manure spreaders, or front-end loaders that scoop and dump the media several times on a concrete slab. A reinforced, raised slab, 4 inches thick and 3 x 5 yards (2.7 x 4.6 m) will accommodate



Figure 6.

approximately 3 yd³ (2.3 m³) of media. The raised concrete slab prevents incorporation of field soil into the media during mixing, and eliminates contamination from diseases, weed seeds, and nematodes transported by runoff water.

Motorized media mixing and transporting systems, and potting machines should be covered by a structure that houses a permanent potting area for the nursery. The permanent potting area may or may not be sheltered if commercial soil mixers and potting machines are not used, but in this case nurseries usually erect a permanent V-shaped hopper from which media falls onto a potting bench. Advantages and disadvantages of potting machines will depend on the particular operation; however, most nursery operators agree that potting machines pace the workers.

Locating the media mixing area and the potting area adjacent to each other minimizes media handling. A very large nursery may have soil mixing and pottings areas located throughout the nursery. This reduces the distance traveled when placing newly potted plants in the field.

Production Areas

Production or plant growing areas will occupy the largest percentage of nursery land and should be adjacent to the potting area to ease the orderly movement and placement of plants in the field. A small part of the production area may be used for evaluating new plant materials with market potential.

Transporting container plants efficiently to and from the field requires a well-designed road system. Roads should be crowned or sloped to one side and surfaced with gravel, seashells, or other materials to support equipment during wet periods. Firm road surfaces also prevent traffic from splashing mud and debris on plants.

Number and size of production areas, roads, and walkways may vary depending upon equipment used and type of production. Road widths will depend on the equipment, but when farm tractors and trailers are used, the perimeter roads should be about 30 ft (9.1 m) wide to allow for turns from the narrower roads between plant beds.

The production area designs in Figure 7, Figure 8, and Figure 9 have walkways that are 2 ft (0.6 m) wide and plant beds that are 8 ft (2.4 m) wide. The designs contain the same amount of area in which to place plants; however, the walkways and length of beds are 50% less for the design in Figure 8 than those in Figure 7, and 50% less for the design in Figure 9 than in Figure 8. The maximum distance a plant must be carried is 100 ft (30.5 m), 50 ft (15.2 m) and 25 ft (7.6 m) for designs in

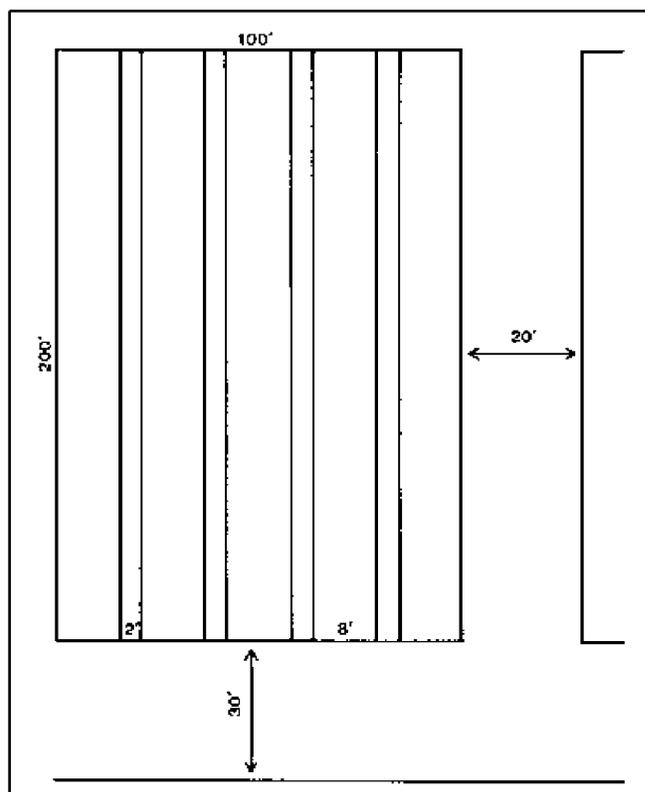


Figure 7.

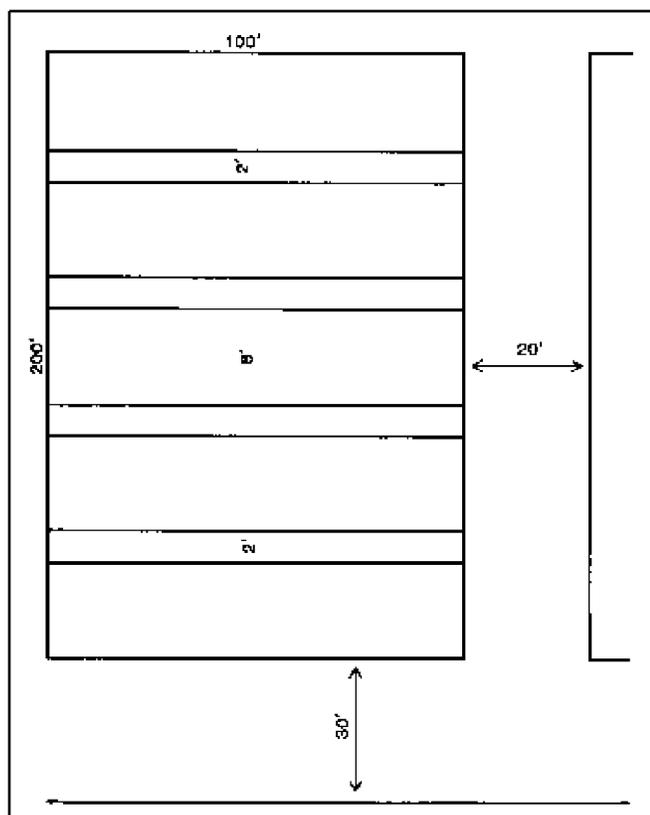


Figure 8.

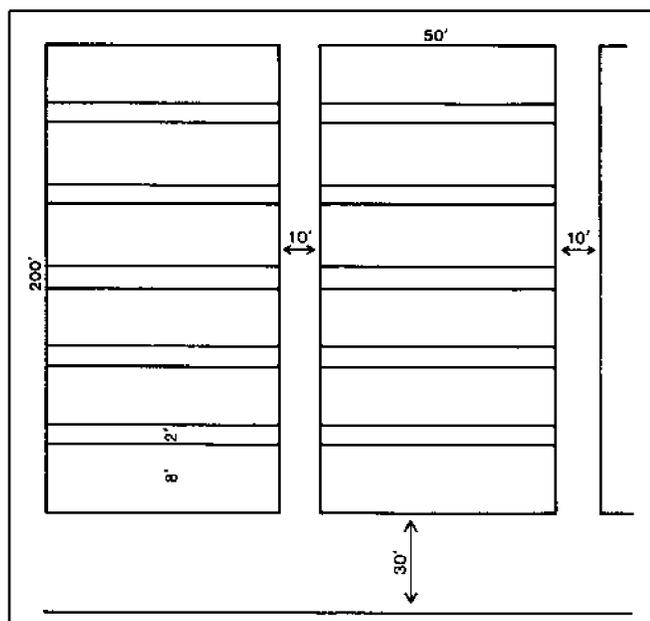


Figure 9.

Figure 7, Figure 8, and Figure 9, respectively, with average

walking distances of 50 ft (15.2 m), 25 ft (7.6 m) and 12.5 ft (3.8 m), respectively. Thus, moving plants in or out of the production beds can be done more efficiently with a design such as Figure 9.

Another advantage of the Figure 9 design is that roads perpendicular to walk-ways are not flanked by drainage ditches that must be crossed by personnel and graded periodically for rapid drainage of water. When growing plants in 5 gallon or larger containers, design efficiency becomes more significant. Production beds in Figure 9 should slope approximately 3% to 4% from the edge of the 10-ft (3.0 m) wide road to the center of the 50-ft (15.2 m) wide production area that slopes toward one end. Runoff water flows on the surface material down the center of the 50-ft (15.2 m) wide production area into a drainage ditch located parallel and beside the 30-ft (9.1 m) wide road. This design may be modified by crowning the 50-ft (15.2 m) wide production area in the center and placing a drainage ditch down the center of the 10-ft (3.0 m) wide road for runoff. Severe washing of the road may result if precautions are not taken.

Production areas in Figure 7 and Figure 8 should be crowned 3% to 4% to the center along the 200-ft (61.0 m) length so that runoff flows toward a 20-ft (6.1 m) wide road on either side of the production area. Ditches between the roads and production areas drain the runoff.

An alternative to crowning the production area is to slope the area to one side. The slope begins at the left side and progresses to the right so the runoff flows into the ditch on the right side of the production area. The road on the right side of a production area slopes toward the ditch on the left side of the road. The ditch may slope to either end of the production area. Production areas are commonly surfaced with gravel, seashells, porous polypropylene, or black plastic. Gravel consisting of a particle mixture of 0.25 to 0.75 inches (0.6 to 2.0 cm) makes an excellent surface to place plants, but is expensive since 100 tons of gravel will only cover about one half acre. Smaller gravels wash away easily, and 1-gallon containers do not set level on larger gravel. Polypropylene and black plastic must be secured around the edges to prevent wind displacement, and equipment driven on these materials may result in tears. Despite precautions, black plastic usually does not last more than 2 years in Florida.

Natural shade areas on the nursery site may be used as production space. Shade may also be provided by shade structures. Roads and drainage ditches for production areas where shade houses are constructed are usually

similar to those of nonshaded areas. Natural shade areas cannot be graded because of possible damage to existing tree roots, so care must be taken to select areas with a 1% to 2% slope. Avoid areas subject to flooding.

Shade structures should accommodate tall pieces of equipment and provide adequate turning space. This aspect is often overlooked. Limbs and/or trees should be removed in natural shade areas to aid accessibility.

The layout and dimension of production areas must be known when designing the irrigation system. Production areas and roads may be modified to maximize irrigation efficiency. Most irrigation systems used in nurseries are permanent overhead delivery systems with impulse nozzles which deliver water in a circular pattern. It may be desirable to locate roads where water distribution patterns meet to ensure elimination of dry spots. Aluminum irrigation pipes placed on the production area surface are occasionally used. These pipes should be placed parallel with roads for minimal interference with equipment.

The use of drip irrigation systems for container production has increased in the last few years due to water shortages. Drip systems efficiently deliver a specified amount of water to each container. A drip system must be properly designed to ensure adequate delivery rates and may require a specific production area design. Details of drip irrigation design are available in OH Commercial Fact Sheet 5, and irrigation design plans are available from the Extension Agriculture Engineer's office. The irrigation design of your nursery should be filed for future reference should irrigation system repairs be necessary.

Provisions for winter protection should be considered when designing container production areas. Winter protection may be provided by pushing containers together during cold periods and placing a

protective wrap of paper or polyethylene around the perimeter of the crowded containers (Figure 10). Plants from 1 or 2 beds are usually crowded together with the long axis of the group oriented in a north-south direction for minimum plant exposure to northerly winter winds. Placing groups north and south is simplified if plant beds are oriented in a north-south direction.



Figure 10.

Location in the production area of quonset houses constructed for cold protection should be based on house capacity and size of container plants. For example, approximately 400 one-gallon plants are placed on an 8 x 50-ft (2.4 x 15.2 m) production bed (spaced 1 ft (0.3 m) on center) and could be crowded together inside a quonset 8 x 12.5-ft (2.4 x 3.8 m). Therefore, an 8 x 25-ft quonset frame is erected for two 8 x 50-ft beds of plants. The use of wider quonset structures, which remain in place throughout the year, could interfere with aisle traffic or equipment designed to pass over the tops of plants. Small portable quonset houses, usually 6 to 8 ft (1.8 to 2.4 m) wide, with variable lengths and constructed of light-weight materials, can be moved to aid in traffic flow.

Sprinkling for cold protection does not require a special size production area. However, many nurseries plan for only a portion of the production area to receive sprinkling for cold protection. Width and length of production areas might be adjusted to ensure proper irrigation delivery rates and adequate coverage when sprinkling.

Service Area

Equipment storage and repair facilities, along with pesticide, petroleum, and fertilizer storage facilities, comprise the nursery service area (Figure 1). They are usually located close to the nursery office yet accessible to supply trucks servicing these facilities. The type of equipment and supplies needing shelter or storage determines the size and type of facilities. Enclosed metal buildings are excellent for repair and maintenance shops, and may be used for storage of small pieces of equipment such as hand sprayers, chain saws and lawn mowers. Equipment repairs by commercial businesses may be less expensive, and an equipment repair facility in the nursery would be unnecessary. Storage facilities for large pieces of equipment, i.e., tractors, forklifts and sprayers, are often open sided "pole barn" type structures.

Pesticide storage facilities should be located in the service area and have a water source which can deliver 20 to 50 gallons per minute to permit rapid filling of pesticide tanks. This capacity may not be available directly from a pressurized water source but can be achieved by a raised storage tank from which water flows through a 2-to 3-inch (5 to 7.5 cm) opening into the spray tank. A pesticide storage building must be properly designed and identified as containing poisons. Pesticide storage building plans are available from the Extension Agriculture Engineer's office.

Employee Facilities

Employee facilities are usually located adjacent to the service area but should be positioned as far as possible from the pesticide storage area (Figure 1). Restrooms, showers, personal lockers, refrigerators and dining tables are usually provided for employees. Employee parking between the service area and the employee facilities is a convenient arrangement.

Shipping Area

Some nurseries load plants directly from production areas while other operations have designated loading areas within the nursery where plants are placed prior to shipment. Shipping areas within the nursery require access roads 20-to 25-ft

(6.1 to 7.6 m) wide with firm surface material and turning space to accommodate 30-ft (9.1 m) long trucks. Placing plants in this area before customer arrival reduces loading time, but irrigation and shade must be provided. Another loading alternative is to build a loading dock. A covered loading dock is preferable since it would permit loading trucks during inclement weather. Most loading docks are 4 ft (1.2 m) high and constructed of concrete. The docks should be large enough to accommodate tractors, conveyors, plant racks and other equipment used in the loading process. Loading docks should be accessible from the public highway and adjacent to the office (Figure 1) due to the interaction between the shipping foreman and sales personnel.

Once the nursery layout design has been implemented, adjustments in the system that would expedite certain production processes is not uncommon. Alterations of the system should only be done after careful examination of the available options, since corrections in the existing layout design are often difficult to accomplish without interrupting existing production practices. Examine the cost-benefit relationship of the alteration before taking action, and if alterations are not feasible at the time, make written notes of the suggested changes and incorporate them at a later date in the existing operation or in the next phase of nursery expansion.